Saskatoon's Green Infrastructure Strategy:

Towards an Interconnected Green Network





Saskatoon is located on Treaty 6 Territory and the Homeland of the Métis.

We pay our respects to the First Nations and Métis ancestors of this land and reaffirm our kinship with all our relations.

Truck Autoon's Green Infrastructure Strateg





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Green infrastructure is a system of natural, enhanced, and engineered assets that provide municipal and ecosystem services by protecting, restoring, or emulating nature. When green infrastructure is designed holistically, it becomes an interconnected **Green Network** that enhances the urban environment and improves quality of life.

Saskatoon's Green Infrastructure Strategy

INTRODUCTION

The Saskatoon community is passionate about our Green Network. This has been reflected in public engagement and community events including Saskatoon Speaks, the *Official Community Plan* redesign, and the annual NatureCity Festival. Indeed, with a vibrant river valley, beautiful parks, cultural spaces, and rare ecological areas, we have much to be proud of. We have a strong legacy of green space management in Saskatoon, from the *Meewasin Valley Project*, the 100 year Concept Plan that established river valley conservation as a norm in the 1970s¹, to the mature American elms and other trees that add character to our streets. Saskatoon residents inform us that they use the Green Network for many meaningful activities including active and passive recreation in over 200 parks, food production in over fifty community gardens, active transportation throughout our extensive trail system, agricultural and environmental research at the University of Saskatchewan, access to wild spaces in our natural areas and naturalized parks, and cultural connections at Wanuskewin Heritage Park.

However, as Saskatoon grows to a population of half a million, our Green Network is under increasing pressure to provide high quality green space to all city residents while supporting storm water management and other ecosystem services. External risks such as climate change will further compromise the Network's capacity to support public needs and municipal services. For example, cottony ash psyllid – whose impact is intensified by warmer winters - has already affected our urban forest. Areas facing recurrent flooding may see these risks increase as storms become more frequent and severe. There is also growing international concern about the rate of biodiversity and habitat loss worldwide. This concern is reflected locally: Saskatoon is home to several increasingly rare grassland ecosystems which Meewasin's Valley-wide Resource Management *Plan*² has found to be at risk from fragmentation, invasive species, and climate change. Feedback from the community and technical experts indicates that Saskatoon's growth and development should be balanced by ecosystem conservation. However, these spaces have not been formally protected, and their management is largely unfunded.



1 Moriyama, R. (1978). The Meewasin Valley Project – 100 Year Concept Plan.

2 Meewasin. (2017). Meewasin Valley-wide Resource Management Plan.

To address these concerns, the City of Saskatoon has created the *Green Infrastructure Strategy (Strategy)*. As defined at the outset of the project, the purpose of the *Strategy* is to establish the vision, actions, and implementation framework to enhance Saskatoon's Green Network by integrating green infrastructure into land use planning and asset management. The *Strategy* identifies Saskatoon's existing green infrastructure, and the municipal and ecosystem services it provides, while considering site-specific factors, community needs, and financial considerations. The Strategy also identifies community partners to strengthen green infrastructure in priority areas.

Nationally, green infrastructure management is emerging as a best practice that maximizes cities' investment in community, public health, and municipal servicing. Cities such as Edmonton³, Metro Vancouver⁴, Halifax⁵, and Calgary⁶ are considering important ecosystem services provided by their own green infrastructure.

The Green Infrastructure Strategy represents a change in perspective to how our own City manages green space. Historically, external stakeholders like Meewasin provided leadership in the management of key green infrastructure such as the South Saskatchewan River. But as Saskatoon grows away from the river, the City itself needs to develop an integrated approach to green infrastructure management. Saskatoon has an opportunity to strengthen the Green Network by working with nature, partnering with the community, and nurturing relationships between people and nature that increase eco-literacy and quality of life.

The *Green Infrastructure Strategy* will position Saskatoon to provide essential municipal services while strategically weaving green infrastructure into the urban fabric, meeting the community's need for a high-quality environment to live, work, learn, and play.



