

AGRICULTURE AND ENVIRONMENT

ENVIRONMENTAL INNOVATION

WATER INNOVATION

FUNDING DETAILS

Assessing water connectivity in rural and urban watersheds for improved water management

This project investigated surface water-groundwater (SW-GW) connectivity in urbanizing watersheds to support more sustainable water management. To achieve this goal, the project examined both urban and natural hydrologic systems to improve understanding of linkages among surface water, groundwater, and stormwater. Emerging low impact development (LID) practices, such as rain gardens and bioretention systems, were a focal point, assessing their influence on hydrologic processes, water quality, and watershed resilience in Alberta. Three primary field studies were completed: (1) a paired-watershed comparison of streamflow response in developed and undeveloped catchments; (2) monitoring of two community rain gardens; and (3) study of bioretention mesocosm cells at the Okotoks Bioretention Facility (OBF). Together, these studies provided a robust framework for assessing the impact of urban development on water movement, storage, and exchange between surface and subsurface systems.



RECIPIENT:

University of Calgary



PARTNERS:

City of Calgary
Town of Okotoks
NSERC
Bow River Basin Council



TOTAL BUDGET:

\$1,676,940



AI FUNDING:

\$460,320



PROJECT DATES:

JAN 2020 –
APR 2025



PROJECT TRL:

N/A
N/A

APPLICATION

The knowledge generated from this project will assist a variety of end users involved in surface water, groundwater and stormwater management. The data and tools generated will benefit municipalities and have policy relevance for Alberta regulatory agencies assessing and mitigating impact of development on hydrologic systems. Results may also be used by water-focused community groups in need of relevant information to support development and implementation of sustainable water management plans. Results have already informed new modeling approaches and design considerations for LID systems in cold climates.



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PROJECT GOALS

The overall goal of this project was to comprehensively evaluate surface water-groundwater connectivity in urban and rural watersheds to support sustainable water management. The key goals of the project were:

- Obtaining high-quality hydrological data in urban and natural settings, with particular emphasis on frozen soil processes, to improve understanding of surface water, stormwater and groundwater linkages.
- Assessing the hydrologic function and water quality treatment performance of LID systems and their associated influence on groundwater.
- Developing and refining hydrologic assessment tools at local and regional scales for improved characterization of water flows and quality prior to and after urban development.
- Informing best management practices for LID system design for stormwater management in the unique geologic and climatic setting of Alberta.

BENEFITS TO ALBERTA

The knowledge generated from this project could result in:

- More flexible, effective water management through improved understanding of hydrologic function within pre- and post-development landscapes.
- Valuable new data and modeling tools for assessing and mitigating impacts of development on hydrologic systems at the urban-rural interface.
- Advancement of best management practices for LID designs in cold regions, which will benefit communities in Alberta and across Canada.
- Science-based guidance for policy development, including the provincial Groundwater Management Framework and City of Calgary guidelines for ephemeral and intermittent streams.
- Collaborations between municipal, provincial, academic and non-governmental agencies to support sustainable watershed management plans.
- Better prediction of hydrologic system response to drought and flood, as well as potential changing climate conditions.



7 Practices/Policies Informed



54 Publications



15 Students Trained

CURRENT STATUS

OCT 2025 - COMPLETE

Key findings highlighted the importance of SW-GW interactions across the landscape, from recharge to discharge zones. Results from the paired-watershed study showed that groundwater was the dominant source of streamflow in both developed and undeveloped catchments, accounting for 86-95% of total discharge. Urban development altered flow pathways and routed water away from the headwater streams, resulting in more static seasonal flows. These insights provide a foundation for improving integrated watershed management through LID-based stormwater optimization and evidence-based guidelines and policies.