



The State of Play Report for Natural Infrastructure on the Canadian Prairies

IISD REPORT



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*with contributions from
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and Emily Kroft*



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Natural Infrastructure for Water Solutions

Natural Infrastructure for Water Solutions (NIWS) is a 5-year initiative (2022 to 2026) led by IISD to scale up NI across the Canadian prairies (Manitoba, Saskatchewan, and Alberta). The NIWS initiative aims for natural infrastructure to be well-understood, adopted, financed, and enabled by policy.

While science and policy are the foundation for this work, IISD is also taking a systems view—looking for opportunities and creative approaches to achieve real impact across the region, working with a network of champions, partners, and decision-makers.

The State of Play Report for Natural Infrastructure on the Canadian Prairies

May 2023

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Indigenous Lands and Cultures

“Indigenous Peoples are rights holders with robust historical, cultural, and spiritual knowledge and connection to their traditional lands and with jurisdiction over their territories” (Tozer et al., 2022, p. 26).

The region we refer to as the Canadian Prairies region is home to incredibly diverse Indigenous lands and cultures, including the Indigenous territories of the Cree, Assiniboine, Salteaux, Lakota, Dakota, Anishinaabe, Ojibwe, Oji-Cree, Blackfoot, Nakota Sioux, Iroquois Tsuut’ina, Stoney Nakoda, and the homeland of the Métis Nation.

With careful consideration and collaboration, natural infrastructure can be an important part of reconciliation and an opportunity to support the United Nations Declaration on the Rights of Indigenous Peoples.



Executive Summary

This report provides a snapshot of the state of natural infrastructure implementation across the Canadian Prairies, specifically as it relates to water management and water infrastructure.

Natural infrastructure is a way to plan and work with nature to meet our infrastructure needs. It uses conserved, restored, or enhanced natural landscapes to deliver targeted infrastructure services like flood mitigation or water treatment. Research and practice increasingly show that natural infrastructure can deliver critical water infrastructure services cost-efficiently while supporting watershed health and the resilience of communities.

In this report, we explore the links between natural infrastructure and water management needs across the Canadian Prairies region and outline the status of natural infrastructure implementation in Alberta, Saskatchewan, and Manitoba. Informed by desktop research and key informant interviews with sector leaders and experts, we identify opportunities and barriers to scaling up natural infrastructure and chart general paths forward.

Interviewees broadly characterized natural infrastructure efforts as nascent but with growing momentum. While there are leading examples of natural infrastructure being applied across the Prairies to meet water-related infrastructure needs, grey water infrastructure remains the default option.

The interest in natural infrastructure is contrasted with the ongoing loss of natural assets critical for watershed function (e.g., wetlands, native grasslands), signalling the need to prioritize conserved and restored natural infrastructure types. The implementation of natural infrastructure is often driven by local capacity, with a clear need to invest in people, organizations, and the pipeline of projects from conceptualization through to implementation and evaluation.

As interest grows and many groups advocate for natural infrastructure, more work is needed to ensure the decision to use natural infrastructure is backed by evidence, adopted at local and regional scales, and enabled by funding and policy.



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Abbreviations and Acronyms

CCME	Canadian Council of Ministers of the Environment
ECCC	Environment and Climate Change Canada
GROW	Growing Outcomes in Watersheds
IISD	International Institute for Sustainable Development
IPCA	Indigenous Protected and Conserved Area
LID	low-impact development
NAI	Natural Assets Initiative (formerly MNAI, the Municipal Natural Assets Initiative)
NbS	nature-based solutions
NDC	nationally determined contribution
NIWS	Natural Infrastructure for Water Solutions
OECD	Organisation for Economic Co-operation and Development
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
WMR	Winnipeg Metropolitan Region



Glossary

Asset management	The process of “inventorying a community’s existing assets, determining the current state of those assets, and preparing and implementing a plan to maintain or replace those assets” (Municipal Natural Assets Initiative, 2018a, p. 2).
Benefits	The range of outcomes (economic, social, environmental, and cultural) provided by solutions to meet infrastructure goals. Co-benefits are the multiple secondary benefits of solutions, such as improved biodiversity, carbon sequestration and storage, enhanced well-being, and opportunities for recreational activities.
Ecosystem services	The benefits that natural ecosystems, via their conditions and processes, provide to humans. Examples include water filtration and climate regulation, as well as cultural services like recreation, aesthetics, and cultural practices.
Grey infrastructure	Human-made structures, such as dams, roads, ditches, pipes, water treatment facilities, storm drains, and bridges, that are often (but not exclusively) constructed from materials such as concrete and steel. Grey infrastructure is typically intended to meet targeted infrastructure outcomes.
Hybrid infrastructure	The use of natural infrastructure to complement or augment grey infrastructure to achieve more resilient infrastructure outcomes.
Low-impact development	Practices typically used in urban stormwater management that apply or mimic natural processes (e.g., increasing the infiltration of stormwater into the soil) to manage runoff as close to its source as possible. Examples of low-impact development include rain gardens, bioswales, soil cells, permeable pavement, and rainwater harvesting.
Natural infrastructure	Conserved, restored, or engineered ecosystems that provide specific infrastructure outcomes, such as flood protection, as well as a variety of co-benefits that support the environment, the economy, and community well-being.
Natural assets (also called “natural capital” assets)	“Ecosystems or ecosystem components considered in terms of their value to society, particularly for the benefits they provide, such as water purification or flood mitigation. These assets can be assessed and managed to ensure ongoing infrastructure outcomes and other benefits to people through the ecosystem services they provide” (Horizon Advisors, 2019).

Sources: Adger et al., 2005; Canadian Council of Ministers of the Environment, 2021; Eyquem, 2021; Horizon Advisors, 2019; Infrastructure Canada, 2018a; Municipal Natural Assets Initiative, 2018a; Toronto and Region Conservation Authority, n.d.




1.0 Purpose and Approach

This report positions natural infrastructure as an important water solution for the Canadian Prairies region that is capable of supporting water infrastructure needs (e.g., water treatment, water supply) while providing other social, economic, and environmental co-benefits. Written as a state of play, the report provides a snapshot of the current state of natural infrastructure implementation across the Canadian Prairies region, specifically as it relates to water management and water infrastructure.

In this report, we use the term “Canadian Prairies region” to refer to the prairie landscapes of Alberta, Saskatchewan, and Manitoba, including key source watersheds.¹ This report

- Explores the links between natural infrastructure and water management needs across the Canadian Prairies region.
- Outlines the status of natural infrastructure implementation.
- Identifies barriers to and opportunities for scaling up natural infrastructure.

This report is informed by desktop research and interviews with 17 experts and leaders conducted to better understand the status of natural infrastructure implementation across the Canadian Prairies region alongside barriers and opportunities (Appendix A). Throughout the report, quotations from interviewees are marked by a .

As part of the International Institute for Sustainable Development's (IISD's) Natural Infrastructure for Water Solutions (NIWS) initiative (Box 1), this report concludes by identifying opportunities and general paths forward to help scale up natural infrastructure across the Canadian Prairies region, to support water-related infrastructure needs while strengthening regional resilience.

¹ The Canadian Prairies region is defined by a mix of hydrological, land-use, and jurisdictional boundaries (see Figure 4).



2.0 Introduction

2.1 The Context

Infrastructure is the backbone of the Canadian Prairies. Electricity grids hum, roads connect, and water treatment plants pump. Communities, industries, farms, and households all rely on a system of built infrastructure that uplifts the Prairies.

Indigenous leaders teach that water is the lifeblood of the land. Across the Prairies, a network of rivers, lakes, wetlands, and aquifers support and sustain life, crisscrossing ecoregions and connecting communities.

Today, a convergence of social, economic, and environmental issues challenge both the built infrastructure that upholds communities and the water systems that sustain ecosystems. More sustainable infrastructure and water solutions are needed—for rural communities, urban communities, Indigenous communities, and ecosystems. In this context, natural infrastructure is increasingly recognized as a strategy to bridge the infrastructure gap, strengthen regional resilience in the face of climate change, reverse biodiversity loss, and support the health of watersheds.



The Canadian Prairies region spans Indigenous treaty lands (page iii) and stretches across Alberta, Saskatchewan, and Manitoba. It has long served as Canada's breadbasket and is a major contributor to the national economy (Sauchyn et al., 2020). The Prairies contain more than 80% of Canada's farmland (Statistics Canada, 2022d), with lakes, rivers, streams, wetlands, and grasslands punctuating sprawling fields of wheat, barley, canola, corn, soybeans, hay, and grazing livestock. Today, the three Prairie provinces are home to approximately 18.2% of Canada's population (Statistics Canada, 2022f) and 39.3% of the Indigenous population throughout Canada (Statistics Canada, 2022h). There is a higher-than-average rural population compared to the rest of Canada (Statistics Canada, 2022f), although there is an ongoing population shift from rural areas to urban centres (Sauchyn et al., 2020). Larger urban centres include Calgary, Edmonton, Saskatoon, and Winnipeg, as well as mid-sized cities like Red Deer, Lethbridge, Brandon, Steinbach, Prince Albert, and Lloydminster.

As part of the larger Lake Winnipeg basin, the Prairies have a limited and variable water supply (Sauchyn et al., 2020). The Prairie climate oscillates between decadal periods of wet and dry, resulting in large variations in water availability between years and seasons and creating challenges for flood and drought management. Adding to these challenges, the Prairies have lost and continue to lose key natural assets. For example, historical estimates suggest a 40% to 70% loss of wetlands by area due to agricultural drainage and urban expansion (Davidson, 2014, as cited in Baulch et al., 2021), while native grasslands face ongoing conversion (Briere, 2022). The anticipated impacts of climate change, combined with ongoing ecosystem degradation, will strain the capacity of existing grey infrastructure to provide urban and rural Prairie communities with reliable, clean water and protection in the face of mounting climate risks (Council of Canadian Academies, 2019; Vigerstol et al., 2021).





2.2 The Opportunity

Natural infrastructure is a way to plan and work with nature to meet our infrastructure needs. It can be a conserved ecosystem (e.g., wetland), a restored ecosystem (e.g., replanted riparian area), or even a nature-based engineered feature (e.g., green roof). The common thread? Natural infrastructure is managed to deliver infrastructure services, like flood mitigation or water treatment, with the potential for many other social, economic, and environmental benefits. Research and practice increasingly show that natural infrastructure can deliver critical water infrastructure services affordably (Bechauf et al., 2022; Organisation for Economic Co-operation and Development [OECD], 2018; United Nations Environment Programme [UNEP], 2014) while supporting watershed health and improving community resilience (Seddon et al., 2021). For example, thinking across the water-energy-food “nexus,” natural infrastructure can help maintain an adequate supply of clean water that, in turn, supports food and energy production and helps to mitigate risks in the face of climate change (Ozment et al., 2015).

In the 21st century, there is both an opportunity and an imperative to think holistically about how infrastructure is conceptualized, designed, and implemented. Harnessing the ecosystem services provided by natural infrastructure can help meet growing water infrastructure needs across the Prairies for drinking water, waste and stormwater, river flow regulation, flood protection, and rural drainage. And while natural infrastructure is important from a water perspective, it is also poised to play a larger role in addressing interconnected challenges facing the Canadian Prairies region.

2.3 Natural Infrastructure for Water Solutions

As interest grows and many groups advocate for natural infrastructure in Canada and internationally, there is a key opportunity to look at natural infrastructure through the lens of water. In this report, we contend that natural infrastructure is well positioned to deliver water-related infrastructure services cost-effectively while also providing economic, environmental, and social co-benefits that can strengthen regional resilience in the face of climate change.

We focus on the water-related benefits of natural infrastructure because water is the lifeblood of the Prairies and because water is a powerful connector of landscapes, communities, and even economic, environmental, and social issues.

As part of IISD’s NIWS initiative (Box 1), this report is a foundational step toward better understanding the current status of natural infrastructure implementation across the Prairies.



Box 1. Natural Infrastructure for Water Solutions



“Taking natural infrastructure from novel to normal.”

NIWS is a 5-year initiative (2022 to 2026) led by IISD to help scale up natural infrastructure for cleaner water and more resilient communities across the Canadian Prairies region. Working with partners, including the Natural Assets Initiative (NAI) and the Winnipeg Metropolitan Region (WMR), the NIWS initiative aims for natural infrastructure to be backed by evidence and adopted, financed, and enabled by policy.

IISD’s expertise has contributed to the growing momentum behind natural infrastructure in Canada and internationally. Through the NIWS initiative and affiliated efforts—including IISD’s [Nature-Based Infrastructure Global Resource Centre](#) and [Nature for Climate Adaptation Initiative](#)—IISD and partners will build upon the illustrative work below to help scale natural infrastructure for water solutions, informed by the priorities and needs of key partners and communities across the Prairies.



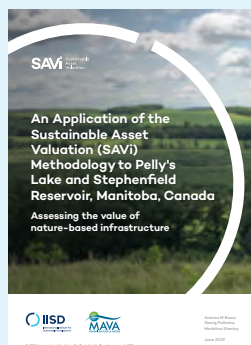
Proceedings of the first forum on natural infrastructure in Canada, convened by IISD in 2018.

[READ](#)



Identifying drivers for the funding and financing of natural infrastructure.

[READ](#)



Assessing the value of natural infrastructure in Canada and internationally using the SAVi methodology.

[READ](#)



Advancing the climate resilience of Canadian infrastructure, including water infrastructure.

[READ](#)



3.0 Scoping Natural Infrastructure for the Prairies

Section 3 provides an overview of natural infrastructure, its application across the Canadian Prairies region, and how it can be leveraged to meet water infrastructure needs while providing important co-benefits.

3.1 What Is Natural Infrastructure?

Natural infrastructure allows us to plan and work with nature to meet infrastructure needs. Natural infrastructure can be a conserved ecosystem, a restored ecosystem, or even a nature-based engineered feature (Figure 1). While there are many definitions of natural infrastructure² and related concepts, we adopt the definition developed by the Canadian Council of Ministers of the Environment (CCME) (2021):

² Infrastructure Canada defines natural infrastructure as “the use of naturally occurring resources or the engineered use of natural resources to provide adaptation or mitigation services to the gradual and/or sudden impacts of climate change or natural hazards” (Infrastructure Canada, 2018a).



Natural infrastructure “uses preserved, restored, or enhanced ecosystem features and materials (e.g., water, native species of vegetation, and sand and stone) to meet targeted infrastructure outcomes, while providing a range of co-benefits to the environment, the economy, community health and well-being” (p. iv).

Related Terms

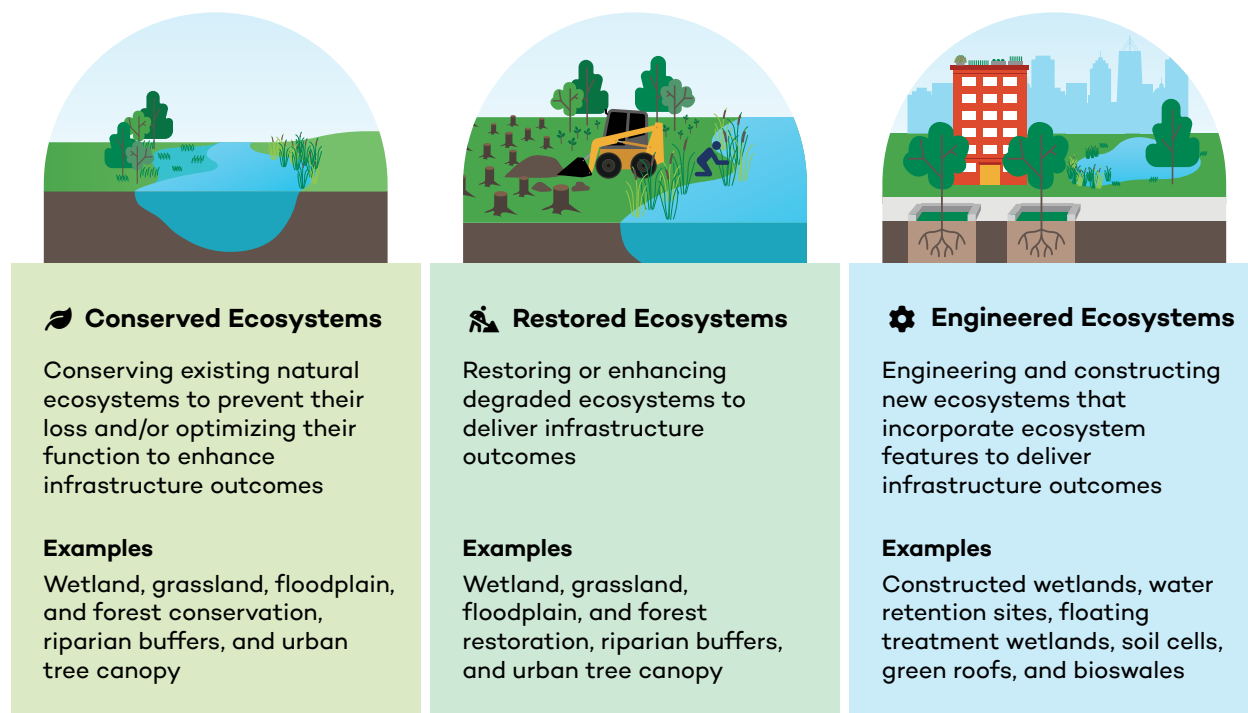
Natural infrastructure is considered a subset of the broader field of **nature-based solutions (NbS)**.

