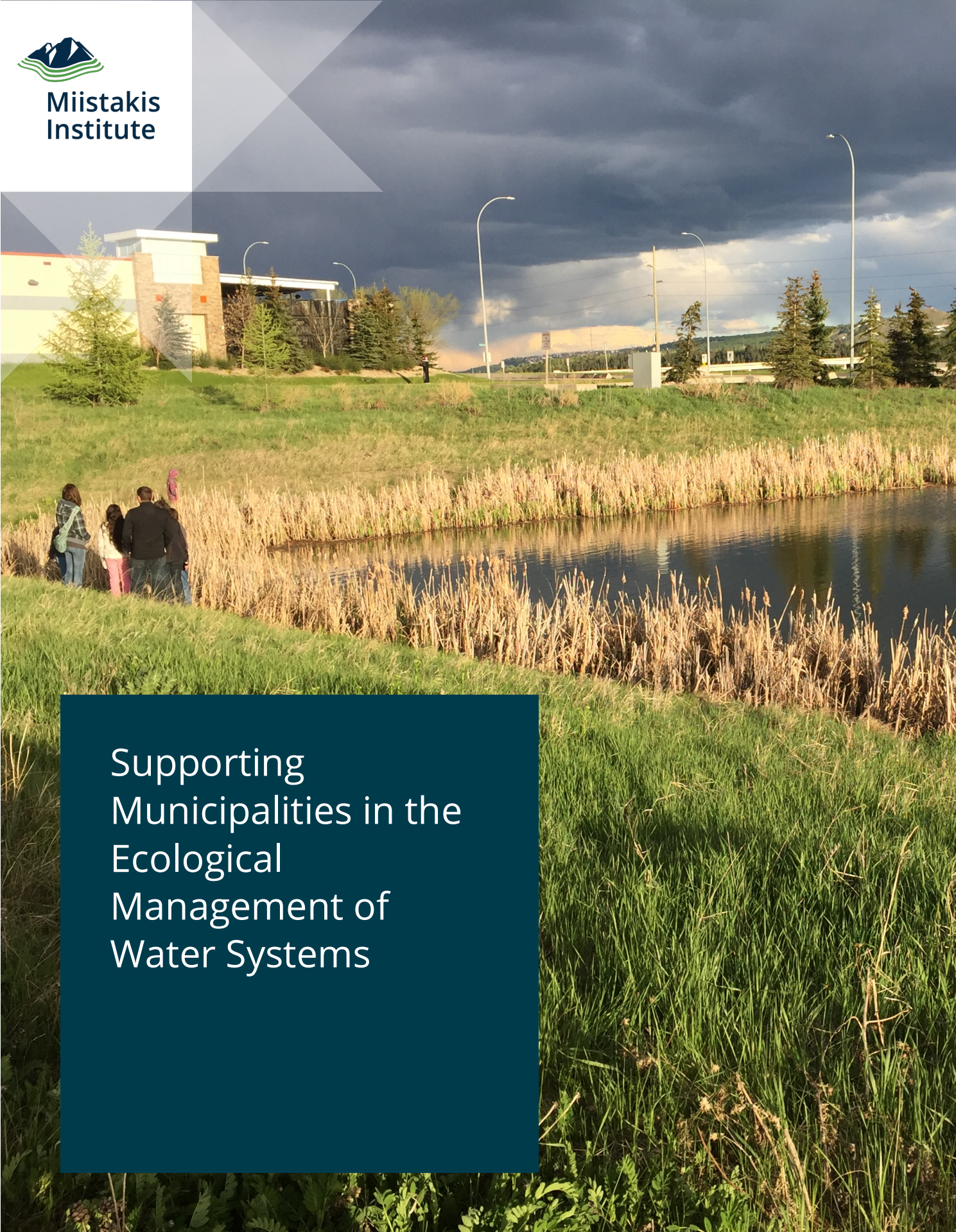




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A photograph of a wetland area. In the foreground, there is a body of water surrounded by tall, green grasses and reeds. In the background, a modern building with a brick and concrete facade is visible, along with several tall, curved light poles. The sky is dramatic, with dark, heavy clouds and a bright patch of light near the horizon. A group of people is standing on a grassy bank, looking towards the water.

Supporting Municipalities in the Ecological Management of Water Systems

Innovative research. Engaged communities. Healthy landscapes.