 3 E.g. O2 Planning + Design. (2017). Breathe: Edmonton's Green Network Strategy.
 4 E.g. City of Vancouver. (2019). Rain City Strategy: A green rainwater infrastructure and rainwater management initiative. E.g. Metro Vancouver. (2015). Connecting the Dots: Regional Green Infrastructure Network Resource Guide.

3

⁵ E.g. O2 Planning + Design. (2017). Halifax Green Network Plan.

⁶ E.g. City of Calgary. (2015). Our BiodiverCity: Calgary's 10-year biodiversity strategic plan.

misâskwatôminihk (Saskatoon): Our Local Context

The land now called Saskatoon has been inhabited since time immemorial⁷. As the Wisconsin Glacier retreated 12,000 years ago, ice-melt gradually formed the watershed we now recognize as the South Saskatchewan River and surrounding prairie potholes, including the glacial channels that became the Northeast, Small, West, and Hudson Bay Swales. In low lying areas, rich sediments deposited from the old glacial lakes gradually formed soils that supported extensive and biodiverse grasslands. Once Opimihaw Creek, now the site of Wanuskewin Heritage Park, was freed from ice, First Nations people moved into the area and began actively caring for and managing the land⁸. Controlled burning, for example, was commonly used to manage the grasslands and attract Plains bison. The descendants of these First Nations – encompassing many individual nations - remain here today.

Over time, the interaction of the First Nations, bison, and grassland vegetation gave rise to rich topsoil and complex ecosystems that supported a variety of fur bearing animals. Starting in the 1600s, many First Nations women married and had children with European fur traders, who arrived seeking new opportunities. These children were the beginning of the Métis Nation. By the mid-1800s, present-day Saskatoon was part of a wider Métis community that included Round Prairie to the south and Batoche to the north⁹. But ongoing waves of settlement sparked a cultural and governance shift on the prairies that began to displace the First Nations and Métis. Chief Atāhkakohp and Chief Mistawasis of two nêhiyawak nations saw the coming pressures of a failing economy and imminent arrival of European settlers and took steps to prepare their people for irrevocable change to their way of life. In the spring and summer of 1876, they led their people to Fort Carlton to meet Treaty Commissioner Morris. Treaty 6 was signed on August 23, 1876¹⁰.

⁷ City of Saskatoon. (2019). ayisiyiniwak: A Communications Guide.

⁸ Canadian Geographic. (2017). Connecting to 6,000 years of history at Wanuskewin Heritage Park.

⁹ City of Saskatoon. (2019). ayisiyiniwak: A Communications Guide.

¹⁰ Office of the Treaty Commissioner. (20119). Treaty Timeline. Accessed from http://www.otc.ca/pages/treaty_timeline.html, November 28, 2019.

Saskatoon was founded in 1882, when Chief Wapahaska (Whitecap) of the Dakota First Nation advised a group of temperance colonists led by John Lake about a suitable location for their new colony on the banks of the Saskatchewan River¹¹. The colony would be named after misâskwatôminihk, the berry that grows abundantly in the river valley. For the next hundred years, land management practices shifted towards city-building and agriculture, as opportunities brought settlers here from around the world. The river and its surrounding ecosystems, however, were still highly valued by the people of Saskatoon. In the 1970s, a partnership between the City, the University of Saskatchewan, and the Province culminated in the creation of the *Meewasin Valley Authority Act (1979)*¹², which both protects public access to the river valley and conserves the ecological and cultural resources within it.

People from all over the world now call Saskatoon home, drawn by both the opportunities Saskatoon offers and a chance to begin anew. But the city's expansion takes us further from the river, with implications for the surrounding ecosystems. And over a century of colonization has left irrevocable impacts on Indigenous and non-Indigenous peoples' relationship with each other, and with the land. The *Green Infrastructure Strategy* was written with input from many voices, and in the spirit of our treaty relationship, provides one opportunity for the many peoples who call Saskatoon home to reaffirm our coexistence on this land.



¹¹ Whitecap Dakota First Nation. (2019). History and Culture. Accessed from https://whitecapdakota.com/history-culture/, November 28, 2019.

¹² Meewasin. (2019). About. Accessed from https://meewasin.com/about/, November 28, 2019.

Towards an Interconnected Green Network

What is green infrastructure?

