

Blackstone Culvert Assessment Project

Sponsored by Stefanie Covino and
the Blackstone Watershed Collaborative



Our Team



Tim Ryan

B.S./M.S. student in Civil
Engineering and Business
Management



**Maryam Al
Hakeem**

B.S. student in Biology &
Biotechnology



Nate Cloutier

B.S. student in Electrical &
Computer Engineering

Students at Worcester Polytechnic Institute (WPI)

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Project Goal

Project sponsored by Blackstone Watershed Collaborative

- To assess culverts and develop criteria for how to prioritize repairs and replacement
 - Assessed culverts in Sutton, MA
 - Developed based on interviews, assessments, and the Aquatic Connectivity Stream Crossing Survey

Work done for Interactive Qualifying Project (IQP), a community based project and graduation requirement

Consequences of Culvert Failure

Safety

Road closures, delayed emergency responses, emergency shelters inaccessible

Economic

Costly repairs and hindered travel



Environmental

Erosion, pollution, and separation of habitats

Community

Property damage, detours, etc.



AQUATIC CONNECTIVITY Stream Crossing Survey DATA FORM

DATABASE ENTRY BY _____ ENTRY DATE _____
DATA ENTRY REVIEWED BY _____ REVIEW DATE _____


CROSSING DATA

Crossing Code _____ Local ID # (optional) _____
Date Observed (month/year) _____ Lead Observer _____
Town/County _____ Stream _____
Road _____ Type ☐ MULTILANE ☐ PAVED ☐ UNPAVED ☐ DRIVEWAY ☐ TRAIL ☐ RAILROAD
GPS Coordinates (Decimal degrees) _____ "N Latitude _____ "W Longitude _____
Location Description
Crossing Type ☐ BRIDGE ☐ CULVERT ☐ MULTIPLE CULVERT ☐ FORD ☐ NO CROSSING ☐ REMOVED CROSSING ☐ BURIED STREAM ☐ INACCESSIBLE ☐ PARTIALLY INACCESSIBLE ☐ NO UPSTREAM CHANNEL ☐ BRIDGE ADEQUATE ☐ Number of Culverts/ Bridge Cells _____
Photo IDs _____ INLET _____ OUTLET _____ UPSTREAM _____ DOWNSTREAM _____ OTHER _____
Flow Condition ☐ NO FLOW ☐ TYPICAL LOW ☐ MODERATE ☐ HIGH ☐ Crossing Condition ☐ OK ☐ POOR ☐ NEW ☐ UNKNOWN
Tidal Site ☐ YES ☐ NO ☐ UNKNOWN ☐ Alignment ☐ FLOW ALIGNED ☐ SKewed 0-45° ☐ Road Fill Height (Top of culvert to road surface; bridge = 0) _____
Bankfull Width (approx) _____ Confidence ☐ HIGH ☐ LOW/ESTIMATED ☐ Constriction ☐ SEVERE ☐ MODERATE ☐ SPANS ONLY BANKFULL/ ACTIVE CHANNEL
Tailwater Scour Pool ☐ NONE ☐ SMALL ☐ LARGE ☐ SPANS FULL CHANNEL & BANKS
Crossing Comments _____