NbS include “measures that protect, repair, and sustainably manage natural or human modified ecosystems, with the aim of maintaining or enhancing the services provided to human communities and benefits to biodiversity” (CCME, 2021).

Similar concepts include nature-based infrastructure, ecological engineering, ecosystem-based adaptation, engineering with nature, green infrastructure, and natural climate solutions, among others (Brill et al., 2021).

Note: This report uses different terms throughout in an effort to reflect the specific term in the referenced work.

Figure 1. Categories and examples of natural infrastructure

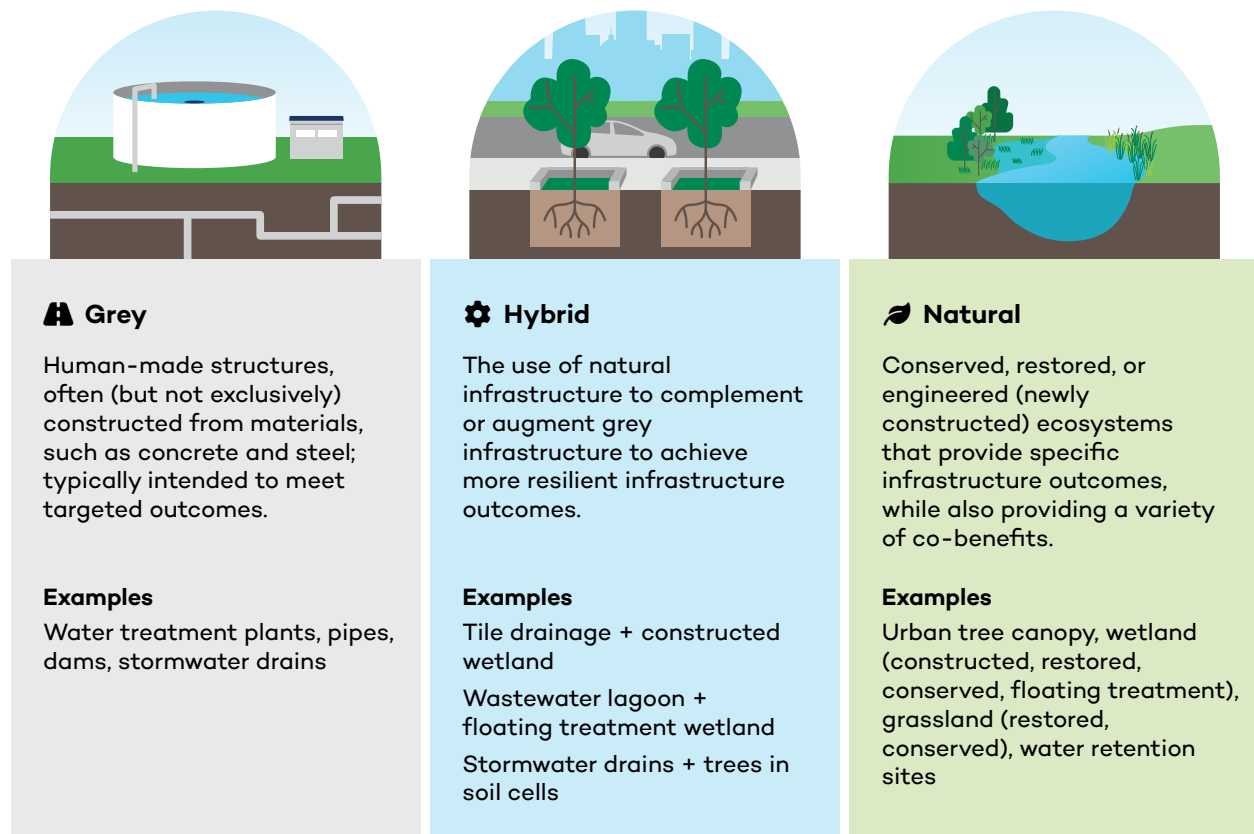


Source: IISD.

3.2 Approaches to Water Infrastructure

Infrastructure needs may be addressed through three approaches: grey infrastructure, hybrid infrastructure, and natural infrastructure (Figure 2). Across this spectrum, different infrastructure types and combinations may be applied, depending on factors including infrastructure needs, site conditions, and local priorities, among others.

Figure 2. Definitions and examples of grey, hybrid, and natural infrastructure



Source: IISD.

Grey infrastructure is typically designed to meet a limited or specific infrastructure goal, while natural infrastructure harnesses the power of nature to:

- **Provide infrastructure services**, such as flood and erosion protection (Bridges et al., 2021; Vouk et al., 2021), drought mitigation, water supply, water treatment (e.g., for stormwater and wastewater), and the protection of healthy aquatic ecosystems (MNAI, 2022; Moudrak et al., 2018; UNEP, 2014; UN Environment et al., 2018).
- **Provide co-benefits**, that is to say, positive outcomes beyond a specified infrastructure function (CCME, 2021), such as heat regulation, carbon sequestration, improved



biodiversity, and opportunities for recreation and well-being, among others (Molnar et al., 2021; Moudrak et al., 2018). In addition to meeting water-related objectives, the co-benefits of natural infrastructure frequently include social, ecosystem service, resilience, and financial benefits (Diringer et al., 2020; Eyquem & Feltmate, 2022).

While natural infrastructure alone is not a panacea, it can play a larger role in the infrastructure mix and support resilient water infrastructure systems. Perspectives on what counts as infrastructure are broadening—for example, Canada’s first National Infrastructure Assessment³ will cover “all sectors of economic, social, sustainable, and natural infrastructure” (Infrastructure Canada, 2022a, p. 4). While water is frequently a key driver of infrastructure decision making, interlinked issues like climate and biodiversity can also drive or influence choices.

3.3 Water Infrastructure in the Canadian Prairies

Water infrastructure is part of day-to-day life in the Prairies, delivering drinking water, wastewater services, stormwater services, irrigation, flow control and flood protection, and rural drainage (Table 1). While water infrastructure needs may be met by either grey, hybrid, or natural infrastructure, grey water infrastructure is the default approach to delivering water infrastructure services. A variety of organizations operate and manage grey water infrastructure—including federal, provincial, and local governments; Indigenous communities; private utilities; agricultural producers; irrigation organizations; and non-government organizations, among others—to achieve the infrastructure services detailed in Table 1.

When considering the implementation of natural infrastructure, scale matters. At the neighbourhood/site scale, for example, natural infrastructure like rain gardens and green roofs are effective strategies to manage stormwater, often reducing the volume that will subsequently enter the grey infrastructure system (CCME, 2021). There is also a role for watershed or landscape-scale natural infrastructure (Federal Emergency Management Agency, 2021), particularly across the Prairies, where climate change is making water-related disasters like flood, drought, and wildfires worse, with risks to communities, infrastructure, and ecosystems (Sauchyn, 2020). For example, when confronted with the need to make expensive water treatment upgrades, New York City instead invested in upstream and rural ecosystem protection (USD 2.5 billion since 1997) in the Catskill and Delaware watersheds, the primary sources of the city’s drinking water (Walton, 2020). The city has saved an estimated USD 10 billion in drinking water treatment costs, plus the annual operating cost of several hundred million dollars (Walton, 2020). The landscape-scale approach has also proven resilient, as New York City residents retained access to clean water despite the far-reaching impacts of Hurricane Sandy in 2012 (Appleton & Moss, 2017, as cited in Skidmore & Wheaton, 2022).

³ In July 2021, Infrastructure Canada released [*Building Pathways to 2050: Moving Forward on the National Infrastructure Assessment*](#); it is currently considering next steps, including mandate, design, and governance.



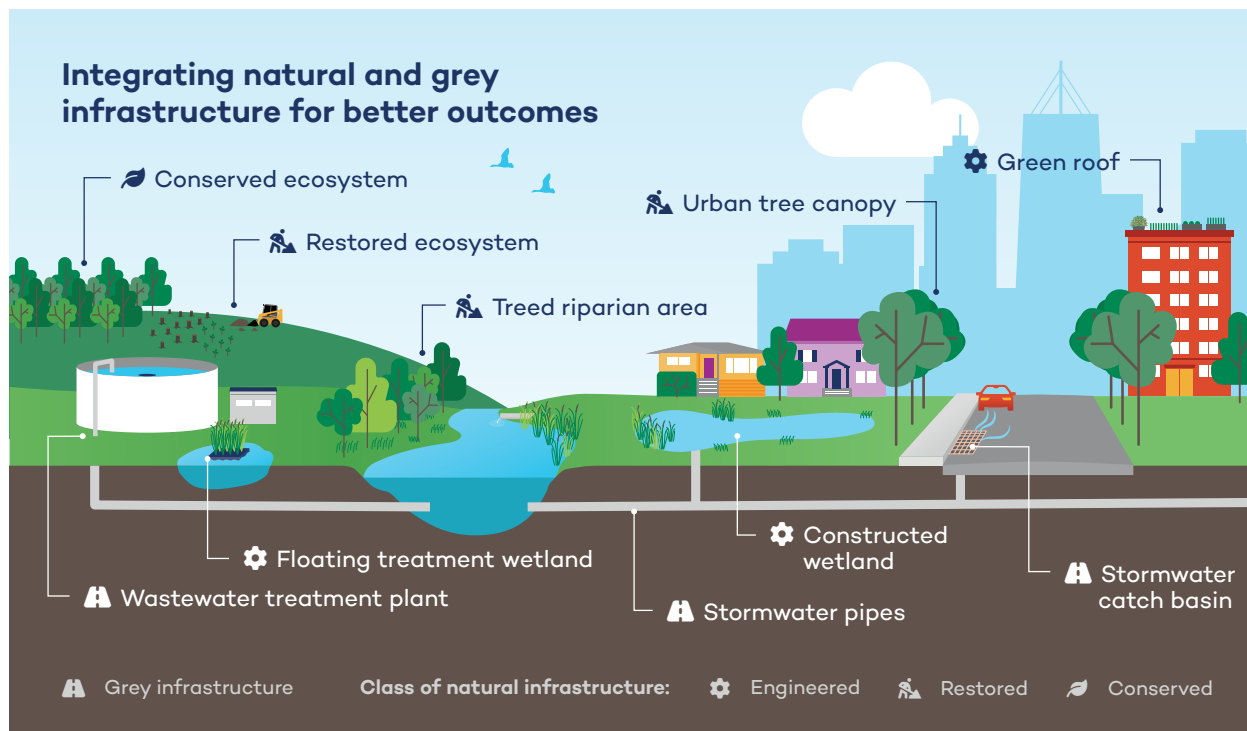
Table 1. Examples of grey water infrastructure in the Canadian Prairies region by category

Category of water infrastructure	Associated grey assets	Example of outcome/service
Potable water	<ul style="list-style-type: none">• Storage reservoirs• Water treatment facilities• Distribution and transmission pipes• Pump stations	Collect and store from raw sources (often rivers or lakes); treat water so it is safe for human consumption
Wastewater	<ul style="list-style-type: none">• Sewer pipes and sanitary force mains• Wastewater treatment facilities• Lagoon systems• Pump and lift stations• Storage tanks	Transport wastewater from point of use (e.g., homes) to treatment facility; return treated wastewater for discharge to the environment (often rivers)
Stormwater	<ul style="list-style-type: none">• Stormwater collection catch basins and pipes, ditches, culverts• Pump stations• Stormwater ponds	Divert stormwater through a network of drainage infrastructure into the environment (often rivers); prevent damage to public and private property
Rural drainage	<ul style="list-style-type: none">• Surface drains and ditches• Sub-surface or tile drainage	Move water (from rainfall or snow) off land for agricultural production
Flow control and flood protection	<ul style="list-style-type: none">• Dams and dikes• Flood bypass and control gates	Reduce the risk of flooding in communities to protect people, property, and the disruption of essential services
Irrigation	<ul style="list-style-type: none">• Reservoirs, dams, and channels• Pipes and pumps	Supply water for crop and livestock production

Source: Adapted from New Zealand Infrastructure Commission Te Waihangā, n.d.






Figure 3. Examples of natural and grey infrastructure in urban and rural areas



Source: IISD.

Box 2. The most efficient approach to natural infrastructure

Intact ecosystems typically provide more abundant and diverse benefits and co-benefits compared to newly restored or constructed systems. Generally, the most cost-effective and efficient approaches to natural infrastructure, in order of priority, are as follows (Moudrak & Feltmate, 2020):

1. Retain and maintain what you have, because  **“the best money you'll ever spend is obviously not destroying something in the first place.”/**
2. Restore what you have lost, remembering that  **“a lot of the benefits aren't going to come back within a time frame that's meaningful to humans. It might be 50 years before it starts to function, 1,000 or millennia before”/** function returns. For this reason, ecosystem restoration is not a substitution for conservation.
3. Build what you must, because  **“if you were to lose one piece of natural intact infrastructure, you'd probably have to bring in at least two or three pieces of equivalently designed green infrastructure to offset those losses.”/**



4.0 The Need to Scale Natural Infrastructure for the Canadian Prairies Region

Section 4 explores the need for water and infrastructure solutions across the Canadian Prairies region.

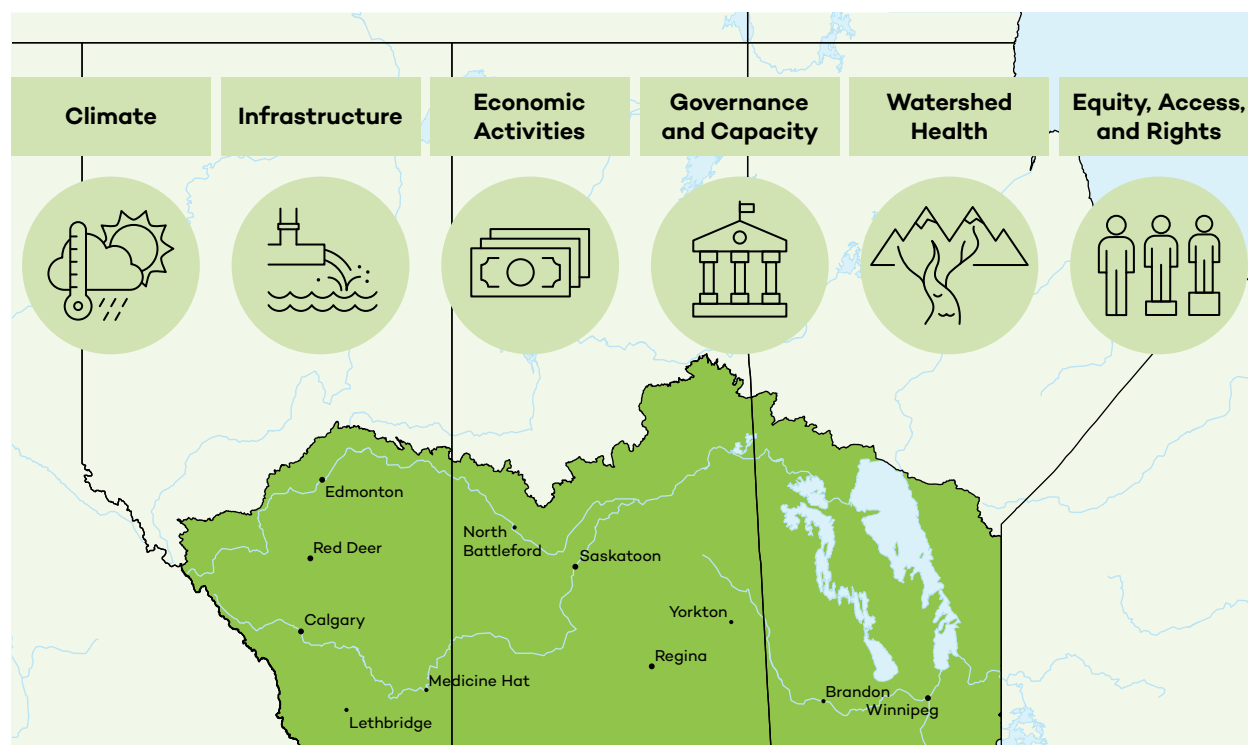
4.1 Why Focus on the Prairies?

The Canadian Prairies region faces a daunting array of challenges in the 21st century, spanning multiple themes, from chronic underinvestment in water infrastructure to climate change (Figure 4).

Viewed another way, however, these challenges may also bring opportunities, fostering innovation spurred on by need. The sections below describe some of the challenges facing the Canadian Prairies region and the ways natural infrastructure can help support Prairie needs.



Figure 4. Issues facing the Canadian Prairies region



Source: IISD.

Note: The outline shows the region of focus for IISD’s NIWS initiative based on a combination of hydrological, land-use, and jurisdictional boundaries.