Green infrastructure is a system of natural, enhanced, and engineered assets that provide municipal and ecosystem services by protecting, restoring, or emulating nature. Green infrastructure can be applied on a range of scales from the regional to site-level. Regional green infrastructure includes larger natural spaces like the Meewasin River Valley, and the corridors and greenways that connect it. Parks and boulevard trees provide access to green infrastructure at the neighbourhood level. Green infrastructure in commercial areas can include rain gardens, trees, green roofs, and planted medians. Many residents also maintain green infrastructure in their own spaces by planting trees or gardens, collecting rainwater, or caring for soil.

Figure 1: Inventory of Saskatoon's green infrastructure including natural, enhanced, and engineered assets. The current state and findings related to each asset are described in more detail in each theme section.



ENHANCED ASSETS

ENGINEERED ASSETS

Where do we find green infrastructure?

Natural assets are native to the Saskatoon region. They include the South Saskatchewan River, grasslands, woodlands, wetlands, and soil systems. These sites often contain important cultural and archaeological features. Natural assets are core ecosystems that provide important habitat for

urban wildlife, mitigate risks from changing climate conditions, support municipal services (e.g. storm water management), and connect the community to nature. They can be carefully integrated into development to conserve as much ecosystem and cultural function as possible.



Enhanced assets are designed places and features that modify natural assets for improved human use in an urban context. These include our formal green spaces such as district and neighbourhood parks, informal green spaces such as roadway greens and medians, the urban forest, and

arable land. Enhanced assets provide space for recreation, relaxation, commuting, and food production. They can also provide linkages and habitat between natural assets, and help absorb storm water.



Engineered assets incorporate nature-inspired design into the built environment to support ecosystem function or greater connectivity to natural and enhanced assets. They include much of our storm water infrastructure, trail systems, Low Impact Development (e.g. green roofs),

Figure 2a: Engineered assets. The River Landing bioswale reduces storm water runoff and supports vegetation that improves pedestrian enjoyment.



and grey infrastructure with nature friendly or cultural considerations. Some grey infrastructure interfaces with green infrastructure. For example, storm water infrastructure can sometimes be naturalized; trails and roadways can be modified to support wildlife movement.

Figure 2b: Engineered assets. Structural soil cells installed on Central Avenue increase soil volumes and retain water for street trees while accommodating nearby traffic loads and surrounding utilities.



Benefits of green infrastructure

Ecosystem services are the array of benefits provided by green infrastructure. Trees purify the air and absorb carbon as they grow. Flowering plants support bees and other insects, which in turn pollinate our crops. Wetlands incorporated into the storm water network help purify our water and store carbon. Well-designed green spaces provide areas for both recreation and relaxation.

The *Millennium Ecosystem Assessment* is a United Nations framework that categorizes ecosystem services into four broad areas: Provisioning, Regulating, Cultural, and Supporting services. Understanding these services is essential to improving our management of the Green Network. *Figure 3: Ecosystem services as categorized in the Millennium Ecosystem Assessment.*



Table 1: Ecosystem services provided by green infrastructure. Natural and enhanced assets tend to provide more ecosystem services than engineered assets, which are typically built for a specific purpose.

Ecosystem services	Level of service provided by asset type		
	Natural	Enhanced	Engineered
Provisioning: products obtained from ecosystems			
Food and fiber			
Wood and fuels			
Genetic resources			
Biochemicals, medicines			
Ornamental resources			
Fresh water			
Regulating: benefits obtained from the regulation of ecosystem processes			
Air quality maintenance			
Climate regulation			
Carbon storage			
Water regulation			
Erosion control			
Water purification and waste treatment			
Regulation of human diseases			
Biological control			
Pollination			
Storm protection			
Cultural: non-material benefits people obtain from ecosystems			
Cultural diversity			
Spiritual and religious values			
Public safety			
Knowledge systems			
Educational values			
Inspiration			
Aesthetic values			
Recreation			
Community building and social relations			
Sense of place			
Heritage values			
Destinations and tourism			
Supporting Services: necessary for the production of all other ecosystem services	5		
Habitat provision			
Biodiversity			
Photosynthesis and primary production			
Oxygen production			
Soil formation and retention			
Nutrient and water cycling			