STRUCTURE 1

Structure Material ☐ METAL ☐ CONCRETE ☐ PLASTIC ☐ WOOD ☐ ROCK/STONE ☐ FIBERGLASS ☐ COMBINATION
Outlet Shape ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ FORD ☐ UNKNOWN ☐ REMOVED ☐ Outlet Armoring ☐ NONE ☐ NOT EXTENSIVE ☐ EXTENSIVE
Outlet Grade (pick one) ☐ AT STREAM GRADE ☐ FREE FALL ☐ CASCADE ☐ TREE FALL ONTO CASCADE ☐ CLOGGED/COLLAPSED/SUBMERGED ☐ UNKNOWN
Outlet Dimensions: A. Width _____ B. Height _____ C. Substrate/Water Width _____ D. Water Depth _____
Outlet Drop to Water Surface _____ Outlet Drop to Stream Bottom _____ E. Abutment Height (Type 7 bridges only) _____
L. Structure Length (Overall length from inlet to outlet) _____
INLET
Inlet Shape ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ FORD ☐ UNKNOWN ☐ REMOVED
Inlet Type ☐ PROJECTING ☐ HEADWALL ☐ WINGWALLS ☐ HEADWALL & WINGWALLS ☐ MITERED TO SLOPE ☐ OTHER ☐ NONE
Inlet Grade (pick one) ☐ AT STREAM GRADE ☐ INLET DROP ☐ PITCHED ☐ CLOGGED/COLLAPSED/SUBMERGED ☐ UNKNOWN
Inlet Dimensions: A. Width _____ B. Height _____ C. Substrate/Water Width _____ D. Water Depth _____
Slope % (approx) _____ Slope Confidence ☐ HIGH ☐ LOW ☐ Internal Structures ☐ NONE ☐ RAFTLES/WEIRS ☐ SUPPORTS ☐ OTHER _____
ADDITIONAL CONDITIONS
Structure Substrate Matches Stream ☐ NONE ☐ COMPARABLE ☐ CONTRASTING ☐ NOT APPROPRIATE ☐ UNKNOWN
Structure Substrate Type (pick one) ☐ NONE ☐ SILT ☐ SAND ☐ GRAVEL ☐ CORRAL ☐ BOULDER ☐ BEDROCK ☐ UNKNOWN
Structure Substrate Coverage ☐ NONE ☐ 25% ☐ 50% ☐ 75% ☐ 100% ☐ UNKNOWN
Physical Barriers (pick all that apply) ☐ NONE ☐ DEBRIS/SEDIMENT/ROCK ☐ DETORATION ☐ TREE FALL ☐ FENCING ☐ DRY ☐ OTHER
Severity (if known; essentially based on barrier type(s) above) ☐ NONE ☐ MINOR ☐ MODERATE ☐ SEVERE
Water Depth Matches Stream ☐ YES ☐ NO SHALLOWER ☐ NO DEEPER ☐ UNKNOWN ☐ DRY
Water Velocity Matches Stream ☐ YES ☐ NO FASTER ☐ NO SLOWER ☐ UNKNOWN ☐ DRY
Dry Passage through Structure? ☐ YES ☐ NO ☐ UNKNOWN ☐ Height above Dry Passage _____
Comments _____

North Atlantic Aquatic Connectivity Collaborative (NAACC)

- Trains and certifies individuals on assessing culverts in order to add to database
- Maintains database of culvert locations and condition
- Our team completed training over course of term (three sessions)
- See where culverts are in the watershed 
naacc.org/naacc_search_crossing.cfm

Prioritization Criteria

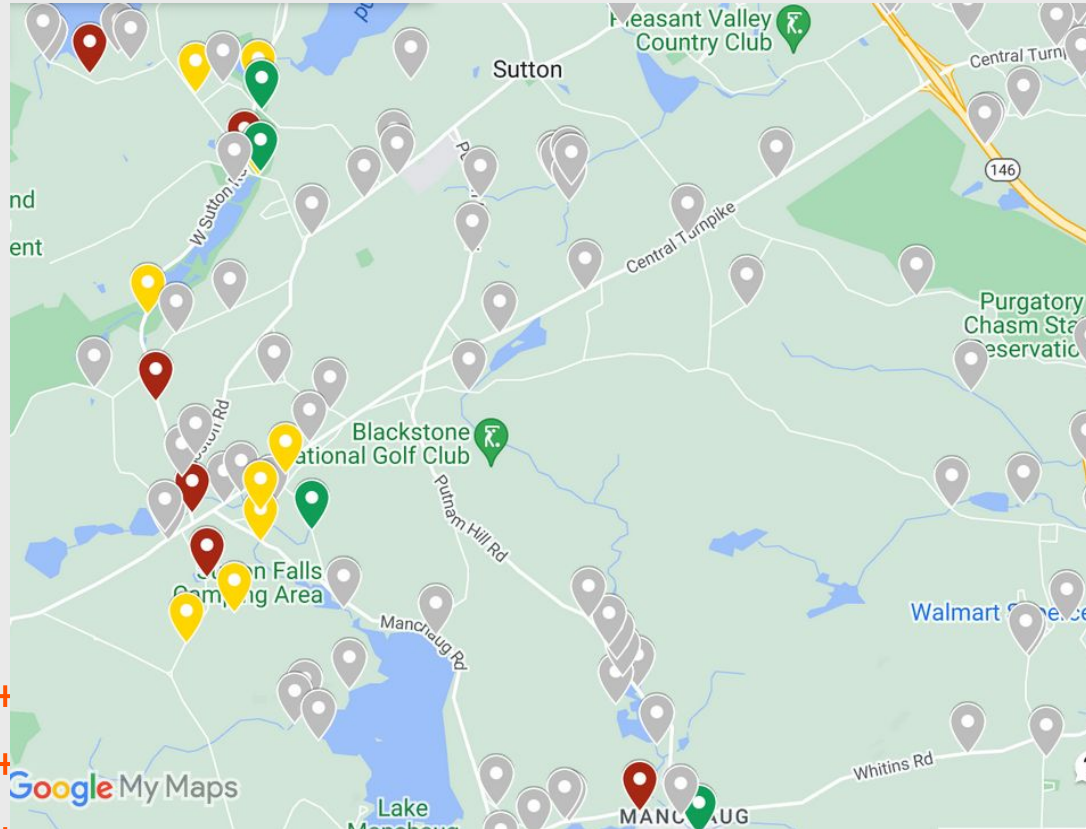
Culvert Scoring Matrix

Each category below is weighted differently. To calculate score, rate on a scale of 1 to 3 and multiply by weight percent when adding final score.