Climate Change

Floods, droughts, and wildfires are getting worse across the Prairies, with unprecedented impacts in recent years and mounting risks (Insurance Bureau of Canada, 2020; Sauchyn et al., 2020). Climate change affects the timing, distribution, and volume of streamflow and water availability (Bonsal et al., 2019). The Prairies experienced a 1.9°C increase in annual temperature and a 3.8°C increase in winter temperature from 1948 to 2016 (Statistics Canada, 2022e). These increases are driving changes in ice and snow cover, glacier melt, freshwater flows, species migration, salinity, and more (Statistics Canada, 2022g). Prairie agriculture, particularly crop production, may benefit from a longer growing season but is also susceptible to water and climate extremes (Sauchyn et al., 2020), particularly the potential for severe multi-year drought (Bonsal et al., 2020). Prairie communities—including Lethbridge, Regina, Saskatoon, Winnipeg, and smaller communities—are some of the most exposed populations to extreme heat under various climate scenarios (Eyquem & Feltmate, 2022).



Infrastructure

Thirty percent of Canada’s grey water infrastructure is in fair to very poor condition (BluePlan Engineering, 2019) and, across the three Prairie provinces, the depreciation of water-related grey infrastructure outpaced investments by nearly CAD 3 billion (21.9%) between 2017 and 2021 (Statistics Canada, 2023). The impacts of climate change will further strain physical infrastructure systems (Skidmore & Wheaton, 2022), in part because investments in infrastructure often fail to account for forecasted climate risks (Canadian Institute for Climate Choices, 2020). Infrastructure planning is also challenged by an incomplete picture of existing infrastructure assets. In 2020, the percentage of municipalities with asset management plans related to potable water (Statistics Canada, 2023), stormwater (Statistics Canada, 2022a), and wastewater (Statistics Canada, 2022b) varied by province: Alberta, 56%; Saskatchewan, 57%; and Manitoba, 35%.



Governance and Capacity

Governance and decision making related to water and infrastructure are fragmented across jurisdictions and levels of government, challenging efforts to coherently address current and future challenges (Western Economic Diversification Canada, 2020). While the Canadian federal government has committed to establishing a Canada Water Agency, the mandate of the agency has not been determined, and the Canada Water Act has not been modernized since it was passed in 1970 (Brandes et al., 2020).



Economic Activities

Key economic activities—including agriculture, mining, forestry, energy, and local manufacturing (Sauchyn et al., 2020)—will be impacted, to varying degrees, by climate change and changing economic conditions. Agricultural productivity is a key concern across the Prairies and will require careful water management in the context of a changing and variable water supply. For example, 79.3% of Canada’s total irrigated land (959,526 ha) is found in the Prairies, with 68% in Alberta, 7.4% in Saskatchewan, and 3.9% in Manitoba (Statistics Canada, 2021). Since 2011, irrigated land area has steadily increased in Alberta (by 30%), Saskatchewan (by 20%), and Manitoba (by 31%).

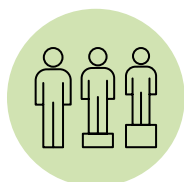


Watershed Health

Watersheds across the Prairies are at high to very high risk from multiple threats, including pollution, habitat and biodiversity loss, habitat fragmentation, overuse of water, and climate change (World Wildlife Fund, 2017). Natural landscapes throughout the Prairies have been highly modified and fragmented, the result of over a century of land development, resource



extraction, and agricultural production. Subsequently, the benefits they provide are severely compromised, and the cumulative effects of human activities on freshwater ecosystems are high relative to other parts of Canada (Statistics Canada, 2022g).



Equity, Access, and Rights

There are Indigenous, rural, and underserved communities across the Prairies where water infrastructure challenges are pervasive and where access to funding or other supports falls short. While Indigenous Peoples have a protected right to their lands and waters (Newman, 2007; Slattery, 2007), many policies have historically failed, and continue to fail, to provide adequate water infrastructure to Indigenous Peoples and honour their right to the land (Baijius & Patrick, 2019; Perry, 2016) (Box 3). Rural communities also need more infrastructure and funding support (Infrastructure Canada, 2019). A failure to embed equity considerations within projects and programs risks exacerbating existing structural inequities, harming people, livelihoods, and ways of life.





Box 3. The Indigenous context across the Canadian Prairies region

Across the Prairies, there are 178 First Nations representing 588,323 persons, 10 Treaties, and 11 linguistic groups (Indigenous Services Canada, 2021). In Manitoba and Saskatchewan, almost half of registered Indigenous Peoples live on reserve, compared to 36% in Alberta (Statistics Canada, 2022h). In 2021, the Métis Nation homeland spanning the Prairies was represented by 287,005 persons in Manitoba, Saskatchewan, and Alberta (Statistics Canada, 2022h).

First Nations communities continue to face long-term drinking water advisories across the Prairies, including three in Manitoba (13 lifted) and eight in Saskatchewan (18 lifted); there are currently zero in Alberta (4 lifted) (Indigenous Services Canada, 2022). Many Indigenous communities also face risks of climate change-induced hazards like floods and wildfires. For example, a recent study found that on-reserve Indigenous communities face a higher risk in the face of floods due to higher socioeconomic vulnerability (Chakraborty et al., 2021).

As of 2021, 587 First Nations communities across Canada received CAD 2.29 billion in investments in water-related infrastructure, ranging from new systems to capacity-building initiatives (Indigenous Services Canada, 2022). However, more investment is needed to meet the estimated CAD 25 billion to 30 billion infrastructure gap for First Nations communities (The Canadian Council for Public-Private Partnerships, 2015).

In its 2021 report on *Advancing the Climate Resilience of Canadian Infrastructure*, Swanson et al. (2021) highlighted that “**Indigenous Knowledge must play a key role in the design and implementation of resilient infrastructure across Canada,**” with Indigenous Peoples across the Prairies already at the forefront of climate impacts.

4.2 Nature to Bridge the Gap



“There's a few key case studies that are showing good examples, but we don't have either widespread acceptance or widespread implementation.”

Natural infrastructure systems are managed using natural elements, such as water, vegetation, trees, and soil, to achieve infrastructure outcomes (e.g., stormwater management, water purification, and flood control) that can replace and/or complement grey infrastructure (Horizon Advisors, 2019). Investing in natural infrastructure can be a game-changer for meeting infrastructure needs while saving money and generating additional benefits (Bassi et al., 2019).



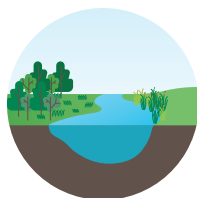
As communities across the Prairies consider approaches to repairing, upgrading, and expanding water infrastructure, natural infrastructure solutions should be considered, as they can be cheaper than relying solely on grey infrastructure and “can offer other valuable environmental and social benefits that are often not attainable through the implementation of traditional, grey-engineered solutions” (Moudrak et al., 2018, pp. 4–5). The financial value of the services provided by natural infrastructure to local communities is now being calculated across Canada through the work of many organizations, including NAI, IISD, the Intact Centre on Climate Adaptation, Ouranos, University of Quebec in Outaouais (Research Chair in Ecological Economics), Insurance Bureau of Canada, and ALUS, among others (Eyquem et al., 2022).

The examples below illustrate how valuable natural infrastructure can be in contributing to infrastructure outcomes:



CAD 5.3 BILLION

There are currently 2.67 million ha of restored and conserved wetlands and natural habitat under Ducks Unlimited Canada’s care across Canada, estimated to provide more than CAD 5.31 billion in ecosystem services annually, including water supply, wastewater treatment, and water purification (Ducks Unlimited Canada, 2021).



CAD 2 MILLION

Pelly’s Lake, an engineered wetland in Manitoba, provides CAD 2 million annually in clean water and flood protection benefits (Bassi et al., 2019).



CAD 3.2 MILLION

Winnipeg’s urban tree canopy is estimated to cover 17% of the city. It provides CAD 3.23 million annually in stormwater management through avoided runoff thanks to interception mostly from American elm and green ash trees (City of Winnipeg, 2021).



5.0 Context and Trends

Section 5 explores the global context for natural infrastructure and critical considerations related to the rights and needs of Indigenous Peoples.

5.1 Natural Infrastructure Around the World

Momentum for natural infrastructure is linked to global efforts related to climate mitigation, climate adaptation, biodiversity, human development, and Indigenous rights. It is recognized globally that halting and reversing ecological decline is fundamental to achieving net-zero targets, which are now part of Canadian law, similar to other jurisdictions (Pörtner, 2021, as cited in MNAI, 2023b). Canada's commitments to international conventions and processes can promote the implementation of NbS and natural infrastructure domestically, recognizing that natural infrastructure is a form of NbS (Table 2).

It is estimated that investment in NbS needs to triple by 2030, from about USD 133 billion per year (United Nations Climate Change, 2022), to meet existing global climate and nature targets. And while international agreements and funding can be powerful drivers for NbS, they are not



sufficient for real-world implementation. For example, in November 2022, the American Biden-Harris administration released the *Nature-Based Solutions Roadmap*, describing NbS as “woefully underused and urgently needed” (The White House, 2022) (Box 4).

Table 2. Examples of international conventions relevant to natural infrastructure in Canada

Convention/agreement	Description	Relevance to natural infrastructure
<p>Paris Agreement (United Nations Framework Convention on Climate Change, 2016)</p>	<p>The international treaty aims to limit global warming to below 2°C, preferably to 1.5°C, compared to pre-industrial levels (Environment and Climate Change Canada [ECCC], 2022a). Participating countries submit their plans for climate action and greenhouse gas emission reduction targets, called nationally determined contributions⁴ (NDCs).</p>	<p>As of December 2022, 105 countries have included NbS as part of their NDCs, including Canada (Nature-based Solutions Initiative, n.d.).</p>
<p>United Nations Sustainable Development Goals (SDGs) (United Nations Department of Economic and Social Affairs, 2015)</p>	<p>The 17 goals, a global effort to end poverty, protect the planet, and improve quality of life, were adopted in 2015. The 2030 Agenda for Sustainable Development sets out a 15-year plan to deliver the goals by 2030 (United Nations Development Programme, n.d.).</p>	<p>NbS can make a major contribution to the Sustainable Development Goals, helping to address biodiversity loss, climate change, land degradation, desertification, food security, disaster risk, infrastructure resilience, urban development, water quality and availability, poverty eradication, inequality, and unemployment (UNEP, 2022c).</p>

⁴ Canada’s current NDC “adopts a target to reduce its economy-wide greenhouse gas emissions by 40-45% below 2005 levels by 2030” (ECCC, 2022a).



Convention/agreement	Description	Relevance to natural infrastructure
<p>United Nations’ Sendai Framework for Disaster Risk Reduction (United Nations Office for Disaster Risk Reduction, 2015)</p>	<p>The voluntary agreement aims to substantially reduce disaster risk and losses in lives, livelihoods, health and the economic, physical, social, cultural, and environmental assets of people around the world by 2030 (United Nations Office for Disaster Risk Reduction [UNDRR], 2015).</p>	<p>Canada is a signatory to the Sendai Framework, acknowledging that intact ecosystems (either conserved, restored, or engineered) are critical to reducing risk in the face of climate change. The UNDRR published a guide to help stakeholders of all kinds to deliver on the environmental components of the Sendai Framework by upscaling the implementation of NbS to increase the resilience of populations (UNDRR, 2021).</p>
<p>United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (United Nations, 2007)</p>	<p>UNDRIP emphasizes the right to self-determination of Indigenous Peoples, including the right to autonomy or self-government; the right to cultural integrity, education, health, and political participation; and free, prior and informed consent regarding legislative or administrative measures that may affect Indigenous People, including but not limited to relocation; violation of Indigenous laws, traditions, and customs; and the disposal of hazardous materials on lands and territories of Indigenous Peoples (United Nations, 2007).</p>	<p>In 2021, the UNDRIP Act came into force, which is intended to provide a roadmap for the federal government and Indigenous Peoples to work together toward implementation (Department of Justice Canada, 2022). The act commits to working with Indigenous Peoples to protect the abundant and diverse natural habitats and water within their communities.</p>
<p>Kunming–Montreal Global Biodiversity Framework (UNEP, 2022b)</p>	<p>The Kunming–Montreal Global Biodiversity Framework is intended to halt and reverse the destruction of nature by 2030, with one goal to protect 30% of the world’s land, water, and marine areas by 2030 (also known as the 30 by 30 target).</p>	<p>The framework paves the way for “more synergistic cooperation between climate and biodiversity using NbS and/or ecosystem-based adaptation to tackle the twin crises of climate change and biodiversity loss in a coherent, complementary manner” (IISD, 2022), also driven by the 30 by 30 target.</p>



Box 4. NbS and infrastructure in the United States

In November of 2022, the Biden-Harris administration released the *Nature-Based Solutions Roadmap*, a strategy for the United States to maximize the potential of NbS to address climate change, nature loss, and inequity (The White House, 2022). In addition to ensuring over USD 25 billion in infrastructure and climate funding, the roadmap prioritizes five action areas: update policies; unlock funding; incorporate NbS into federal facilities and assets; train the workforce; and prioritize research, innovation, knowledge, and adaptive learning. The roadmap builds on previous commitments from the Biden Administration, including Executive Order 14072, which directs federal agencies to identify opportunities for greater deployment of NbS.

The United States has also made historic investments in infrastructure, climate adaptation, and NbS. The United States introduced two pieces of legislation to help confront the climate crisis through NbS: the Inflation Reduction Act in August 2022 and the Infrastructure and Jobs Act in November 2021 (Bertrand, 2022). The Inflation Reduction Act allocates USD 19.5 billion to support the growing demand and interest in climate-smart agricultural practices, including cover crops and agroforestry. The Infrastructure and Jobs Act invests over USD 2.1 billion for ecosystem restoration activities and over USD 3.3 billion for wildfire risk reduction. Additional investments include USD 8.7 billion to incorporate climate resilience into transportation and USD 8.6 billion to restore and conserve coastal habitats.

In the United States, the water quality requirements under the Clean Waters Act are a primary driver of green infrastructure for stormwater management. The Clean Waters Act and the Water Infrastructure Improvement Act specifically require the promotion of green infrastructure, and subsequently have been used to improve water quality of runoff and prevent combined sewer overflow events. The Environmental Protection Agency has developed [resources and tools](#) to support these regulatory requirements and implementation (Harrington & Hsu, 2018).

Efforts to scale up NbS or natural infrastructure are, of course, not impervious to critique. For example, while the implementation of NbS may contribute to nature and climate targets, some NbS, such as protected areas and forest plantations, have displaced Indigenous Peoples, restricted livelihoods, and harmed cultural practices (Lo et al., 2022; Osborne, 2015; Vanclay, 2017). The focus on NbS may also avoid or obscure contentious issues related to governance, land, and cultural rights. As an example, in the context of climate change, Indigenous Peoples may be vulnerable to both the impacts and potential solutions of climate change, framed as a “twin vulnerability” (Townsend et al., 2020). There are ongoing discussions at multiple levels regarding how to advance NbS without exacerbating inequities while upholding Indigenous rights, both globally and across Canada (Box 5). There is also concern that NbS can bring about maladaptive outcomes when it is used in pursuit of a narrow or siloed set of objectives, such as carbon

sequestration alone (Seddon et al., 2020), or promote a “polluter-pays” ideal that could enable the destruction of nature via offset markets that fund NbS (Focus on the Global South, 2021).

Box 5. Backlash and recommendations for NbS

In 2020, the International Union for the Conservation of Nature made recommendations to help ensure that NbS, including natural infrastructure, are designed and implemented to deliver benefits for natural systems and people, rather than inadvertently exacerbating ecosystem damage and inequity. Recommendations related to natural infrastructure from Indigenous perspectives include the following:

- Having a defined and fully agreed upon feedback and grievance resolution mechanism that is available to all stakeholders before an NbS intervention is initiated.
- Participation that is based on mutual respect and equality, regardless of gender, age, or social status, and upholds the right of Indigenous Peoples to free, prior, and informed consent.
- Stakeholders who are directly and indirectly affected by NbS identified and involved in all processes of the NbS intervention.
- Decision-making processes to document and respond to the rights and interests of all participating and affected stakeholders.
- Where the scale of NbS extends beyond jurisdictional boundaries, mechanisms established to enable joint decision making by the stakeholders in the affected jurisdictions.



Indigenous Peoples’ leadership and participation in conservation efforts and scaling up natural infrastructure are critical, and efforts are likely to fail without Indigenous-led governance (Artelle et al., 2019).



Several Indigenous-led and collaborative initiatives have emerged that provide new and much-needed approaches to work together across the Prairies, with two initiatives described below:

- The Collaborative Leadership Initiative supports a formal collaboration that, in 2019, brought together 18 municipalities in the WMR and 11 First Nations to develop a reconciliation framework and build a co-governance table to tackle shared social issues, creating a strong economy and protecting land, water, and air. This effort is facilitated by the [Centre for Indigenous Environmental Resources](#) and has supported the implementation of several Indigenous-led natural infrastructure projects. The WMR, in partnership with the NAI, recently released *The Journey So Far: Reconciling First Nations' Worldview and Perspectives With Natural Asset Management* (Bear & Bill, 2023), which considers how natural asset management can evolve and adapt to uphold Indigenous rights.
- The [Conservation through Reconciliation Partnership](#), launched in 2019, is an Indigenous-led project aiming to create a coalition of Indigenous and non-Indigenous leaders, organizations, academics, conservation organizations, and knowledge specialists to implement the 28 recommendations issued by the Indigenous Circle of Experts. The recommendations include the creation and expansion of Indigenous Protected and Conserved Areas (IPCAs) with a focus on Two-Eyed Seeing and Ethical Space.