Valuating ecosystem services

Other municipalities and regions are developing dollar values for the ecosystem services provided by their Green Networks. For example, a 2010 report estimated the economic value of ecosystem services in BC's Lower Mainland at \$5.4 billion, conservatively¹³. Similar ecosystem services valuation is in the early stages in Saskatoon. For example:

- The 2019 Urban Forest Canopy Inventory and Assessment identified that Saskatoon's urban forest provides almost \$1.5 million in annual carbon sequestration. This does not include additional substantive ecosystem services such as pollution removal, storm water management, and habitat provision¹⁴.
- A 2017 report estimated the economic value of ecosystem services provided by the natural capital in the Meewasin Valley at over \$182 million per year¹⁵.

A note on asset and valuation terminology:

Municipalities are increasingly using finance terminology (e.g. "asset" and "natural capital") to describe green infrastructure. Understanding that green infrastructure requires comparable management and accounting decisions as grey infrastructure better enables full-cost accounting. For this reason, we have chosen to include finance terminology.

However, we recognize the need to view nature and cultural spaces beyond their capital function. Globally and locally, using finance language to describe nature is generating controversy. Some scholars discuss nature's intrinsic value. Many Indigenous worldviews see the land as sacred, and believe humans should not apply economic terminology to it. We shouldn't lose site of the intrinsic value of nature when applying an asset management approach. Ecosystem service valuation is a new field to analyze green infrastructure. Emerging best practices, such as those developed by the Municipal Natural Assets Initiative and the *Canadian Environmental Accounting Standards*, will allow us to:

- Identify and quantify the value of ecosystem services provided by the Green Network
- Develop a framework for natural asset accounting
- Integrate natural assets into an asset management system
- Measure the status of our Green Network by developing indicators to track ecosystem health
- Identify risks to ecosystem services, such as the loss of soil or water quality
- Prioritize actions to strengthen our green infrastructure
- Manage and fund the Green Network more consistently

¹³ Pacific Parklands Foundation. (2010). Natural Capital in BC's Lower Mainland.

¹⁴ Diamond Head Consulting. (2019). Urban Forest Canopy Inventory and Assessment.

¹⁵ Saskatoon Regional Economic Development Authority. (2017). Estimate of Economic Value of Meewasin Valley's Natural Capital.

Development of the Green Infrastructure Strategy

The *Green Infrastructure Strategy* was developed using the following process:

- Vision and Guiding Principles: From 2017 to 2019 feedback from over 600 community members, technical experts, and the Indigenous Technical Advisory Group¹⁶ informed the development of the Guiding Principles and vision for the Green Network (see Table 2). The Guiding Principles were endorsed by Council in May of 2018.
- Inventory and Findings: The current state of green infrastructure assets in Saskatoon's Green Network was compiled in the Green Infrastructure Strategy Baseline Inventory Report that was presented to City Council in May of 2018¹⁷. As the project progressed and information became available¹⁸, the inventory was refined and updated.

Figure 4: Development of the Green Infrastructure Strategy

Findings related to each asset were developed through further analysis of risks and opportunities in the Green Network. Analysis included research into Saskatoon plans and policies, practices in other municipalities, and feedback from internal stakeholders and technical experts.

- **Themes:** The inventory, findings, and resulting actions were organized into five themes: Community, Governance, Open Space, Ecology, and Storm Water.
- Actions & Initiatives: Actions and initiatives are designed to address risks and take advantage of opportunities.
- Implementation: As the *Strategy* is implemented, initiatives that address the actions will be prioritized through further stakeholder and community input. Initiatives will be brought forward to Council for deliberation throughout implementation to direct priorities and funding.



16 City of Saskatoon. (2020). Green Infrastructure Strategy Engagement Report.

17 City of Saskatoon. (2018). Green Infrastructure Strategy Baseline Inventory Report.

18 E.g. Diamond Head Consulting. (2019). Urban Forest Canopy Assessment. E.g. Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

Vision and Guiding Principles

The vision for Saskatoon's Green Network is to provide sustainable habitat for people and nature. The following Guiding Principles provide a framework through which the vision will be achieved. These principles were used to analyze the existing Green Network, create themes, and develop actions and key performance indicators to address network risks.