| ID | Safety Impacts of Closure (20%) | Movement Impacts of Closure (20%) | Structural Condition (20%) | Organism Passage (20%) | Flooding and River Flow (20%) | Score |
|----|---------------------------------|-----------------------------------|----------------------------|------------------------|-------------------------------|-------|
| 1 | 2 | 2 | 1 | 1 | 1 | 7 |
| 2 | 1 | 1 | 2 | 3 | 3 | 10 |



Culvert Map of Sutton, MA



- Unassessed Culverts
- High Priority Culverts
- Medium Priority Culverts
- Lowest Priority Culverts

Culvert Assessment

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Findings and Outcomes

- Many culverts were found to be constrictive and/or in poor condition
- In the long run, proactive repairs are cheaper than reactive repairs
- Very little to no outreach material for culvert awareness

Deliverables:

- GIS Map
- Prioritization Plan
- Outreach Material
- We got certified!

Resources

Funding Opportunities

You can apply for public and private grants which are the biggest funding sources for culvert repair/replacement.

Apply for Grants

- Division of Ecological Restoration (DER): Culvert Replacement Municipal Assistance Grant Program
- Energy and Environmental Affairs (EEA) Municipal Vulnerability Preparedness (MVP) Action Grants

Resources

- [Streamcontinuity.org/naacc](https://streamcontinuity.org/naacc)
- Informational video: www.youtube.com/watch?v=vWVtVFa0OFW8
- [Mass.gov/river-restoration-culvert-replacements](https://mass.gov/river-restoration-culvert-replacements)
- [Mass.gov/service-details/mvp-action-grant](https://mass.gov/service-details/mvp-action-grant)
- Central MA: cmrpg.org/culverts



Thank you to everyone who helped in this project including



blackstonecollaborative.org

Acknowledgments

- Blackstone Watershed Collaborative
- Clark University
- People we interviewed
- Professor Paul Mathisen

Made By: Maryam Al Hakeem, Nate Cloutier and Tim Ryan



DISCOVERING THE HIDDEN WORLD OF CULVERTS

What is a Culvert?

A culvert is a structure that channels water past obstacles and is typically used to channel streams under roadways.



A good culvert lets the water continuously flow and without noticing the road being there. A bad culvert can restrict water, impact water quality, cause flooding, and/or create barriers to fish and other wildlife.

Why are Culverts Important?

Culverts play a role in flooding and erosion prevention, channel road runoff, water and organism passage under roads.

Culverts in Sutton, MA

Sutton has over 100 culverts, with many built in the 1940s. Many are in a state of disrepair.

Culvert Failure



Aging culverts in Massachusetts are prone to failure. Failure can have severe consequences.

- Safety - Road closures and delayed emergency response times
- Economic - Costly emergency repairs
- Community - Property damage, road detours and traffic impact
- Environmental - erosion, polluted storm runoff and blocking of streams and habitats



What to do?

Know where your culverts are located. Check out the NAACC database at naacc.org/naacc_search_crossing.cfm and search for your community.

Assess local culverts. Whether you are already certified, can get certified, or hire a consultant, definitely take a look at your local culverts' conditions. Also, make sure to regularly assess how they're performing - especially before and after large storms.



Want to get Certified?

Find a training. Get certified in the NAACC protocol so you can put your assessments into the 13-state database maintained by UMass Amherst. Check out [Streamcontinuity.org/naacc/about/upcoming-events](https://streamcontinuity.org/naacc/about/upcoming-events) to find an upcoming training, or contact your local watershed organization to see if they can help organize one.

- GIS Map Link:
www.google.com/maps/d/u/3/edit?mid=1epBSdiVJzAL6uf6qC7M2yJ5qWR1QKRU&ll=42.120465823251024%2C-71.75432055000002&z=12
- Scoring Matrix link:
<https://docs.google.com/spreadsheets/d/1vPJ3KstPYvzhoehd3-S8sblhQFA0xNn8r1xjCKeHHsw/edit?usp=sharing>



THANK YOU!

Do you have any questions?