Two-Eyed Seeing

Mi'kmaw Elder Albert Marshall, from Eskasoni First Nation in Unama'ki (Cape Breton) described Two-Eyed Seeing as “learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of mainstream knowledges and ways of knowing, and to use both these eyes together, for the benefit of all” (Prairie Climate Centre, 2021).



6.0 Current Status of Natural Infrastructure

Section 6 provides a snapshot of the current state of natural infrastructure implementation in the Prairies, informed by interviews and desktop research. Specific examples from Alberta, Saskatchewan, and Manitoba are highlighted.

6.1 What Is the State of Play of Natural Infrastructure Implementation?

This section draws insights from desktop research and key informant interviews with 17 experts to better understand the status of natural infrastructure implementation across the Canadian Prairies region, alongside gaps, challenges, and opportunities (Appendix A). Building on IISD's past work to advance natural infrastructure in Canada and across the Prairies, these efforts yielded broad insights into natural infrastructure and its existing application.

In response to the question “How would you characterize the state of play of natural infrastructure adoption?” interviewees broadly characterized efforts as nascent but having growing momentum. There are leading examples of natural infrastructure being applied across the Prairies to meet water-related infrastructure needs; however, these are often site-specific,



forming a patchwork of projects. The interest in natural infrastructure is contrasted with the ongoing loss of natural assets critical for watershed function (e.g., wetlands, native grasslands), signalling the need to prioritize conserved and restored natural infrastructure types. The implementation of natural infrastructure is often driven by local capacity, with a clear need to invest in people, organizations, and the pipeline of projects from conceptualization through to implementation and evaluation. Grey infrastructure continues to dominate infrastructure spending, suggesting that there is a long way to go to take natural infrastructure from novel to normal.



What is the current “state of play” of natural infrastructure implementation across the Prairies as it relates to water management?

WHAT EXPERTS ARE SAYING

A bit of a reframing that’s happening and there’s now a spotlight on natural infrastructure.

A relatively young, nascent stage. People are interested in it. People want to do it. It’s definitely not mainstreamed yet.

Still need storm pipes and stormwater system.

We need to find the balance between working with the nature that’s already in place and making sure it stays in place, versus bringing in new green infrastructure to help with issues.

Because if you have a project that’s really liked by the community, don’t be surprised if the politician likes it too.

Want examples, concrete examples as close to home as possible.

There’s no one way or the other.

Slightly more forward-thinking municipality.

Need collaboration at a watershed scale to take it to creation or construction of a more naturalized solution, you have to go the extra mile.

It’s not necessarily an unwillingness [to implement NI], but there’s a capacity problem.

Natural infrastructure for me is largely around wetland conservation and preservation.



6.2 A Prairie-Wide View

The Canadian Prairies region is home to hundreds of water-related natural infrastructure projects, ranging from small rain gardens on private properties to large-scale riparian restoration projects. The maps below share examples of different types of natural infrastructure implemented in Alberta, Saskatchewan, and Manitoba (Figures 5, 6, and 7) (Box 6). These maps illustrate the diversity of water-related natural infrastructure across a variety of settings—in urban and rural areas, on public and private lands, and at the neighbourhood/site scale and watershed/landscape scale.

For a project to be included in the scan, it needed to

1. Feature the conservation, restoration, or enhancement of natural or engineered systems, as per the definition of natural infrastructure (page 8).
2. Have a clear infrastructure service or active management for the purpose of delivering a water-related service, as categorized in Table 1 (page 10), as well as co-benefits.

These projects are only a sample of the many projects occurring and are intended to illustrate a range of natural infrastructure types alongside the range of water-related benefits and co-benefits of natural infrastructure. In the figures below, the primary water infrastructure category for each project example is shown, although examples also provide economic, social, and environmental co-benefits.

Most of the examples are driven by community members, local government leaders, or conservation organizations. Although a handful of examples demonstrate more regionally scaled efforts (Box 7), like the Dry Lake Project in Saskatchewan, natural infrastructure efforts are still often site-specific, fragmented, and/or pilot projects, not yet reaching a scale of landscape-level deployment. A similar trend is reported internationally: the OECD (2020) reports that the uptake of natural infrastructure and NbS internationally remains limited compared to grey infrastructure.

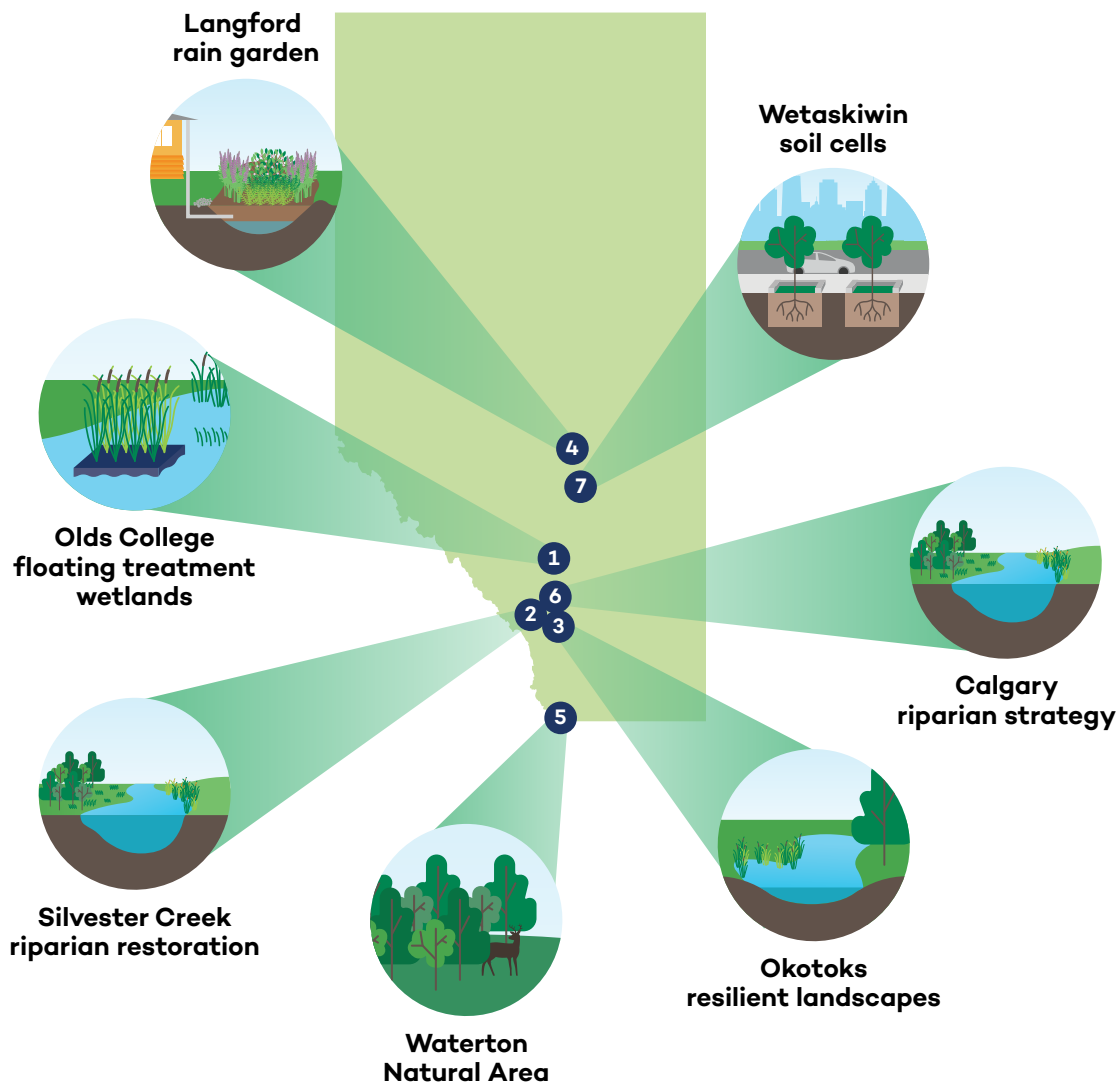
Other examples of case studies of natural infrastructure in Canada are available in:

- [Benefits of Adopting Natural Infrastructure: A Comparison of Natural and Grey Infrastructure Solutions](#)
- [Pathways to Living Cities](#)
- [Wetlands Can Be Infrastructure, too](#)
- [Can Green Roofs Help Cities Respond to Climate Change?](#)
- [Growing Forests in a City](#)



Alberta

Figure 5. Examples of natural infrastructure projects in Alberta



Source: IISD.

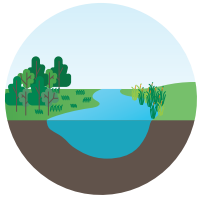


1. Olds College floating treatment wetlands

At Olds College, scientists are studying the ability of floating treatment wetlands to filter nutrients and contaminants from feedlot runoff and are recycling wastewater and improving the quality to a point where it could potentially be used to irrigate crops or as a water source for livestock.

Type: floating treatment wetlands

Category: irrigation/wastewater

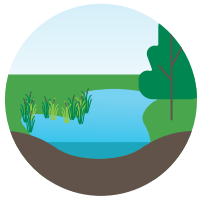


2. Silvester Creek riparian restoration

Cows and Fish has worked across Alberta for 30 years to promote riparian stewardship, including along the Eastern Slopes, where streams and rivers in the headwaters provide a critical source of water for Albertans and the Prairies. Multiple riparian area restoration projects along the Eastern Slopes—including at Silvester Creek, featuring willow plantings and engagement with the off-highway vehicle community—demonstrate the benefits of restoration for water quality and ecosystem health.

Type: riparian restoration

Category: flow control and flood protection



3. Okotoks resilient landscapes

The Town of Okotoks has taken important steps to promote natural solutions and resilient landscapes throughout its community. Okotoks installed a bioretention bed with underground water storage that supplies a solar-powered irrigation system that polishes stormwater and reduces water demand. Okotoks also implemented a deeper topsoil bylaw for public space, requiring 300 mm of soil depth beneath turf (as opposed to the more typical 150 mm), allowing for more stormwater absorption and water availability for plants. Okotoks also has a Water Conservation Rebate Program that provides residents with rebates to reduce water use during peak demand and also supports long-term conservation with efforts like rainwater harvesting systems and barrels, drought-tolerant or alternative turf, and drought-tolerant vegetation.

Type: policy and programs

Category: stormwater



4. Langford rain garden

The Langford rain garden in Edmonton demonstrates how rain gardens installed on residential properties can manage water flows. Instead of rainwater flowing off the roof of the Langford house and onto the pavement as usual, it now flows into the rain garden, which reduces the risk of flooding.

Type: rain garden

Category: stormwater

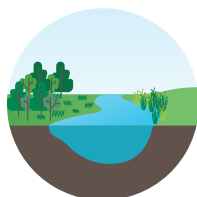


5. Waterton Natural Area

The Waterton Natural Area, in southwestern Alberta, is an area of native grassland, parkland forest, wetlands, and riparian areas rich in natural assets that support wildlife and a clean, abundant water supply and sequesters carbon. The Nature Conservancy of Canada has secured conservation protection on approximately 35,000 ha—30% of the Waterton Reservoir Watershed—through conservation easements or by purchasing and leasing back land to ranchers. The collaborative initiative preserves watershed benefits for generations to come and helps ranchers maintain their way of life.

Type: conservation

Category: potable water, flow control and flood protection



6. Calgary riparian strategy

The 2013 flood in Calgary demonstrated that intact riparian zones had very little damage when compared to those that were developed with homes or infrastructure, prompting a call to action for the protection of riparian areas. Riparian health assessments, a part of the Riparian Action Program, show that riparian health is improving at most sites throughout the city, thanks to restoration, management improvements, and the recovery of natural vegetation.

Type: riparian restoration and conservation

Category: flow control and flood protection



7. Wetaskiwin soil cells

In 2017, the city of Wetaskiwin's Main Street found itself in desperate need of repairs to its road and underground drainage system. Wetaskiwin incorporated street-side bioretention cells into the upgrade, providing better drainage, improved traffic safety, and aesthetic appeal. The natural infrastructure has helped reduce peak flows into the sewer system and prevented the need to expand the existing drainage infrastructure.

Type: bioretention cells

Category: stormwater



Box 6. Municipal Natural Assets Initiative



NAI is a Canadian not-for-profit that “provides scientific, economic and municipal expertise to support and guide local governments in identifying, valuing and accounting for natural assets⁵ in their financial planning and asset management programs, and developing leading-edge, sustainable and climate-resilient infrastructure” (MNAI,

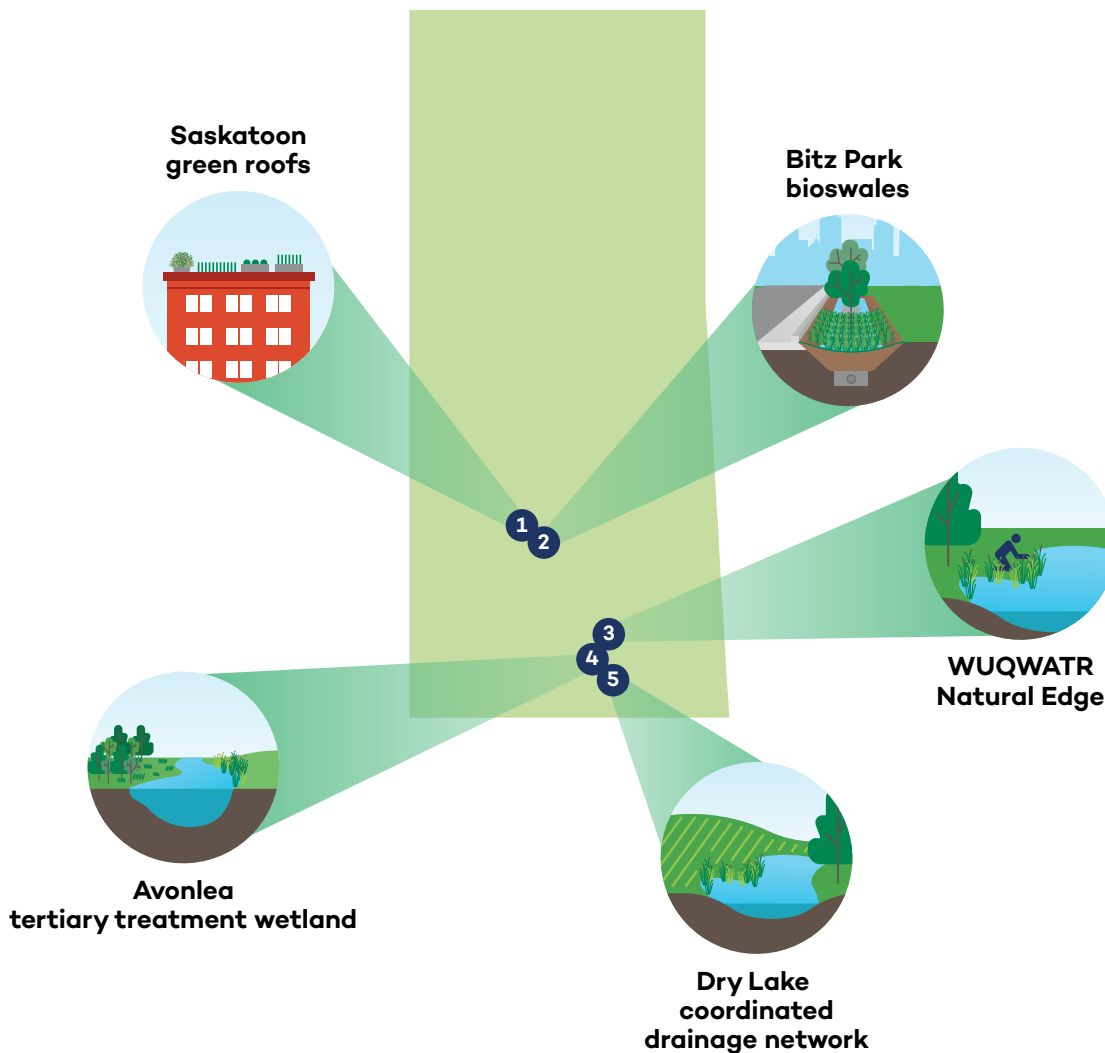
2023c). NAI supports communities across Canada along the natural asset management process. In the Prairies, NAI works with the City of Selkirk, the City of Winnipeg, and the City of Saskatoon, which have all completed Natural Asset Inventories; the Town of Okotoks has completed both Natural Asset Inventories and Management Projects.