Table 2: Vision and Guiding Principles

Vision: Saskatoon's Green Network provides sustainable habitat for people and nature.				
Guiding Principles	Key Performance Indicators (KPIs)			
Climate Change Adaptation and Mitigation				
 Our contributions to climate change are mitigated and our ability to adapt to local change is enhanced Natural carbon sinks such as soil and vegetation are increased The urban heat island effect is reduced, and air quality improves Green infrastructure installations reduce heating and cooling needs (e.g. shading by trees) Resilience to overland flooding increases 	 Carbon sequestration Permeability Urban heat island effect 			
Ecological Integrity				
 Biodiversity and ecosystem health in the Green Network is conserved and supported Significant natural areas including the river and local watershed are protected Policy guides appropriate land uses based on site-specific criteria Ecological connectivity throughout the Green Network is enhanced Ecosystem stressors such as light and noise are minimized Sensitive ecosystems are buffered from adjacent land uses. Connections from green to grey infrastructure are gradual and natural Biodiverse and resilient vegetation is planted throughout the Green Network Abundant, high quality soil is managed to support healthy vegetation and absorb more storm water 	 Ecosystem health Habitat quantity Water quality 			
Education and Awareness				
 Saskatoon residents value the Green Network Traditional and local ecological knowledge is a valued part of decision making and management The community is aware of appropriate uses of green spaces The community is active in caring for the Green network The Green Network is governed in partnership with other stakeholders 	Community engagement and eco-literacy			

Equitable and Accountable	
 All residents have access to the Green Network within walking distance Accessibility barriers are addressed Green infrastructure is distributed equitably throughout Saskatoon The Green Network is designed through equitable and inclusive consultation An ethical space framework is in place to guide relationship building New green infrastructure is installed in areas with low distribution, walkability, or accessibility first 	 Accessibility Distribution Walkability
High Quality	
 Robust asset management ensures Green Network design and management is cohesive Green spaces are built and operated for their best purpose, considering the current infrastructure, its ecosystem services, and community needs Green infrastructure is implemented through proactive funding and planning 	Level of investmentPolicy cohesionProvision
Integrated and Multifunctional	
 Green infrastructure forms a connected network that provides multiple ecosystem and municipal services The Green Network includes a variety of green infrastructure such as ecological features, Low Impact Development (LID) installations, recreation amenities, food production, and cultural spaces Green storm water management is incorporated into Green Network planning Aquatic assets in the Green Network are incorporated into the storm water network while considering ecological function and health 	Connectivity
Public Safety	
 All residents feel safe and welcome in the Green Network CPTED principles are incorporated into Green Network design and management Green spaces are designed to minimize incompatible uses and manage conflicts 	Social interaction and community cohesion
Recognizable and Unique Places	
 A range of green space types and functions reflect culture, heritage, traditional land uses, and community identity Green infrastructure includes sites with unique characteristics, historical features, traditional uses, and place-based elements Development, construction, and maintenance standards conserve cultural elements Important places have site-specific management Views, vistas, and viewsheds are considered during design 	Placemaking
Sustainable	
Projects are analyzed through a Triple Bottom Line framework to consider environmental health and integrity, social equity and cultural wellbeing, economic prosperity, and fiscal responsibility	Triple bottom line
Wellness: Physical and Mental	
 Green Network planning considers residents' physical, spiritual, and mental wellbeing The Green Network provides space for all residents to enjoy activities such as physical exercise, traditional or ceremonial uses, family outings, community gatherings, or solitude in natural settings 	Public health



SASKATOON'S GREEN NETWORK

When green infrastructure is designed holistically, it becomes an interconnected **Green Network** that enhances the urban environment and improves quality of life (see Figure 5).

Taking a network approach to green infrastructure ensures that the multiple interactions of people, nature, and assets in the Green Network are considered holistically. Systems thinking in both planning and land use frames green infrastructure assets through a web of interrelationships that provide far more ecosystem services when designed together than apart.

Figure 5: Green infrastructure assets interconnecting to form the Green Network and achieve the vision.