Supporting Municipalities in the Ecological Management of Water Systems

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Public Final Report

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Project Partners

Regional Wetland Data Strategy

- Bow River Basin Council
- City of Airdrie
- City of Calgary
- City of Chestermere
- County of Newall
- Fiera Biological Consulting
- Foothills County
- Mountain View County
- Municipal District of Bighorn
- North Saskatchewan Watershed Alliance
- Nose Creek Watershed Partnership
- Oldman River Regional Services Commission
- Rocky View County
- Town of Cochrane
- Town of High River
- Town of Okotoks
- Town of Strathmore
- University of Saskatchewan
- Wheatland County

Municipal EcoToolkit

- Environmental Law Centre
- Low Impact Development Alberta

Call of the Wetland

- City of Calgary, Urban Conservation
- Calgary Zoo
- Alberta Conservation Association

Amphibian Connectivity in Calgary

- City of Calgary, Urban Conservation
- Calgary Zoo
- University of Saskatchewan

Executive Summary

Although natural water bodies are generally provincial jurisdiction, municipalities are the primary land use decision makers, thus every natural water system in Alberta is affected by municipal decision making. However, there is limited municipal capacity to address these issues, limitations on data, few opportunities to engage citizens, and few policy-level tools informed by science. Reconciling this inconsistency requires increased municipal capacity, increased public engagement, collaboration between municipalities, creative municipal water policy, and accessible information.

Miistakis' multi-faceted program targeted this gap by mobilizing citizen scientists, engaging multiple municipalities, generating more usable data sets, applying hydrological modelling, creating a science-based ecotool-kit, and generating information usable by any Alberta municipality.

This program increased the capacity for Alberta municipalities to more effectively and more creatively integrate ecosystem-based approaches into their policy and operational structures for managing the natural water systems within their boundaries. Specifically, the results from this project supported municipal decision-makers and stakeholders in the Bow River Basin (City of Calgary, Bow River Basin Council, Alberta Environment and Parks, municipalities along the Bow River, water modeling experts), while generating information and tools usable by any Alberta municipality.

There were four distinct but linked programs that aimed to increase the capacity for Alberta municipalities to more effectively and more creatively integrate ecosystem-based approaches into their policy and operational structures for managing natural water systems by:

- Engaging citizens to gather amphibian data from urban wetlands that is used in municipal conservation decision making (**Call of the Wetland**);
- Developing a common strategy for neighbouring municipalities to integrate wetlands data into municipal planning (**Regional Wetlands Data Strategy for Bow River Basin Municipalities**);
- Creating regulatory guidance and templates for Alberta municipalities (**Municipal EcoToolkit**); and
- Generating a method for mapping wetland/hydrological connectivity in an urban municipality which can be used in residential and natural area planning (**Amphibian Connectivity in the City of Calgary**)

The benefits realized by this program include:

- Citizens engaged in generating valuable data and wetland management within the City of Calgary
- Improved maintenance and restoration of the Bow River region's wetlands by ensuring there is standardized wetlands data, in a form usable in municipal planning and programming, extending across the Bow River Basin, that is publicly accessible, and sustainably current over time.
- Enhanced protection of natural systems within municipalities through their land use and regulatory decisions related to green infrastructure, wetlands, riparian areas, environmental management, and sensitive ecological features.
- Improved wetland biodiversity through the identification of wetland connectivity in the City of Calgary.

Introduction

Sector Introduction

Every natural water system in Alberta (wetlands, riparian areas, groundwater) is affected by municipal decision making, and every provincial plan to use or conserve aquatic ecosystems (regional plans, biodiversity management frameworks, Water for Life, etc.) relies to some extent on municipal decision making. However, there is limited capacity within municipalities to address these issues, limited data and information, few opportunities to engage citizens, and insufficient policy-level tools that are informed by sound science. When these water system issues are addressed at the municipal level, the emphasis is on heavily-engineered solutions, rather than increasing the capacity for municipalities to work with their natural systems.

Regional Wetland Data Strategy

- Municipalities in Alberta play the most direct role in land use planning decisions
- Land use planning and decisions have the most direct impact on wetland persistence and health

Municipal EcoToolkit

- Municipalities in Canada are becoming increasingly aware of and concerned about natural infrastructure within their communities
- Natural systems represent the working capital in a natural infrastructure system

Call of the Wetland

- To better support City of Calgary biodiversity goals, urban ecology monitoring and research programs need to be developed
- There is a need to build social capital in urban areas to support investments in urban biodiversity conservation

Amphibian Connectivity

- A key component of biodiversity is maintaining places for animals to move to inform biodiversity conservation goals

Knowledge or Technology Gaps

Regional Wetland Data Strategy

- Alberta municipalities do not have access to wetlands data that facilitates municipal planning, wetland protection, and wetland restoration

Municipal EcoToolkit

- While tools exist to help, Alberta municipalities demand for information on protecting their natural systems outstrips the available information resources

Call of the Wetland

- The City of Calgary does not have the knowledge of urban amphibians diversity or occupancy.