⁵ To uphold Indigenous rights, the NAI and the WMR collaborated on *The Journey So Far: Reconciling First Nations Worldview and Perspectives with Natural Asset Management* (Bear & Bill, 2023). The effort acknowledges that the term “natural assets” is not reflective of First Nations’ perspectives, as the land’s natural features hold greater meaning compared to the existing terminology, which conveys monetary implications. To better reflect this view, “natural assets” were subsequently referred to as “land, water, and other natural resources.”



Saskatchewan

Figure 6. Examples of natural infrastructure projects in Saskatchewan



Source: IISD.



1. Saskatoon green roofs

In Saskatoon, local residents are installing green roofs on their homes. Green roofs, or rooftop gardens, provide multiple ecological and economic benefits, like reducing stormflow and reducing heating and cooling needs for the building. While the total number remains small, residents hope the trend will continue to grow, showcasing how private residents can support natural infrastructure.

Type: green roof

Category: stormwater



2. Bitz Park bioswales

In Bitz Park, a park in the Rosewood community of Saskatoon, bioswales have been added to the parking lot to improve water infiltration and pollutant removal, as well as to support biodiversity.

Type: bioswale

Category: stormwater

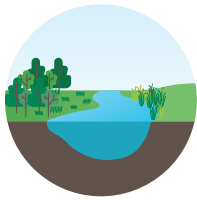


3. WUQWATR Natural Edge

Six watershed associations, including the Wascana Upper Qu'Appelle Watersheds Taking Responsibility in Regina, partnered with [Natural Edge](#), a program that helps property owners enhance their riparian areas by planting native species along their shorelines. Property owners are provided with re-naturalization kits containing 50 native plants and assistance planting. The native plants help reduce soil erosion and filter runoff while providing wildlife habitats.

Type: riparian buffer

Category: flow control and flood prevention

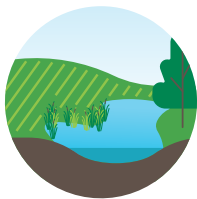


4. Avonlea tertiary treatment wetland

The Village of Avonlea struggled with maintaining its effluent lagoon for years. Thanks to a community-led initiative, it began operating a tertiary treatment wetland in 2012 to improve water quality prior to release into an ephemeral creek in the Moose Jaw River Watershed. Since implementation, Avonlea has not released untreated effluent.

Type: constructed wetland

Category: wastewater



5. Dry Lake coordinated drainage network

The Dry Lake project in the Gooseberry watershed is a coordinated approach to agricultural water management, with the collaboration of 73 landowners over 18,000 acres under a single approval. The project includes the installation of 30 staging culverts for controlled spring water release on agriculture fields and the restoration and retention of 13.8 ha and 8.5 ha of wetland habitat, respectively. The intent is to take a landscape approach to managing water to allow field access, especially in the face of climate change, while reducing the risk of flooding to downstream neighbours.

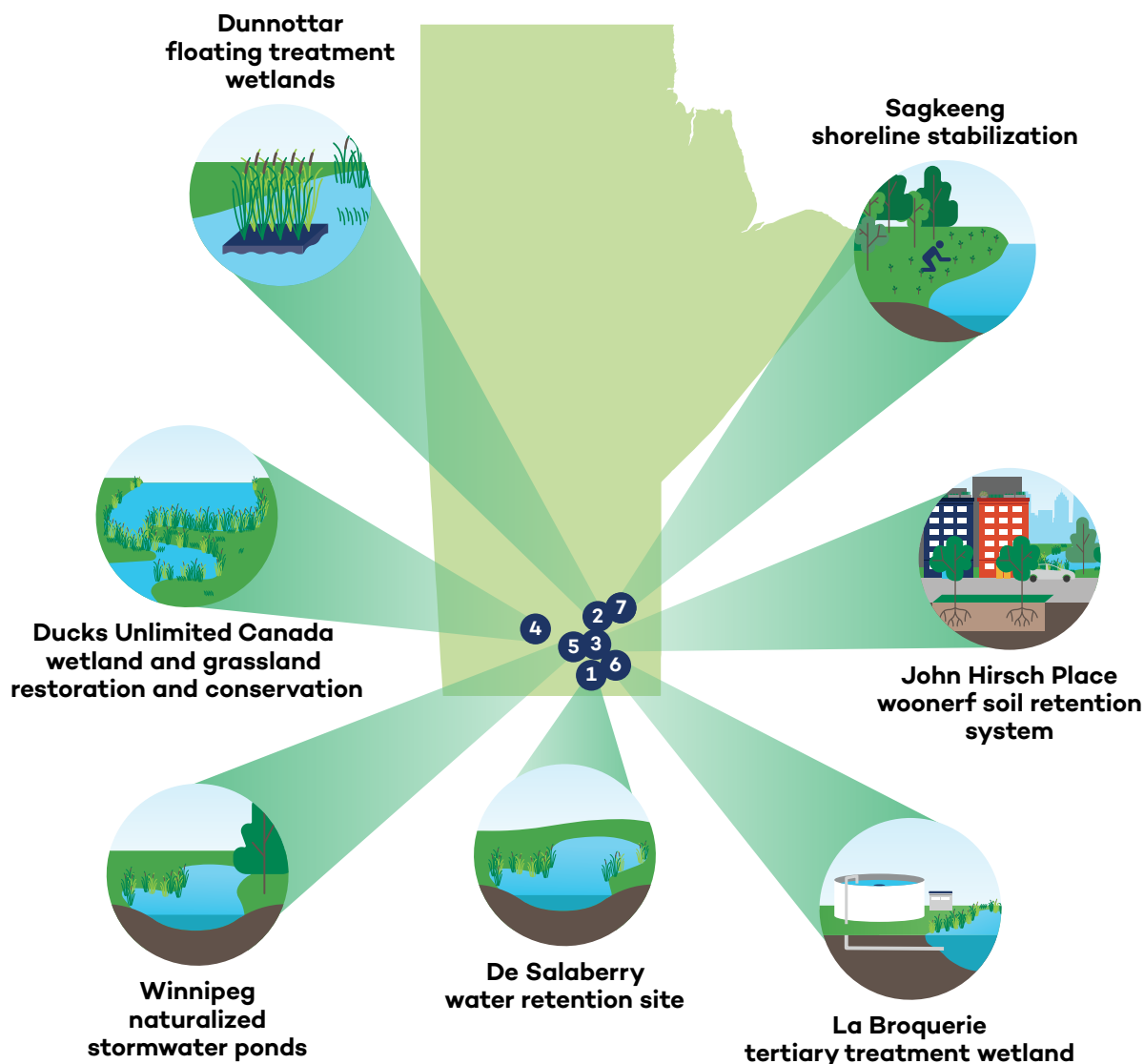
Type: wetland conservation/restoration and agricultural water management

Category: rural drainage

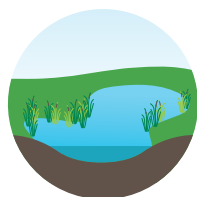


Manitoba

Figure 7. Examples of natural infrastructure projects in Manitoba



Source: IISD.

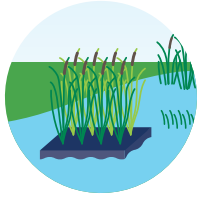


1. De Salaberry water retention site

The De Salaberry water retention site, southeast of Winnipeg, is managed by the Seine-Rat-Rousseau Watershed District. Its purpose is to reduce the risk of flood damage in the surrounding area and to protect surface and groundwater quality in the Red River basin.

Type: water retention site

Category: flow control and flood prevention



2. Dunnottar floating treatment wetlands

The Village of Dunnottar, in partnership with IISD and Scatliff:Miller:Murray, is home to five floating treatment wetlands arranged in an arc at the outlet of its secondary wastewater lagoon to optimize filtration. These small rafts contain dense aquatic vegetation that cleans the water of excess nutrients and other potentially harmful contaminants.

Type: floating treatment wetland

Category: wastewater

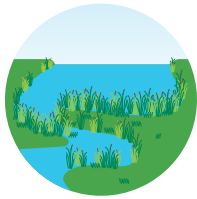


3. John Hirsch Place “Woonerf” soil retention system

In Winnipeg, John Hirsch Place is the site of the city’s first-ever “woonerf.” A woonerf is a Dutch model of a living street that prioritizes pedestrians over automobile traffic. This woonerf utilizes an underground soil retention system that helps take the burden off the city’s combined sewer system (an initiative within the Combined Sewer Overflow Master Plan described in example 5). When stormwater enters the system through a series of installed catch basins, the soil cells retain water, which keeps the water out of the sewage system while also providing an important water source for trees growing along the woonerf.

Type: soil retention

Category: stormwater

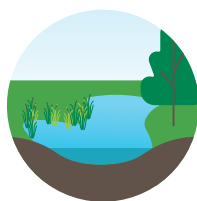


4. Ducks Unlimited Canada wetland and grassland restoration and conservation

In 2022, the Conservation Trust provided CAD 960,000 to Ducks Unlimited Canada to restore and conserve nearly 1,781 ha of wetland and grassland habitat on private land, using both long-term, incentive-based agreements and perpetual easements. Wetlands and the surrounding grasslands are intrinsic components of a healthy watershed, and this approach to restoring or conserving both habitat types provides broader benefits, including more water storage capacity and water quality improvements across the watershed. The effort also supports agricultural producers, keeping water on the landscape for livestock and forage production, which is particularly important as the frequency and severity of drought increase.

Type: wetland and grassland conservation/restoration

Category: flow control and flood prevention/rural drainage

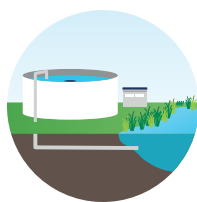


5. Winnipeg naturalized stormwater ponds

Across Winnipeg, suburban neighbourhoods have implemented naturalized stormwater ponds, designed and built by [Native Plant Solutions](#), that are surrounded by native grassland species, as opposed to the more common turf grasses. The success of these naturalized systems has resulted in transformational change at the local level, where all new stormwater ponds in Winnipeg must be naturalized. These ponds reduce stormwater runoff and improve local water quality. Additionally, the City of Winnipeg has initiated a major infrastructure upgrade program called the Combined Sewer Overflow Master Plan, which is intended to reduce the impact of combined sewer overflows on the local waterways. In the city's budget, 10% is allocated to green infrastructure solutions, like rain gardens, bioswales, green roofs, rainwater collection, permeable pavement, and green streets strategies that maintain tree canopies, promote healthy soils, and protect existing habitats.

Type: constructed wetland, rain garden, bioswales, green roofs, urban tree canopy

Category: stormwater



6. La Broquerie tertiary treatment wetland

La Broquerie built a tertiary treatment wetland to improve the quality of treated wastewater prior to discharge into the Seine River. The wetland is planted with cattails, a native wetland species that removes nutrients, like phosphorus, helping to achieve the provincial requirements for discharge levels of phosphorus at less than 1 mg/l.

Type: constructed wetland

Category: wastewater



7. Sagkeeng shoreline stabilization

As part of a riparian restoration initiative, Sagkeeng First Nation is planting hundreds of native trees along shorelines for bank stabilization and protection against erosion, employing local contractors and workers. The trees will also help filter phosphorus to prevent it from contributing to algal blooms in Lake Winnipeg. This Indigenous-led project showcases how natural infrastructure can also support social and economic benefits to communities.

Type: riparian restoration

Category: flow control and flood prevention



Box 7. Indigenous-led natural infrastructure

IPCAs “are lands and waters where Indigenous governments have the primary role in protecting and conserving ecosystems through Indigenous laws, governance, and knowledge systems” (Indigenous Circle of Experts, 2018, p. 5).

As conserved ecosystems, IPCAs are also an example of Indigenous-led natural infrastructure and can support local biodiversity while safeguarding Indigenous rights, including the right to exercise free, prior, and informed consent. Examples can include Tribal Parks, Indigenous Cultural Landscapes, Indigenous Protected Areas, and Indigenous Conserved Areas. While there is a growing momentum behind IPCAs, to our knowledge there are no formal IPCAs in the Prairies region to date (Molnar et al., 2021). IPCAs may also help support the federal government’s 30 by 30 target and efforts toward reconciliation.

As example outside the Canadian Prairies region is Sakitawak Conservation IPCA, one of four Métis-led initiatives in Canada, managed by a partnership between the Village of Île-à-la-Crosse, A La Baie Métis Local 21, the Big Island Fisherman’s Cooperative, and the N-14 Trapper’s Association. Covering 22,000 km² of pristine boreal forest, the IPCA is managed to promote sustainable development, advance Indigenous ways of life and knowledge systems, and implement stewardship activities to protect the habitat of vulnerable species.

6.3 Natural Infrastructure in Practice

6.3.1 Building a Better Business Case

Context and Status

While natural infrastructure can help bridge the infrastructure gap and strengthen regional resilience, it is currently underused, partly because of a lack of frameworks and tools for identifying and measuring benefits, valuing the full scope of co-benefits, demonstrating a positive return on investment, and integrating it within infrastructure decision making (Shiao et al., 2020).

Project developers, champions, and funders of natural infrastructure often need to provide robust evidence that projects that include natural infrastructure can meet infrastructure goals cost-efficiently while providing social, economic, or environmental co-benefits. However, according to Shiao et al. (2020), building a better business case for natural infrastructure is challenging due to

Why It’s Important

There is a need to build a better business case for natural infrastructure by bringing together the resources needed by practitioners and policy-makers to champion, assess, and evaluate natural infrastructure across scales.



- **Uncertainty:** Adopters, including businesses and local governments, are uncertain that natural infrastructure will effectively address their specific priorities or needs.
- **Lack of awareness:** Public awareness and acceptance are limited, as the evidence and positive examples of natural infrastructure are published academically and not shared widely.
- **Economics:** The financial benefits of grey infrastructure have been quantified and are well understood, while standards, frameworks, and tools to quantify, value, and monetize the benefits of natural infrastructure are limited.

Benefits and Co-Benefits

A myriad of indicators, metrics, and frameworks can be applied to identify and evaluate specific benefits and co-benefits of natural infrastructure, although there is currently no clear consensus regarding best practices (Shiao et al., 2020). According to the Pacific Institute’s guide, *Benefit Accounting of Nature-Based Solutions for Watersheds*, there are three general steps to evaluating the benefits of NbS (or natural infrastructure); Step 3 is an optional progression in the evaluation process depending on local needs:

- **Step 1. Benefit identification:** Establish the full range of the types of benefits associated with a given NbS or natural infrastructure type.
- **Step 2. Benefit accounting:** Estimate each benefit either quantitatively or qualitatively.
- **Step 3. Benefit valuation:** Assign a monetary value to benefits.

Valuation

Oftentimes, the processes, tools, and norms that shape infrastructure decision making do not capture the range of benefits that natural infrastructure can provide, in part because natural infrastructure benefits fall outside of conventional economic systems or methods. This can lead to grey infrastructure appearing as the more attractive option on paper, despite the real-world cost savings and added benefits of natural infrastructure options (Bassi et al., 2019; Eyquem et al., 2022). Decision making may also be biased toward projects with short-term benefits, as shown in the United States, where high discount rates in federal cost-benefit analyses often favour grey infrastructure projects with greater short-term benefits (The White House, 2022).

Experts and natural infrastructure leaders in Canada have flagged the need for more tools and practical valuations that help natural infrastructure compete with traditional infrastructure and prove its return on investment (International Institute of Sustainable Development, in press). For example, IISD’s Nature-Based Infrastructure Global Resource Centre uses the Sustainable Asset Valuation (SAVi) methodology to compare natural and grey infrastructure options, including economic, social, and environmental costs, benefits, and risks over a project’s life cycle. There are also groups advocating to “get nature on the balance sheet” (Eyquem et al., 2022) and work with public sector accounting bodies and standards agencies to develop practical guidance for local governments that wish to value and make disclosures relating to their natural assets (Box 8). And while benefit valuation in economic terms can be a powerful driver for decision making (Box 9), it should be seen as part of a bigger picture, including community needs, priorities, and values.



WHAT EXPERTS ARE SAYING



What experts are saying about building a better business case

So, we're still trying to find that happy medium of what is good enough, accessible enough, and tells a story, yet still has that level of robustness.

[NI can justify both] a different approach and potential cost difference.

We can have less expensive water quality treatment if we manage our land with upstream natural infrastructure.

If we're not demonstrating the value and working with people on the ground to show them how these could be implemented, then nothing's ever gonna happen with that, unfortunately.

if we could find the value of reducing treatment costs of water for the city by having better quality water coming to their system.

If you can create buy in with understanding and education, I think that's the biggest hurdle in order to get natural infrastructure projects off the ground. Because if you have a project that's really liked by the community, don't be surprised if the politician likes it too.

Mainstreaming [some already understood NI practices are a] low hanging fruit.

Think about funding in terms of leaving stuff alone.

If the area has lots of green vegetation and so on, there's a very clear link between that and morbidity and mortality, particularly heat dome and other sorts of high heat event. And who cares about that? The local health authority because they're not dealing with dead and dying people. And that saves money.