GREEN INFRASTRUCTURE





Connecting the Green Network

Approaching green infrastructure as a network is consistent with landscape ecology concepts (see Figure 6). When green infrastructure is connected, resiliency increases, and the overall benefits exceed the contributions of an individual piece. Forming an interconnected Green Network through Saskatoon's dense urban fabric while balancing urban development is a significant design challenge. The Green Network is currently fragmented by multiple land uses, making it more vulnerable to external risks. The *Natural Areas Inventory* has identified connectivity gaps in the Green Network (shown on Map 3) that can be addressed through various actions identified in this document. Figure 6: A landscape ecology approach to green infrastructure¹⁹.

CONNECTIVITY PREFERENCE

LESS MORE

CONTIGUITY. Green

infrastructure should be connected wherever possible. Multi-partner coordination is required to overcome obstacles associated with jurisdictional boundaries.

PROXIMITY. Green infrastructure projects located close to one another provide more benefits, such as stepping stone habitat, than

SIZE. Although existing land use will dictate the type of green infrastructure that can be implemented, generally speaking, larger projects will provide more benefits than smaller ones.

those that are farther apart.

19 Figure modified from: Metro Vancouver. (2015). Connecting the Dots: Regional Green Infrastructure Network Guide.



The Green Network and Risks

The *Green Infrastructure Strategy* was prompted by various risks identified by internal and external stakeholders. These are challenges that may impede progress towards the Green Network vision. Considering the many benefits of and connections between assets will allow the City to address multiple risks at once. Risks that prompted the *Strategy* are identified in the following pages.

Climate change and biodiversity loss

Technical experts and best practice research indicate that climate change and biodiversity loss are two of the biggest risks to Saskatoon's Green Network.

Climate Projections and Possible Impacts identified specific risks to civic operations that could result from changing climate conditions. Many of these risks apply to the assets in the Green Network. Climate change is anticipated to lead to a "warmer, wetter, and wilder" future which could increase heat stress to people and ecosystems, and increase pest and disease outbreaks²⁰. Simultaneously, Meewasin's *Valley-wide Resource Management Plan* identifies local species and ecosystems to be at risk from invasive species, fragmentation, and climate change, among other factors²¹.

Climate change and biodiversity loss can compound to create a higher threat level than either risk alone. For example, increased heat stress to ecosystems may hasten the spread of invasive species, which in turn would reduce biodiversity and decrease overall ecosystem services provided by the Green Network. *Figure 7:* The dual risks of climate change and biodiversity loss in the Green Network.



Public Safety in the Green Network

Structures, facilities, and developments with any public access have potential to put the public at risk. Safety considerations include appropriate illumination of sites, maintenance of sight lines, and compatible uses of green space.

²⁰ City of Saskatoon. (2019). Climate Projections and Possible Impacts.

²¹ Meewasin. (2017). Meewasin Valley-wide Resource Management Plan.

Climate change and public health impacts

Green infrastructure is increasingly recognized for its public health benefits including air and water quality improvements, reduced pollution exposure, improved mental health through connection to nature, and increased opportunities for physical activity and community building²².

However, one factor that impacts public health is the urban heat island effect, which will likely worsen with climate change. This could disproportionately impact citizens who have limited options for shelter and air conditioning, and those who rely on walking and transit to move around. Major pedestrian areas such as City Centre, Strategic Infill areas, and Bus Rapid Transit Corridors have a high amount of hard surface, which worsens the urban heat island effect. At the same time, the City plans to increase pedestrian access to these areas.

Reactive funding to the Green Network

Climate change adaptation is often initiated reactively after an incident occurs. Adaptation efforts such as the *Flood Protection Plan* and *Cottony Ash Psyllid Response Plan* intersect with the *Green Infrastructure Strategy*. Research suggests that the rate and severity of climate change impacts is likely to outstrip the ability of municipalities to rely solely on a reactive adaptation approach.

Figure 8: The urban heat island effect. "On a hot, sunny summer day, roof and pavement surface temperatures can be 27-50°C hotter than the air, while shaded or moist surfaces remain close to air temperatures"²³.