Amphibian Connectivity

- The City of Calgary does not have the knowledge to identify keystone wetlands or corridors to support amphibians a key component of supporting biodiversity.

Project description

Knowledge or Technology Description

Regional Wetland Data Strategy

- Objective: To develop a strategy that will improve the ability of municipalities in the Bow River basin to secure accessible, usable, current, consistent wetlands data

Municipal EcoToolkit

- Objective: To provide a web-based mechanism municipalities can access to learn more about protecting their natural systems

Call of the Wetland

- Objective: Establish a citizen science amphibian monitoring program

Amphibian Connectivity

- Objective: Use results from Call of the Wetland occupancy modeling to develop connectivity models for amphibian species in city of Calgary

Updates to Project Objectives

Regional Wetland Data Strategy

- No change

Municipal EcoToolkit

- Originally conceived as a 'bylaw' toolkit, feedback indicated a 'natural infrastructure' toolkit would be of more use

Call of the Wetland

- No change

Amphibian Connectivity

- No change

Performance Metrics

Regional Wetland Data Strategy

- HQP Trained / Retained
 - 4 full-time staff members were engaged in this project
 - The resultant dataset
- Municipal decision makers engaged
 - 12 municipalities participated in developing the Regional Wetland Data Strategy
- Citizen scientists engaged
 - n/a
- Ecological data sets developed
 - Project catalyzed a provincial commitment of over \$500K to create the recommended wetland datasets

Municipal EcoToolkit

- HQP Trained / Retained

- 5 full-time staff members were engaged in this project
- Municipal decision makers engaged
 - Over 40 natural system protection tools were include in the Municipal EcoToolkit
- Citizen scientists engaged
 - n/a
- Ecological data sets developed
 - n/a

Call of the Wetland

- HQP Trained/Retained
 - 3 full time staff members were engaged in this project
- Municipal decision makers engaged
 - City of Calgary a partner in the project, and city staff participated in amphibian surveys
- Citizen scientists engaged
 - Over 250 Calgarians undertook amphibian surveys, and 200 attended events hosted by Call of the Wetland
- Ecological data sets developed
 - Systematic dataset of amphibian diversity and occupancy at 54 wetlands in city of Calgary

Amphibian Connectivity

- HQP Trained/Retained
 - 2 full time staff members were engaged in this project
- Municipal decision makers engaged
 - City of Calgary staff participated on advisory committee
- Citizen scientists engaged
 - n/a
- Ecological data sets developed
 - Keystone wetlands and corridors for amphibians identified in City of Calgary

Methodology

Regional Wetland Data Strategy

- Used surveys, interviews, literature reviews, cataloguing, workshop, and advisory group to determine municipal wetland data issues, needs, and opportunities
- Developed *Bow Basin Municipal Wetland Datasets: A strategy for securing accessible, usable, current, consistent wetlands data* based on this information

Municipal EcoToolkit

- Used literature review, interview, survey, and partner engagement to determine needed municipal natural infrastructure tools
- Developed Municipal EcoToolkit based on this information

Call of the Wetland

- Citizen science approach, systematic monitoring of wetlands using smartphone to report survey results, occupancy modeling

Amphibian Connectivity

- Advisory committee, connectivity modeling using software packages from Circuitscape and Linkage Mapper

Project Results

Regional Wetland Data Strategy

- Survey/interviews/summary report of municipal wetland data issues and needs
- Catalogue of wetland datasets available to municipalities in the Bow River basin
- Municipal workshop convened involving representatives from 12 municipalities in the Bow River basin
- A collaboratively-developed strategy for gathering source/input data, processing, and resultant wetland datasets usable by municipalities in the Bow River basin
- An additional \$500K secured to develop wetland inventory across the basin (current, drained/impacted/historical)

Municipal EcoToolkit

- Survey of municipal personnel regarding desired tools / priorities
- Over 40 tools identified, written up, associated resources identified, and programmed to user-friendly web site
- Reviews by outside experts, including Alberta Low Impact Development Partnership and Environmental Law Centre

Call of the Wetland

- Citizen science amphibian surveys (>1000) completed after three seasons
- Occupancy modeling completed
- Communication material developed and shared with participants
- Regular meetings with Urban Wetland Network