Box 8. Putting nature on the balance sheet

A 2022 paper by the University of Waterloo’s Intact Centre on Climate Adaptation, KPMG, and the Municipal Natural Assets Initiative suggests three pathways to “get nature on the balance sheet” in Canada (Eyquem et al., 2022):

- Include natural assets in public sector financial statements (currently under consideration by the Canadian Public Sector Accounting Board).
- Establish national guidelines and standards for identifying and valuing natural assets in Canada. A Canadian National Standard, *Methodology for Completing Natural Asset Inventories* (CSA W218) is expected for release in mid-2023, to provide a consistent approach to natural asset inventories (CSA Group, 2022).
- Engage financial institutions and organizations to set frameworks and metrics that account for the value of nature, guide private investments to protection and restoration opportunities, and enable the return on investment in nature to be measured.

Box 9. City of Calgary’s approach

Many municipal governments do not currently include natural assets in their approaches to asset management, though they face increased risk of loss or degradation without clear accounting and valuation. The City of Calgary recently completed an analysis to determine the value of its natural assets, including grasslands, forests, riparian areas, watercourses, and naturally occurring and/or enhanced wetlands (other natural infrastructure like green roofs and bioswales were not included). The study demonstrated that natural assets provide significant value to the City of Calgary, in the range of CAD 2.5 billion annually for the following services: recreation, amenity and enjoyment, habitat, water retention, urban heat reduction, and carbon storage (City of Calgary, 2021).

6.3.2 Supporting Local Governments

Context and Status

Local governments in Canada own and manage over 60% of Canadian grey infrastructure assets (Johal, 2019), including infrastructure to deal with stormwater, wastewater treatment, drinking water treatment, and flood protection and drainage. They also manage other types of infrastructure that have an impact on water


Why It’s Important


Local governments need information, guidance, and capacity to support natural infrastructure efforts that match their needs and help to bolster capacity in rural and underserved communities.



(e.g., design of roadways and earthworks) and can create policies and bylaws that influence the decisions of private landowners and developers. Increasingly faced with extreme weather events, many municipal governments are being called upon to address intersecting challenges (i.e., the infrastructure gap, fiscal crunch, water, climate, biodiversity, etc.) and are thus key players for decisions related to local and regional natural infrastructure implementation.

Water-related infrastructure depreciation is outpacing investment by 21.9% in the Canadian Prairies (Statistics Canada, 2023), with 20% to 40% of Canada's water infrastructure rated as being in fair, poor, or very poor condition (BluePlan Engineering, 2019). To varying degrees, local governments are taking stock and planning for upgrades using asset management plans for their water-related infrastructure, with 56% of municipalities in Alberta, 57% in Saskatchewan, and 35% in Manitoba having completed asset management plans related to potable water, stormwater, and wastewater (Statistics Canada, 2022a, 2022b, 2022c). Even fewer local governments have taken stock of their natural assets, with only five well-known examples in the Prairies (Eyquem et al., 2022), although anecdotal evidence suggests an uptick in interest.

Local governments across the Prairies vary in size and may include urban municipalities (such as cities, towns, and villages), rural municipalities, and specialized municipalities.⁶ The ability to implement natural infrastructure projects varies based on factors including funding, capacity, awareness, policy, and more (Canadian Association of Municipal Administrators, 2022). Despite some interesting natural infrastructure project examples from leading local governments (see Section 6.2: A Prairie-Wide View), natural infrastructure remains novel across most of the Canadian Prairies region and currently lacks implementation at regional or watershed scales. Despite the growing availability of funding opportunities, smaller local governments may lack the resources (financial, staff time, technical training) to apply for or meet the requirements of  **“shovel-ready projects,”** / as is required for the Canadian federal Natural Infrastructure Fund.

Overall, grey water infrastructure is still the go-to choice, unless one is engaging with a  **“slightly more forward-thinking municipality.”** / Existing municipal policy tends to reflect the dominant worldview of nature as property (MNAI, 2023b), instead of prioritizing its protection,⁷ and does not typically integrate natural infrastructure or natural assets into local government land-use plans or decision-making processes (Shaw, 2019). As a result, many Prairie communities are losing natural assets and green space, with three-quarters of large and medium-sized cities across Canada becoming more developed and less green between 1999 and 2019 (Webber, 2022).

According to a systematic review of barriers facing natural asset management in British Columbia conducted by the NAI, priority solutions to facilitate natural infrastructure as a common practice at local scales include 1) education and capacity building, 2) strategy, policy, and bylaw development, 3) new programs and changes to operations, and 3) building third-party support


⁶ Manitoba has 137 municipalities, Saskatchewan has 779, and Alberta has 340 (Statistics Canada, 2022f).

⁷ On the contrary, Indigenous values rate nature as equal to human beings in importance (MNAI, 2022).



for natural infrastructure (Cairns & Hallsworth, 2021). The review also highlighted the need for a more affirmative direction for natural infrastructure within policy and legislation at the provincial and local government levels (MNAI, 2022). These recommendations and other best practices (Box 10) can be considered across the Prairies. For example, there is currently no regulation to require local governments to incorporate natural assets in asset management planning, as will be required in Ontario in 2024 (Government of Ontario, 2022).

For truly impactful outcomes, natural infrastructure efforts cannot be made in bits and pieces, and they cannot be restricted to public lands or within the boundaries of individual local governments (Box 11). The benefits provided by an ecosystem, on either public or private land, can be degraded by the management of the surrounding landscape or, in some instances, lost to conversion to urban development or agriculture. Ecosystem management on private land has been historically challenging, with land-use activities straining the ecosystem services provided (McFatridge, 2018). As described in MNAI (2018b), local governments have a variety of land uses to promote natural asset protection for societal benefits, such as land acquisition (e.g., the [City of Edmonton's Environmental Strategic Plan](#), prioritizing the acquisition of sensitive lands), conservation easements (e.g., [Ducks Unlimited Canada](#) on wetland and grassland habitat), and specialized plans (e.g., [Winnipeg Urban Forest Strategy](#)). The Toronto and Region Conservation Authority, which has jurisdiction over some of the highest-value lands in Canada, has a greenspace securement goal and a range of securement tools linked to regulation and planning, stewardship (e.g., incentives and education), and acquisition of full or partial interest (e.g., fee simple, covenant, easement, lease, or agreement) (Toronto and Region Conservation Authority, 2020).

Some incentives exist for private lands, such as [ALUS Canada](#), which compensates farmers for restoring and maintaining NbS on their land, and [EPCOR's Stormwater Integrated Resource Plan](#), which has delivered natural infrastructure on public land in Edmonton and is now moving into initiatives on private land. Despite these examples, there is overall insufficient uptake  **“to build [natural infrastructure and natural asset management] at a scale that matters.”/**



What experts are saying about supporting local governments

WHAT EXPERTS ARE SAYING

It's not necessarily an unwillingness [to implement natural infrastructure], but there's a capacity problem.

Prefer the least expensive option.... considering only the sticker price.

There's nothing that motivates a local government more than seeing that buddy up the road is doing [natural infrastructure], too. And then they say, "well, they're doing it, they've got a case. Why am I not doing it?" So that's a huge motivator.

Key need is to build capacity at the local government level for the decision-makers, the employees, and the elected officials.

Incorporating natural solutions into their conventional needs.

[Lack of professionals] that are qualified and competent to work in this space.

They need clean water, they need sewage treatment, they need flood damage reduction hazard planning, and quality of lives for their residents. And that's where nature comes in.

Grey infrastructure, as soon as you cut the ribbon, it starts to deteriorate.

Natural infrastructure literally grows over time and strengthens and continues to deliver those services.


Municipalities are typically very conservative in their approaches to how they deal with things.


100% if natural infrastructure isn't going to solve the problem [the municipality is] concerned about, they're not going to invest in it.

We need to build [natural infrastructure and natural asset management] at a scale that matters.



Box 10. How local governments can increase natural infrastructure

Local government leadership surrounding natural infrastructure is critical and the  **“work needs to be done now.”** / Examples of  **“low-hanging fruit”** / to support local efforts include

- Urban development increases imperviousness and changes the hydrological regime in that location. Natural infrastructure and low-impact development (LID) should be mainstreamed into the planning process for new neighborhoods, as they have a significant positive impact on runoff. A review of the “friendliness” towards LID in existing regulations ranked Alberta as “highly LID-friendly,” where LID has become the mainstream technology for stormwater management (Ishaq et al., 2019). Manitoba and Saskatchewan were categorized as “moderately LID-friendly” where LID has gained considerable acceptance but is not yet mainstreamed.
- Under the Ontario Water Resources Act, the Government of Ontario is developing a *Low Impact Development Stormwater Management Guidance Manual* with the intention that local governments, developers, and others can plan, design, and implement LID or natural infrastructure-type approaches to stormwater management, including rain gardens, green roofs, urban trees, permeable pavement, and rainwater harvesting. The guidance will not have mandatory requirements but will provide information to clarify whether LID is an effective option to treat and manage stormwater to the required levels.
- Natural infrastructure can be implemented in processes that are already  **“well-oiled machines,”** / like sidewalk renewal, where there are many kilometres of hard surfaces in a community under local government jurisdiction.

Box 11. Gibsons, B.C., and the need for scale

Gibsons, B.C.—an early leader and champion of natural asset management—was the first local government in Canada to put natural assets at the core of its infrastructure, planning, and operations. However, despite the 2014 Town Council calling nature its most valuable asset, meaningful progress on natural asset management has been stymied by a lack of clear regulatory or governance drivers to support natural asset management across local government borders, a watershed, or regional scales (MNAI, 2022).

For example, while Gibsons has recognized the local aquifer as a critical natural asset that is the sole source of the town’s water supply, there is little they can do to protect the aquifer from industrial, commercial, and residential developments happening outside of Gibsons’ boundaries but within the aquifer’s recharge area.

Learning from the Gibsons example, NAI (2022) stresses the need for regional and watershed-scale collaboration, supported by a clear framework for watershed management and natural asset management. The next era of natural asset management will likely be defined by the ability, or not, for jurisdictions to work together to conserve, enhance, or engineer resilient natural infrastructure systems that work in tandem with grey infrastructure.



6.3.3 Mobilizing Capital

Context and Status

Public funding for natural infrastructure is on the rise in Canada through a variety of federal and provincial investments supporting natural infrastructure directly or climate adaptation efforts more broadly (Table 3). The Government of Canada's Budget 2021 established a CAD 200 million Natural Infrastructure Fund (Government of Canada, 2021). Canada's draft National Adaptation Strategy, released in November 2022, includes support for natural infrastructure and ecosystem restoration and commits CAD 1.6 billion over 5 years, with up to CAD 489.1 million to top up the Disaster Mitigation and Adaptation Fund and up to CAD 530 million to expand the Green Municipal Fund to support community-based adaptation.

Provincial governments are also investing, to varying degrees, in watershed resilience and/or natural infrastructure programs (Box 12). Still, increases in funding must be contextualized in terms of need and distribution.

- **Need:** While the CAD 200 million Natural Infrastructure Fund is a laudable step forward for federal funding, it will not stretch far. For context, according to the Municipal Natural Assets Initiative, one restoration project in a single floodplain required CAD 54 million from the Canadian Disaster Mitigation and Adaptation Fund (R. Brooke, personal communication, February 1, 2023). If compared to the CAD 200 million of the Natural Infrastructure Fund, this one large project, in theory, would use more than a quarter of the entire allocation.
- **Distribution:** The availability of funding does not guarantee the distribution of funding to areas with the highest infrastructure need or equitable distribution. For example, as of the end of the 2020/21 fiscal year, only 10.6% of the total funding from the Green Municipal Fund was distributed to communities in the three Prairie provinces.

Grey infrastructure remains the default option for most infrastructure spending in Canada, but investments in natural infrastructure are becoming substantial. There are also growing investments in infrastructure, defined more broadly. The Government of Canada launched its Long-Term Infrastructure Plan in 2018 to inject over CAD 180 billion into infrastructure investment over 12 years across five priority infrastructure areas: social, green, public transit, trade and transportation, and rural and northern communities. This total includes CAD 26.9 billion in

Why It's Important

Public, private, and philanthropic funders can play a catalytic role in scaling up natural infrastructure by boosting the amount and diversity of capital available to support projects. Mobilizing more capital for natural infrastructure also requires a strong business case, a project pipeline, and a way to connect project developers with tangible investments.



new funding for green infrastructure (including natural infrastructure and clean energy initiatives) (Infrastructure Canada, 2018b). In the flagship Investing in Canada Infrastructure Program, 16% of the almost 8,000 projects currently planned under the Green Infrastructure stream are in the Canadian Prairies, with CAD 2 billion of the total CAD 9 billion budget for this stream allocated to Prairie projects (Infrastructure Canada, 2022b).

Table 3. Examples of federal and provincial funding programs relevant to natural infrastructure

Funding program	Goals	Description	Examples of natural infrastructure supported
Investing in Canada Infrastructure Program	<ul style="list-style-type: none"> • Pollution reduction • Clean water • Resilience to climate change • Inclusive communities 	The Investing in Canada Infrastructure Program was launched in 2021 and will provide CAD 33 billion in funding in four streams: public transit, green infrastructure, community, culture, and recreation infrastructure, and rural and northern communities infrastructure (Infrastructure Canada, 2023a).	<ul style="list-style-type: none"> • Bioswales • Flood mapping
Nature Smart Climate Solutions Fund	<ul style="list-style-type: none"> • Carbon capture • Climate change impact mitigation • Water quality • Habitat conservation 	The fund will invest CAD 1.4 billion over 10 years to achieve 2–4 megatonnes of emissions reductions annually through the conservation and restoration of natural habitats (Environment and Climate Change Canada, 2023). Additionally, CAD 36.9 million has been set aside for Indigenous-led Natural Climate Solutions (Environment and Climate Change Canada, 2022d).	<ul style="list-style-type: none"> • Conserved, restored, and enhanced grasslands and wetlands



Funding program	Goals	Description	Examples of natural infrastructure supported
Natural Infrastructure Fund	<ul style="list-style-type: none"> • Use and uptake of natural infrastructure • Community awareness 	<p>The fund was launched in 2021 with a budget of CAD 200 million to promote natural infrastructure for climate change resilience, access to nature, environmental quality, biodiversity, and habitat (Government of Canada, 2021).</p>	<ul style="list-style-type: none"> • Soil cells • Engineered wetlands • Riparian buffers
Indigenous Guardians	<ul style="list-style-type: none"> • Indigenous-led natural climate solutions 	<p>The program was initiated in 2018 and was extended in 2021 to provide up to CAD 100 million to Indigenous-led programs by 2026 (Environment and Climate Change Canada, 2022d).</p>	<ul style="list-style-type: none"> • Conserved wetlands • Restored grasslands
Disaster and Mitigation Adaptation Fund	<ul style="list-style-type: none"> • Mitigate climate change risk to infrastructure 	<p>Launched in 2018, more than CAD 1 billion is available (as of April 2023) to improve community resilience against the impacts of climate change, including natural infrastructure (Infrastructure Canada, 2023b).</p>	<ul style="list-style-type: none"> • Rain gardens • Trees • Wetlands
The Trusts (MB)	<ul style="list-style-type: none"> • Watershed resilience to climate change • Water quality 	<p>As of June 2021, CAD 179 million has been granted to fund 119 conservation projects in Manitoba, via the Conservation Trust (est. 2018), the GROW Trust (est. 2019), and the Wetlands GROW Trust (est. 2020) (Manitoba Habitat Heritage Corporation [MHHC], 2021).</p>	<ul style="list-style-type: none"> • Riparian buffers • Habitat restoration
Alberta Community Resilience Program (AB)	<ul style="list-style-type: none"> • Long-term resilience to floods and droughts • Healthy watersheds 	<p>Program funds are allocated annually and cover 70% of costs up to CAD 3 million and 90% of costs greater than CAD 3 million for design and construction.</p>	<ul style="list-style-type: none"> • Bioswales • Engineered wetlands



Funding program	Goals	Description	Examples of natural infrastructure supported
Watershed Resiliency and Restoration Program (AB)	<ul style="list-style-type: none"> Restored, enhanced, and conserved freshwater ecosystems 	Since the program was initiated in 2014, CAD 40 million of funding has been distributed, with CAD 7 million planned for projects in 2023 and 2024 (Government of Alberta, 2022).	<ul style="list-style-type: none"> Riparian buffers Restored wetlands
Resilience Agricultural Landscapes Program (SK)	<ul style="list-style-type: none"> Water quality Soil health Biodiversity Resilience 	This program is part of a CAD 53.4 million Climate Change and Environment priority area funded through the federal/provincial Sustainable Canadian Agricultural Partnership (2023–2028) and promotes beneficial management practices for sustainability in agriculture (RealAgriculture, 2023).	<ul style="list-style-type: none"> Native and tame grasslands Riparian buffers

Private Finance

Globally, only 17% of the financial flows to NbS solutions are contributed by the private sector (USD 26 billion per year), and public funds are increasingly stretched (UNEP, 2022a). Increasing the share of private finance to NbS and natural infrastructure will require a stronger investment case (i.e., the return on the investment relative to the level of risk). Despite growing momentum surrounding carbon markets and climate finance, there are persistent barriers facing NbS investments, including high (perceived) risks, a lack of predictable revenue streams, and the small scale of the asset class (UNEP, 2022a). While there are some innovative examples of private financing mechanisms being applied in North America to support large-scale projects (Vajjhala & Roy, 2020), bankable and sustainable natural infrastructure projects must be identified across the Prairies to drive regional investment. It is also important to recognize that large-scale natural infrastructure projects are unlikely to emerge on their own, requiring clear leadership supported by a mix of early-stage capital and predevelopment support, plus funds for planning and design, construction, and operations and maintenance (Vajjhala & Roy, 2020). The implications of private sector finance must also be explored through the lens of equity, recognizing that while additional finance can “increase the pie” for natural infrastructure, “how the pie is sliced” is critical for the distribution of benefits and justice outcomes (Toxopeus et al., 2020).



What experts are saying about mobilizing capital

A lot of desire for private capital to come in and fund municipal green projects because, well, the municipality will pay the bond back.

People are realizing, huh, it's actually expensive to get these benefits in other ways.

Identify beneficiaries for [NI], and that's what needs to be scaled, because those beneficiaries have benefits for liability holders.

In terms of loan funding, that's been our greatest area of success where it helps meet regulatory compliance.

Drop in the bucket.

We've not seen any growth in the diversity of funding bodies. It's the same funding bodies, all the time.

Just wants to build something.

Right now the numbers are really paltry.

I don't think it's just backing up a truck of money. I think it's also making better use of existing funding programs.

Billions far more... a need for funding and financing greater by orders of magnitude than what is currently available.

When we speak of funding... the best money you'll ever spend is obviously not destroying something in the first place.

Identifying where these [NI] deployments can prevent much larger investments, where they can work in parallel to the grey infrastructure system.

Municipalities are clamoring for more money to pay for their infrastructure deficits. This is the opportunity for natural infrastructure.

WHAT EXPERTS ARE SAYING



Role of the Insurance Sector

Insurance payouts have risen significantly across Canada, driven by an increase in weather-related disasters (e.g., wildfires, winter storms, floods) and the cost of each event (Canadian Institute for Climate Choices, 2020). For example, costs associated with catastrophic insured losses due to floods have increased tenfold in the last decade (Insurance Bureau of Canada, 2020). As a strategy to limit the likelihood and severity of natural disasters—and to mitigate the financial costs of these events borne by Canadians and by the insurance sector—the insurance industry is now piloting insurance products to incentivize conservation and invest in upstream water management (Ducks Unlimited Canada, 2022; Swiss Re, 2020). The insurance industry is also involved in discussions related to flood resilience with the Canadian government through the Task Force on Flood Insurance and Relocation (Government of Canada, 2022a). Beyond insurance products, some groups, like the Canadian-based mutual insurance company The Co-operators, are using impact investing to support the transition toward a more sustainable, resilient, and low-emission society (The Co-operators, 2020).

Box 12. Manitoba's trusts



“I don't believe organizations who do good work should be beggars.”

Since 2018, the Manitoba government has invested CAD 204 million to establish three endowment funds—the Conservation Trust, Wetland Trust, and GROW (Growing Outcomes in Watersheds) Trust—to ensure long-term support for natural infrastructure and conservation initiatives (Government of Manitoba, 2020).

- **Conservation Trust (CAD 102 million):** Established as part of Manitoba's Climate and Green Plan, revenues from the Conservation Trust fund on-the-ground projects that benefit watersheds, conservation, soils, wildlife, and connecting people to nature. In 2022, the Conservation Trust provided CAD 2.9 million in grants to 14 conservation groups who matched CAD 6.6 million in funding, for a total investment of CAD 9.5 million in conservation initiatives (MHHC, n.d.).
- **GROW Trust (CAD 52 million):** The GROW Trust supports watershed-based conservation. In 2022, the GROW Trust provided CAD 7.5 million in grants to 13 Watershed Districts (MHHC, n.d.).
- **Wetlands GROW Trust (CAD 50 million):** Supports the protection of critical temporary Class 1 and 2 wetlands, recognizing their vulnerability to drainage in the absence of protective regulation or policy.

Since the first projects received funding in 2019, CAD 28.36 million has been committed to 152 conservation projects delivered by 47 Manitoba-based groups (MHHC News Release, 2022). Praised by many interviewees as part of this research, the consistent and flexible funding allows organizations to focus on on-the-ground work for a range of projects.



6.3.4 Strengthening Policy

Context and Status

Responsibility for water is shared across levels of government in Canada. The **federal government** has jurisdiction where there is potential for significant economic impact and transboundary water management, covering specific areas, including fisheries; navigation; water on federal lands, territories, and Indigenous reserve lands; and national policy or standards related to environment and health issues. Federal government programs related more specifically to natural infrastructure span departments, including ECCC, Agriculture and Agri-Food Canada, Indigenous Services Canada, Natural Resources Canada, Infrastructure Canada, and more. A similar array exists at the provincial and municipal levels.

Why It's Important

There are multiple policies—at local, regional, provincial, and federal levels—that influence or can influence natural infrastructure implementation across the Prairies. According to UNEP (2022c), scaling the use of NbS (and natural infrastructure) will require that these actions are “integrated into, and linked across different policies, strategies, actions plans and programs” (p. 22).

Provincial governments are typically responsible for freshwater management, such as providing authorization for water use within their borders, pollution control, and managing inland fisheries, aquatic species at risk, and invasive species.

Natural Resources Canada’s regional perspectives report in the Canadian Prairies highlights the value of collaborative water management as a key climate adaptation strategy—and one necessary for future prosperity (Sauchyn et al., 2020). Collaborative water management requires alignment at all levels of government, as well as watershed management groups and other stakeholders, to promote practices and policies that decrease the adverse impacts of water excesses and shortages, which are predicted to increase in the face of climate change (Sauchyn et al., 2020; Box 13).

All three Prairie provinces have invested—to varying degrees—in watershed management. The responsibilities of watershed management groups differ, but generally, they promote conservation, best management practices, and stewardship activities at the watershed level, working with municipal and provincial governments. The provinces have the following:

- 14 Watershed Districts in Manitoba
- 9 Association of Watershed members in Saskatchewan
- 11 Watershed Planning and Advisory Councils in Alberta.

Municipal governments have a significant regulatory and management purview that may influence natural infrastructure adoption, including, for example, having day-to-day operational



and management responsibility for drinking water and wastewater services while also having power over land use and zoning. Faced with a changing environmental governance context—including interlinked issues related to climate, infrastructure provision, biodiversity, Indigenous rights, and more (MNAI, 2023a)—many municipalities are exploring options for bylaws, policies, or plans that support infrastructure priorities in the face of climate change and a fiscal crunch.

More and more, NbS and natural infrastructure are growing components of government programs, strategies, and funding initiatives at different levels. Canada’s National Adaptation Strategy emphasizes the power of nature to support more resilient communities, with a round table on Resilient Natural and Built Infrastructure established to inform objectives for both Infrastructure and Nature and Biodiversity (Government of Canada, 2022b). Provincial and municipal governments have also emphasized NbS in climate change action plans and asset management strategies, respectively. The Government of Manitoba (2022) has acknowledged an infrastructure deficit in their 2022 Water Management Strategy, with natural infrastructure identified as one of the opportunities to better manage water. More examples are shared in Table 4.

Table 4. Examples of federal and provincial strategies that have specific reference to natural infrastructure

Name	Reference to natural infrastructure
Canada’s National Adaptation Strategy: Building Resilient Communities and a Strong Economy – For Comments 2022	“Climate-resilient infrastructure policies and programs can result in significant avoided damages and provide a number of co-benefits, such as enhanced livability of communities and protection of Canada’s biodiversity. Additionally, natural infrastructure solutions are increasingly seen as win-win investments that support traditional infrastructure outcomes, such as stormwater management, and deliver valuable co-benefits to communities, such as climate change resilience, reduced pollution, and carbon sequestration” (ECCC, 2022b, p. 25).
2022 to 2026 Federal Sustainable Development Strategy 2022	“Natural infrastructure such as conserved and restored wetlands and marshes can help prevent climate change impacts such as flash floods and support the conservation and recovery of wild species, including species at risk” (ECCC, 2022c, p. 98).
Manitoba’s Water Management Strategy 2022	“However, there is a growing recognition that healthy ecosystems and naturally occurring ecological processes can play a significant role in helping to efficiently and reliably achieve water management objectives that have traditionally been attained through engineered water infrastructure. This is referred to as natural infrastructure, or green infrastructure, which is a type of nature-based solution” (Government of Manitoba, 2022, p. 22), with a strategic objective to “prioritize incorporating natural infrastructure and nature-based solutions to water management challenges” (Government of Manitoba, 2022, p. 23).



Name	Reference to natural infrastructure
Saskatchewan's <i>The Statements of Provincial Interest Handbook; Companion Document to The Statements of Provincial Regulations</i> 2021	To plan for climate change, council should “talk with [their] neighbours about different ways to take advantage of natural infrastructure, new approaches to increasing climate change awareness and action in the community, or budgeting for small pilot projects” (Ministry of Government Relations Community Planning, 2021, p. 81).
Natural Infrastructure Blueprint for the City of Calgary 2019	“The City can take steps outlined in this Blueprint to apply academic research, best practices, and lessons learned from cities around the world to fully integrate natural infrastructure concepts and opportunities broadly into budgeting, project development, and long-term stewardship of The City’s resources” (Chadsey et al., 2019, p. 3).





WHAT EXPERTS ARE SAYING



What experts are saying about strengthening policy

The status quo is a lot easier to justify because that's how [they've] done it all the time.

You can kind of worm natural infrastructure in, but it is currently secondary to grey.

No one likes doing emergency planning... that's why we have huge bills after the fact for cleanup.

It's going to take some very dramatic, costly, you know, very expensive events before we might see that wide scale adoption [of natural infrastructure]

What is best for our province and best for our environment.

Funding for important projects, water management, or many other things regarding the environment should not be left to strictly political, bureaucratic [people].

If [natural infrastructure] is not clear in the policy... not clearly laid out that either this is an option or this should be an option, it might not even be considered.

Need to be completely overhauled.


They all want to be reelected in four years.


The cheapest way to resolve flood damages is to never allow development in those areas. That's really the bottom line for us.


[Approvals] are set up for major oil and gas projects and things that destroy nature. And not for things that improve nature.



Box 13. Saskatchewan's upcoming wetland policy

The Global Water Futures Prairie Waters project, out of the University of Saskatchewan, estimates that 90% of Saskatchewan's existing wetlands have been degraded or impacted, often drained to increase arable land for agriculture (Peiris, 2021). While Alberta and Manitoba both have existing wetland policies, Saskatchewan's Water Security Agency is currently developing a policy, as well as working on completing a wetland inventory for the agricultural landscape of the province. To understand the economic drivers behind agricultural drainage and determine how to balance productivity and sustainability, researchers are collecting and incorporating data from a 40-acre research site at the Glacier FarmMedia Discovery Farm, northwest of Saskatoon (Radford, 2020).  **"If we don't have [ag producers] on board... we don't stand a chance to have an ag [wetland] policy implemented. That is the reality of where we are in Saskatchewan."/**

The importance of wetlands was already acknowledged in Prairie Resilience: A Made-in-Saskatchewan Climate Change Strategy, thanks to their ability to build resilience in landscapes by retaining carbon and mitigating the impacts of flood and drought (Government of Saskatchewan, 2017). The new policy in Saskatchewan is an opportunity to prioritize the protection of wetlands and recognize their benefits as natural infrastructure. Wetlands deliver primary services, like flood protection, but also co-benefits, such as habitat and carbon sequestration, that provide tremendous value to landowners, as well as to communities. If these benefits are explicitly acknowledged in the policy, this can help in raising the profile of wetland conservation as an infrastructure solution. Saskatchewan is also in the process of developing an Agricultural Water Management Strategy (anticipated for release in 2024), which should include  **"ways to use natural infrastructure to assist in the delivery of the strategy."/**

Many jurisdictions, Manitoba and Alberta included, use a "mitigation sequence" for wetland protection: 1) avoid impacts; 2) minimize unavoidable impacts; and 3) compensate for unavoidable impacts with restoration, enhancement, creation, and protection. Clare et al. (2011) report that, despite existing wetland policies, wetland loss continues as decision-makers fail to prioritize avoidance and minimization, instead relying on compensation. One of the key factors identified as a driver is that wetlands are chronically undervalued, even though  **"the best money you'll ever spend is obviously not destroying something in the first place. By the time you've got to restore it, a lot of the benefits aren't going to come back within a time frame that's meaningful to humans. It might be 50 years before it starts to function, 1,000 or millennia before" /** function returns.

Time will tell if Saskatchewan implements an effective wetland policy that avoids the loss of intact wetlands and recognizes benefits to the broader public and agricultural resilience.



7.0 Finding a Way Forward




Section 7 identifies key barriers to and opportunities for scaling natural infrastructure across the Prairies.

7.1 Barriers and Opportunities


Despite some progress in scaling up natural infrastructure in recent years, interviews with key leaders and experts identified a range of barriers facing implementation.

Far too often, many people are unaware of natural infrastructure, and uncertainty around the performance and valuation of natural infrastructure compared to grey infrastructure limits uptake. Many Prairie communities struggle with limited capacity and path dependency, with limited drivers to change practices. Even as funding for natural infrastructure increases, many communities struggle to access funding or navigate funding streams, requiring more support to design projects and overcome technical challenges. Policies and regulations—from local to federal scales—that lack or limit affirmative direction for natural infrastructure are also key barriers. Table 5 summarizes these barriers, and others, in four categories: 1) business case, 2) municipalities, 3) funding, and 4) policy.

Table 5. Key barriers to scaling up natural infrastructure for the Canadian Prairies region from interviews with key leaders and experts

Barriers	Description	
 Business case	Uncertainty around measuring performance and valuation	Monitoring and evaluation of natural infrastructure solutions can be complex, and there is currently no clear consensus regarding best practices or the level of detail required.
	Accounting for societal benefits on private land	Agricultural producers need an economic analysis that shows the value of keeping the ecosystem versus converting, which could support more realistic and enticing ecological goods and services payments for producers, making these ecosystems too valuable to convert.
 Municipalities	Grey infrastructure remains the go-to choice	The financial benefits of grey infrastructure are quantified and well understood and remain the go-to choice for municipalities; natural infrastructure solutions are ill-understood for both services and financial performance.
	Lack of resources and trained experts	Smaller municipalities often have limited staff and financial resources. As the demand for natural infrastructure grows, there is a risk of a widening gap in trained professionals to support the expansion of natural infrastructure.
	Current procurement strategies	Focusing exclusively on the initial procurement price (and ease) of infrastructure does not reflect the long-term value of natural infrastructure. Compared to grey infrastructure, natural infrastructure may have lower maintenance and operation costs, does not depreciate in the same way (it can actually provide more robust benefits over time), and provides primary and co-benefits as opposed to a singular service.
 Funding	Funding requirements	Instead of funding “shovel-ready” projects, applicants need support for the front-end work of natural infrastructure projects, like planning, building partnerships, stakeholder engagement, and engineering design. Smaller municipalities and non-profit organizations often lack the expertise or resources to support these crucial upfront efforts.



Barriers	Description	
 <p data-bbox="277 632 354 663">Policy</p>	Awareness and demand	Property damage, impacts on human health, and loss of life are on the rise from increasingly frequent and severe disastrous weather events like drought, floods, extreme heat, wildfires, and storms. However, despite rising risks, some groups remain unaware of nature-based options or default to traditional practices as part of business-as-usual routines.
	Election cycles and administrative turnover	The 4-year election cycle can make it challenging for elected officials to implement new ideas like natural infrastructure. In some instances, decision making is motivated by what will get them re-elected instead of prioritizing choices for long-term societal well-being. Administrative turnover, particularly in smaller communities, can also challenge natural infrastructure project development and implementation.