Amphibian Connectivity

- Modelling scope agreed on by expert Advisory Committee
- Hosted numerous technical Zoom meetings to inform modeling
- Connectivity modeling completed
- Working with City of Calgary on implementation of results

Key Learnings

Regional Wetland Data Strategy

- Municipalities' ability to pursue wetland conservation and restoration is confounded by supporting data that is limited, inconsistent, out of date, and difficult to access
- The use of provincially-available LiDAR and SPOT data can be used to create a cross-basin wetland inventory at the provincial standard of 0.04ha resolution
- Municipalities in southern Alberta place a similar, high priority on addressing this issue
- Wetland replacement fees can be used to develop usable wetland datasets on an on-going basis

Municipal EcoToolkit

- Municipalities were more interested in support for 'natural infrastructure' identification/protection than bylaw information
- Toolkit development needed to be formed around "101" detail and "201" detail, rather than full descriptions of only a few tools

Call of the Wetland

- Meeting urban biodiversity goals requires biological data to develop meaningful conservation strategies and monitor change over time
- Calgary supports three species of amphibians but has lost three species that were traditionally reported within the current city limits
- There are 4000 wetlands within City of Calgary limits, keystone wetlands were identified that support amphibian seasonal habitat needs but most occur along the periphery of the city limits.

Amphibian Connectivity

- Wetland connectivity for amphibians occurs along riparian corridors of large river and creek systems, in larger natural areas, along green spaces of major roads and on the urban fringe.

- Many inner Calgary city wetlands support amphibians but are isolated and may not be able to recolonize after local extinction events.
- A concerted effort is needed to improve and maintain existing wetland corridors for amphibians.

Outcomes and Impacts

Regional Wetland Data Strategy

- Web sites
 - Wetlands Data Workshop (www.wetlanddataworkshop.ca)
- Workshop
 - Municipal Wetland Data Workshop (convened Feb 13, 2020; 25 participants from 12 different municipalities in the Bow River basin)
- Reports
 - Kinas, Holly and Guy Greenaway. 2020. *Wetlands Data Needs and Issues: A Survey of Municipalities in the Bow River Basin*. Miistakis Institute for the Rockies, Inc.
 - Sanderson, Ken and Guy Greenaway. 2020. *Wetlands Datasets in the Bow River Basin: A Preliminary Catalogue of Wetlands Datasets Available to Municipalities*. Miistakis Institute for the Rockies, Inc.
 - Greenaway, Guy and Nicole Kahal. 2020. *Municipal Wetland Data Workshop: Meeting Record*. Miistakis Institute for the Rockies, Inc.
- Strategy
 - Advisory Committee: Alberta Land Institute, Alberta Association of Conservation Offsets, Bow River Basin Council, North Saskatchewan Watershed Alliance, Oldman River Regional Service Commission, Fiera Biological Consulting, Wheatland County, Palliser Environmental, Nose Creek Watershed Partnership, City of Calgary.
 - Greenaway, Guy. 2020. *Bow Basin Municipal Wetland Datasets: A strategy for securing accessible, usable, current, consistent wetlands data*. Miistakis Institute for the Rockies, Inc.

Municipal EcoToolkit

- Web sites
 - *Municipal EcoToolkit: Tools for maintaining your natural systems* (www.ecotoolkit.ca)
- Reports
 - Kinas, Holly and Guy Greenaway. 2020. *Municipal EcoToolkit Survey Report*. Miistakis Institute for the Rockies, Inc.

Call of the Wetland

- Website: www.callofthewetland.ca

- Data collection tool: Smartphone application available on app store of Google play by searching “call of the wetland”
- Unpublished manuscript to Journal of Urban Ecology entitled ‘*Can we keep amphibians on the urban landscape – Citizen Scientists Answer the Call*’
- Products shared with participants:
 - https://www.rockies.ca/files/reports/MIR_COTW_ParticipantReport_AP_R2020_digital.pdf
 - <https://storymaps.arcgis.com/stories/40ca50453cea48d398ad2479509833e0>

Amphibian Connectivity

- *Keystone Wetlands and Corridors for Amphibians in the City of Calgary* - Report in draft being reviewed by Advisory Committee
- Spatial models shared with Urban Conversation and Planning Departments City of Calgary.