7.2 Opportunities and Paths to Scale

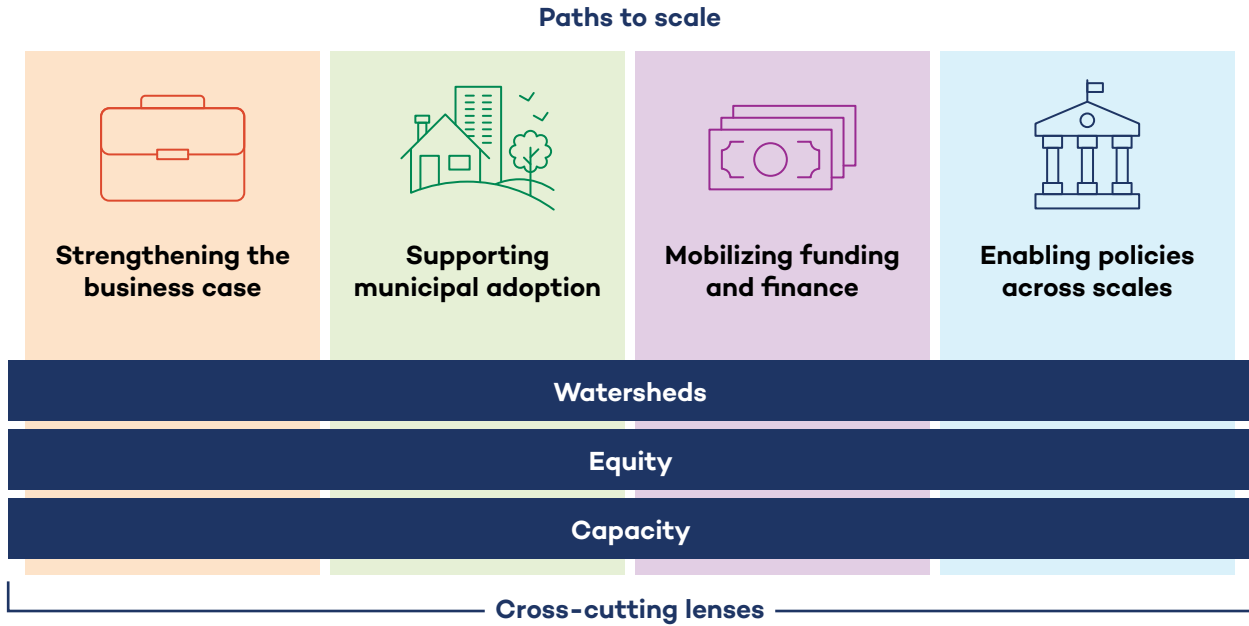
Scaling natural infrastructure across the Prairies will require a sustained and multi-pronged effort by many groups. Despite multiple barriers, many solutions are readily apparent, and there is a growing momentum that can be harnessed to meet the intersecting challenges of the 21st century.

Figure 8 summarizes key paths to scale for natural infrastructure across the Canadian Prairies region gleaned from the key informant interviews and a literature scan conducted for this report. It highlights four paths to scale, including

1. Strengthening the business case for natural infrastructure by demonstrating how impactful and cost-effective it can be.
2. Encouraging local municipalities to adopt more natural infrastructure projects.
3. Enabling access to funding for those who want to implement natural infrastructure.
4. Making sure that natural infrastructure is enabled by policy and championed by all levels of government.



Figure 8. Key paths to scale natural infrastructure across the Canadian Prairies region





Source: IISD.

Each of these paths includes an array of opportunities, with core themes summarized in Table 6 based on key informant interviews. In addition to these four priority paths, three cross-cutting lenses were identified as key considerations for scaling: watersheds, equity, and capacity.







Table 6. Key opportunities to scale up natural infrastructure in the Canadian Prairies region from interviews with key leaders and experts.

Opportunities	Description
 <p>Business case</p>	<p>Primary benefits, co-benefits, and multi-solving</p> <p>Multi-solving is the integration of economic, social, and environmental priorities. Instead of trying to solve one issue at a time, it supports the provision of multiple benefits and is a particularly attractive feature of natural infrastructure.</p>
	<p>Public and political buy-in</p> <p>Improve general understanding and knowledge of natural infrastructure for the public and elected officials, with demonstration sites to generate interest and create firsthand experience.</p>
 <p>Municipalities</p>	<p>Increasing resilience and risk reduction</p> <p>Investment in climate-resilient natural infrastructure is crucial to adapting to a rapidly changing climate; it is often more flexible in response to changing conditions, can complement grey and hybrid infrastructure, and can better address the complex climate crisis.</p>
	<p>Regional collaboration</p> <p>To ensure impactful benefits, natural infrastructure needs to be implemented at larger scales; this may involve municipal regions and other partnerships that share resources and technical expertise to address the lack of capacity in individual small municipalities.</p>
	<p>Easy-to-implement standards</p> <p>Some standards and guidelines do exist; however, they are underused, in part due to a lack of awareness or technical barriers. Standards could be developed, redesigned, or better communicated to address these issues.</p>
	<p>More tools to support implementation</p> <p>Although more financial support is needed, increased funding will need to be complemented by other supports, including regional demonstration sites, knowledge exchange, easy-to-access and implement standards, monitoring guidelines, access to technical expertise, and support for funding applications.</p>



Opportunities	Description	
 Funding	Endowment funds	Manitoba's new funding model of endowment funds, which included a total investment of CAD 204 million for the Conservation Trust, Wetland Trust, and GROW Trust, ensures long-term, stable support for conservation initiatives—including natural infrastructure efforts. These funds not only enable more natural infrastructure projects but also ensure that relevant organizations can focus on projects rather than worrying about how they will secure future funding.
	Life-cycle support for projects	Mobilize capital to support projects across their entire life cycle, including early-stage catalytic support, pre-development support, money for planning/design, construction/implementation, operations/maintenance, and monitoring/evaluation.
	Mobilizing private capital	Private capital can play a larger role in funding natural infrastructure, recognizing the limits of public funding. However, viable financing mechanisms must be developed based on a clear return on investment.
 Policy	Planning instead of reacting	All levels of government tend to be reactive to the issues or disasters that arise instead of planning to avoid disaster-related risks in the first place. Natural infrastructure and emergency planning were highlighted as two critical approaches to increasing community resilience.
	Redesign approval processes	Some provincial approval/licensing processes are more specific to resource development, and as a result, restoration and natural infrastructure projects are denied; the development of approval processes that are specific to restoration and natural infrastructure projects could assist in the scaling up of natural infrastructure efforts.
	Updated or new policies	Redesign strategies, regulations, and policies relevant to adaptation, water management, agriculture, infrastructure, and other relevant sectors to explicitly allow, require, or promote natural infrastructure.



7.3 Cross-Cutting Lenses

Watersheds

Strengthening natural infrastructure efforts at watershed and regional scales is an important strategy to scale natural infrastructure and to support healthy, resilient watersheds. There are opportunities to accrue benefits and offset negative impacts when a broader landscape approach is taken at the outset. For example, work by the Collaborative Leadership Initiative brought together municipalities and Indigenous communities to identify and implement several natural infrastructure priorities at a regional scale (Centre for Indigenous Environmental Resources, 2023). Rather than a patchwork of natural infrastructure projects, there are opportunities to work together across jurisdictions if supported by the right drivers—whether through policy, regulation, or other incentives and tools for collaboration.

Equity

Equity is an “essential lens” that should be cultivated intentionally throughout the design and implementation of natural infrastructure projects and programs so that costs and benefits are distributed fairly (Diringer et al., 2019, p. 19). While evidence increasingly shows clear benefits for natural infrastructure to deliver infrastructure services related to water quality and quantity, it is also important to consider co-benefits, the equitable distribution of benefits, equitable access to funding, and the potential for trade-offs or imposed harms caused by natural infrastructure implementation (Box 14). Numerous equity-based approaches can contribute to a more nuanced understanding of the different needs and preferences of groups. The Pathways to Living Cities framework emphasizes these social considerations, seeking to make natural infrastructure more “equitable, abundant, and thriving” by involving communities in decision making and growing support across different social groups and levels of government (Tozer et al., 2022).

Capacity

One key takeaway is that natural infrastructure deployment depends on capacity, supported by enabling social infrastructure—that is, people, institutions, and networks. Latham and Layton (2022) write that “it is the people that work on infrastructure, as much as it is infrastructure that supports people,” highlighting how the people, institutions, and networks that develop and make infrastructure function are often overlooked (Box 15). NAI explores this issue through the lens of natural asset management, stating that “some local governments do not have the capacity (staff) to work on, or even think about, natural asset infrastructure issues, or develop funding proposals” (MNAI, 2022). A joint effort by NAI and partners at Royal Roads University is currently underway to assess national knowledge, curriculum, training, competency, and capacity needs to advance natural assets management, both via municipalities and professional organizations (e.g., engineers, planners, asset managers).



Box 14. Equity as an essential lens

The design of natural infrastructure projects and supporting programs can determine whether efforts are inclusionary or exclusionary (Moore, 2021), whether they impose costs or detrimental effects to non-beneficiaries (Saguin et al., 2017), and whether they lead to gentrification (Sbicca, 2019). For example, a recent study found a widespread failure of green infrastructure plans in 20 American cities to conceptualize and operationalize equity, with less than 10% of plans acknowledging the differential vulnerability of community members to the hazards to be managed by green infrastructure (Grabowski et al., 2023). Cities like Atlanta and Portland, through their 2015 Climate Action Plan, stood out as more equity-minded by framing the links between green infrastructure and equity.

Working with communities and rightsholders to understand needs, priorities, and options related to infrastructure is essential, so that efforts are focused on meeting the real-world needs of communities and so that work is done in a way that centres equity, upholds rights and diverse worldviews, and strengthens relationships. Canada's draft National Adaptation Strategy acknowledges in the guiding principles, for example, that the implementation of climate adaptation must "respect jurisdictions and uphold Indigenous rights" and "advance equity and environmental justice" (Government of Canada, 2022b, p. 17).

Box 15. The need for capacity

Capacity is clearly a limiting factor for natural infrastructure implementation in rural areas, based on interviews conducted for this report. Communities need capacity—including staffing, expertise, and resources—to identify and design projects, apply for and report on funding, and build and maintain projects. Research in the United States shows that, despite a USD 1.2 trillion investment in climate resilience through the Infrastructure Investment and Jobs Act, many rural communities lack the capacity to access needed infrastructure funding. Many of the places that lack capacity also need infrastructure investments the most, including rural and historically underserved communities (Headwaters Economics, 2022).

Across the Prairies, limited capacity—in rural communities, local watershed management and stewardship organizations, and the available pool of qualified professionals—threatens to stymie progress toward natural infrastructure implementation and related efforts linked to watershed management, climate adaptation, and rural economic development.

Investing in programs and personnel that bolster local government and watershed capacity is a significant opportunity for natural infrastructure and for rural economic development. For example, the green infrastructure sector in Ontario was estimated to contribute CAD 4.64 billion in GDP in 2018 and to directly employ 84,400 people, with the potential to grow by 22% to 73% by 2030 based on various sector growth scenarios (Green Infrastructure Ontario Coalition, 2020).



8.0 Call to Action and Conclusion

Natural infrastructure practitioners and communities throughout the Canadian Prairies region are already innovating at a local scale. Many projects—such as floating treatment wetlands, naturalized stormwater ponds, and efforts by municipal governments to create Natural Asset Inventories—actively show that natural infrastructure solutions are viable. However, these efforts are often isolated and small in scale. To speed up adoption and create the transformational systems needed to achieve landscape-level outcomes, decision-makers and communities need targeted resources, tools, and supports to inform the way forward.

This report was written as an accessible entry point for those wanting to learn more about natural infrastructure, its implementation across the Prairies, and the potential for natural infrastructure to play a larger role in the water infrastructure mix of the future. Establishing natural infrastructure as a viable, landscape-level solution to addressing the interlinked water challenges of the Canadian Prairies requires innovative interventions addressing the business case for natural infrastructure, municipal adoption, funding, and policy. Thoughtful implementation must also consider watersheds, equity, and capacity as key make-or-break factors shaping the future of natural infrastructure and the resilience of the Prairies region.

Moving forward, IISD's NIWS Initiative will continue to conduct research, build lasting partnerships, and support shared efforts to mainstream natural infrastructure. IISD recognizes that many groups have driven the growing momentum behind natural infrastructure, including municipal leaders and staff, grassroots non-government organizations, watershed organizations, Indigenous communities, policy-makers, professional practitioners, researchers, and many more. Harnessing this momentum and coordinating efforts across groups can contribute to scaling natural infrastructure while recognizing the urgent need to find water solutions that meet the needs of Prairie communities and ecosystems.



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Appendix A. Summary of Key Informant Interviewees

Background

The International Institute for Sustainable Development conducted key informant interviews with 17 subject matter experts and natural infrastructure leaders across Canada. Interviewees were selected to represent diverse geographies, affiliations, and backgrounds.

The purpose of the key informant interviews was to gather baseline information on the context, barriers, and opportunities that may influence the scaling up of natural infrastructure solutions across the Prairies to address water-related challenges.

Of particular interest were key barriers and opportunities, as well as knowledge gaps that exist in the following areas:

1. Performance metrics and benefit-cost analysis used by practitioners to make the business case for specific natural infrastructure solutions.
2. Asset and infrastructure management conducted by municipalities and watershed associations involving natural infrastructure solutions to balance service, cost, and risk.
3. Financing and funding pathways for natural infrastructure solutions, from the perspective of both providers and receivers of capital.
4. The design and implementation of policies that can enable the scaling up of natural infrastructure solutions to meet water needs at federal, provincial, and municipal levels.

A key limitation of this work was that no Indigenous individuals or groups were directly interviewed, signalling the need to strengthen engagement and relationship-building in future phases of work.

The key informant interviews were not solely a data-gathering exercise. A supporting objective of the key informant interviews was to build relationships, connection, and trust among key stakeholders and groups. Through this lens, these conversations highlighted novel insights about the system(s) that influence natural infrastructure implementation across the Prairies and in Canada.

Key Informants

IISD interviewed 17 key informants between August and December 2022. Informants were selected to gain insight into the broader context of natural infrastructure implementation in each of the three provincial jurisdictions and federally, while also providing specific input to the four areas outlined above. The following informants participated:



- Pascal Badiou, Research Scientist, Ducks Unlimited Canada
- Shannon Frank, Executive Director, Oldman Watershed Council
- Steve Strang, Manitoba Director (retired), Red River Basin Commission
- David Fortin, Independent
- Doug Johnson, Executive Director, Special Projects, Water Security Agency
- Dustin Carey, Lead, Land Use Sector Development, Green Municipal Fund, Federation of Canadian Municipalities
- Dany Robidoux, Executive Director, Eco-West
- Stephen Carlyle, Chief Executive Officer, Manitoba Habitat Heritage Corporation
- Jillian Curley, Corporate Environmental Specialist, City of Calgary
- Danah Duke, Executive Director, Miistakis Institute
- Holly Annand, Water Resource Engineer, Associated Engineers
- Catherine Lafleur, Manager, Infrastructure Canada
- Hiran Sandanayake, Chair of Climate Change Committee, Canadian Water & Wastewater Association
- Anton Skorobogatov, Research Development Lead, MAGNA Engineering
- Bryan Osborne, Ph.D. student, University of Manitoba
- Roy Brooke, Executive Director, Natural Assets Initiative
- Kristian Dubrawski, Assistant Professor, University of Victoria

Interview Questions

General

1. Can you tell us a little about your background? What is your personal story that has shaped what you do and the perspective that you have?
2. How would you characterize the current “state of play” of natural infrastructure implementation across the Prairies as it relates to water management? What stands out to you?
3. What is your role in the current system? How might your role influence the adoption and scaling of natural infrastructure?

Natural Infrastructure

4. What types of natural infrastructure solutions have you seen implemented in the Prairies, including the purpose, location, and by whom?
5. What were the drivers behind the natural infrastructure solutions (if known)?



6. Did the natural infrastructure solutions perform and provide the intended outcomes (e.g., flood mitigation, improved water quality, reduced flood peak, etc.)?
7. Which types of natural infrastructure solutions do you believe are most needed to address current and future water-related challenges? Why?
8. What are the most significant barriers to the large-scale adoption of natural infrastructure solutions across the Prairies for addressing water-related challenges? Where are things most “stuck”?

Metrics and Business Case

9. Building a better business case for natural infrastructure requires good science, metrics, an understanding of performance, etc. In your experience, what is needed to build a better scientific and/or business case for natural infrastructure across the Prairies?
10. From your perspective as a [researcher], what have you learned about the potential for natural infrastructure to support water quality, water quantity, and specific water-related infrastructure outcomes? Active areas of research?
11. What are the key barriers experienced by natural infrastructure practitioners in making the business case for natural infrastructure solutions?
12. What are some successes you have seen or experienced supporting the business case for natural infrastructure?
13. What are some key opportunities to better support the business case for natural infrastructure solutions?

Infrastructure Management for Municipalities and Watershed Organizations

14. Have natural infrastructure solutions helped you manage cost and risk in the delivery of municipal and watershed services?
15. What barriers have you experienced in attempting to use or adopt natural infrastructure to manage cost, risk, and level of service?
16. What do you see as the key opportunities for scaling up the use of natural infrastructure for addressing municipal and watershed services?

Financing and Funding (Providers of Capital)

17. What successes have you seen/experienced in financing or funding natural infrastructure solutions?
18. What barriers have you experienced?
19. What do you feel are the key opportunities for mobilizing capital to scale up the adoption of natural infrastructure solutions across the Prairies?



Enabling Policies

20. What policies or programs have helped implement natural infrastructure solutions to help meet water needs or address water challenges?
21. How would you currently characterize the policy context linked to natural infrastructure scaling? Are there key pieces of policy that act as barriers and/or could be areas of opportunity to help scale natural infrastructure across the Prairies?
22. What have been some of the main barriers to the design, implementation, and monitoring of policies for natural infrastructure?

Closing Questions

23. Is there anything else you would like to share regarding your experience and expertise with water-related natural infrastructure solutions?
24. What would be your advice to help ensure that this multi-year Natural Infrastructure Water Solutions initiative can make a difference across the Prairies? Are there any pitfalls that we might not be aware of?
25. Is there anything else we should have asked?

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