Benefits

Economic

Regional Wetland Data Strategy

- As well as employment generated in this phase, project catalyzed second phase of \$500K to be invested in Edmonton-based 5-member data consultancy

Municipal EcoToolkit

- Municipalities will be able to use the tool guidance to direct their RFPs, engagement with consultants, and make the case for hiring necessary specialists

Call of the Wetland

- Data collection smartphone application being adopted by City of Calgary for resource field staff to use to report amphibian observations. App development valued at \$50,000.

Amphibian Connectivity

- n/a

Environmental

Regional Wetland Data Strategy

- Derived datasets will provide critical missing link in wetland restoration activity at the municipal level

Municipal EcoToolkit

- The Municipal EcoToolkit provides municipalities with practical guidance for maintaining the ecological systems within their communities

Call of the Wetland

- Amphibian occupancy modeling supports development of biological conservation strategies to protect and enhance keystone wetlands

Amphibian Connectivity

- Amphibian connectivity modeling supports development of biological conservation strategies to maintain and restore wetland corridors

Social

Regional Wetland Data Strategy

- n/a

Municipal EcoToolkit

-

Call of the Wetland

- Engaged over 200 Calgarians in amphibian monitoring and fostered dialogue on importance of wetlands and biodiversity through a citizen science approach. Citizen science approaches have been shown to result in enhanced engagement, increased scientific literacy, foster environmental stewardship and improve collaboration.

Amphibian Connectivity

- n/a

Building Innovation Capacity

Regional Wetland Data Strategy

- The base wetland datasets created through this project will underpin new and more effective wetland modelling techniques.

Municipal EcoToolkit

- The Toolkit provides the oft-missing knowledge of how new tools – and existing tools – can be applied to maintain natural infrastructure within in a municipal context.

Call of the Wetland

- Strong model on citizen science approach to monitoring and researching biodiversity in urban environment
- Development of Call of the Wetland smartphone application

Amphibian Connectivity

- This project highlighted the importance of investing in a connected landscape – and outlined barriers and restoration needs to enhance amphibian densities.

Recommendations and Next Steps

Regional Wetland Data Strategy

- The Regional Wetland Data Strategy was intended to create a strategy, but not implement it. However, we believe we are already well down that implementation track as the Government of Alberta has already indicated a willingness to adopt the strategy. Next steps will be finalizing the funding, securing the source imagery, and creating the new wetland datasets.

Municipal EcoToolkit

- The Municipal EcoToolkit is currently a Phase I, meaning we have done the background research, developed an initial web-tool, and completed preliminary outreach. The next phase will require gathering more practical information from municipalities to populate the EcoToolkit so they can learn from each other. This will involve visiting municipalities in Alberta, giving them training on the Toolkit, and soliciting resources from them that can augment the Phase I Toolkit.

Call of the Wetland

- Continue sharing results through presentations/webinars
- Publish manuscript in Journal of Urban Ecology
- Identified the need for an urban wetland monitoring program that assess the condition of both terrestrial and aquatic habitat.

Amphibian Connectivity

- We are developing a second phase to scope each keystone wetland in terms of enhancement possibilities through a workshop with City of Calgary and amphibian experts.

- Develop a framework that builds off the wetland corridor and barrier mapping to prioritize restoration efforts
- Develop urban road mitigation guidelines for amphibians

Knowledge Dissemination

Regional Wetland Data Strategy

- The knowledge gained in this project was continuously disseminated through workshop presentations to decision-makers, convening of an advisory group, and the maintenance of a website to provide all reports and materials back to participants and advisors.

Municipal EcoToolkit

- This project is, at its core, a knowledge dissemination project, where the information gathered about different tools for maintaining municipal natural infrastructure, was drafted in a form relevant to municipalities and made available through the Municipal EcoToolkit web site.

Call of the Wetland

- Knowledge was disseminated through the program website, Miistakis website, emails to participants, Miistakis newsletter, and webinars.
- Raw data was shared with City of Calgary, Government of Alberta, and project partners at Mount Royal University.

Amphibian Connectivity

- The report will be shared on Miistakis website and presented to City of Calgary Biodiversity Committee.
- The modeling products will be shared with City of Calgary

Conclusions

Miistakis' multi-faceted program focused on supporting municipalities in the ecological management of water systems and increased the capacity for Alberta municipalities to more effectively and more creatively integrate ecosystem-based approaches into their policy and operational structures for managing the natural water systems within their boundaries.

Our highly collaborative approach, engaging 24 municipal, conservation and academic partners and over 200 citizens of Calgary resulted in the creation of new, innovative tools, strategies and models to guide municipal water management

decision-making, to help maintain natural infrastructure within in a municipal context to ensure healthy aquatic ecosystems.