22 E.g. United States Environmental Protection Agency. (2017). Healthy benefits of green infrastructure in communities.

²³ United States Environmental Protection Agency. (2019). What is the urban heat island effect?

Green Space Inequities

Inequities in the Green Network are experienced in different ways by different user groups. Inequity is a complex topic that can be analyzed in multiple ways, some of which are described below.

Accessibility considers barriers that may impede users from accessing green spaces. Barriers could include lack of curb cuts or trail disconnections. There are multiple accessibility barriers within the Green Network that City staff have identified.

Distribution is how evenly green infrastructure is spread throughout Saskatoon. This could include the amount of park space per neighbourhood (see Map 4), the distribution of the urban forest canopy, or the presence of food deserts. Many neighbourhoods currently have low distribution of green infrastructure.

Walkability is the average time a person must walk to reach green space. The World Health Organization recommends that citizens should have access to green space within a five minute walk from their home. Currently, 18% of residents in Saskatoon live beyond a five minute walk to a green space²⁴.



24 Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

Green Network Themes

Addressing risks identified in the previous section will allow Saskatoon to achieve an interconnected Green Network. In the following sections, risks to the green infrastructure in each theme are identified, and opportunities to address risks are proposed as actions. Through these actions, network risks will be addressed, and the vision for the Green Network will be achieved.

Figure 9: Green Network themes, inventory, and maps.

Community : The Green Network facilitates placemaking, honours culture, and inspires community- led transformation.	 INVENTORY: Cultural spaces Wayfinding and interpretive features Community spaces Urban agriculture
Governance : The Green Network is governed with an emphasis on partnerships and triple bottom line solutions.	 INVENTORY: Regulatory context Green Network distribution Green Network ownership and management Meewasin
Open Space : The Green Network links all Saskatoon residents to high quality, interconnected green space.	 INVENTORY: Formal and informal green space Green space distribution Trails and greenways Urban forest
Ecology : The Green Network conserves biodiversity, supports high quality habitat, and increases climate change resilience.	 INVENTORY: Significant natural areas Arable land Naturalized parks and features Nature friendly design Soil assets
Storm Water : More rain is managed where it falls. Storm water is recognized as an important resource.	INVENTORY: • Aquatic assets • Low Impact Development • Grey storm water assets

Community The Green Network facilitates placemaking, honours culture, and inspires community-led transformation.

COMMUNITY: INVENTORY, FINDINGS, AND ACTIONS

The Green Network is integral to the Saskatoon community's wellbeing and quality of life. Well-designed green space can infuse cities with a sense of place, tell the story of how we all came to be here, build social relations, and foster citizen ownership. Natural, enhanced, and engineered assets all provide ecosystem services that affect the community's sense of place and residents' interaction with their city. Community is site-specific, and relies on people engaging in placemaking right where they live. Placebased design therefore must be considered in green infrastructure planning.

What's discussed in this section?

Any site that provides significant cultural or community services. Such sites are dependent on the interaction of people with each other and with their spaces. Significant community sites were included in this section, however, all green infrastructure in this document can be designed to better support community needs and facilitate placemaking throughout the Green Network.

COMMUNITY INVENTORY:

- Cultural spaces
- Wayfinding and interpretive features
- Community spaces
- Urban agriculture



26





28

Cultural Spaces

Current state

Saskatoon has a long history of multiculturalism. Sites in the Green Network associated with different cultural groups and events is an important part of community identity. The City has a partial inventory of such sites. However, there is an identified need to work with the community to create a complete inventory of the locations of historical and current cultural spaces, as well as share the stories about those spaces in the community's words.

Inventory

Map 5 shows documented cultural spaces in the Green Network. The following is the list of inventoried sites.

Archaeological and Paleontological Sites: Alexander MacGillivray Young Park, Diefenbaker Park, Gowen Sites, Holiday Park, Moose Jaw Trail, Northeast Swale, Peggy McKercher Conservation Area, Peturrson's Ravine, Sanitorium Site, Silverwood Factoria and Heritage Site, Sutherland Beach, U of S Remediation and Buffer Lands, Wanuskewin Heritage Park, Woolly Mammoth Sites

Heritage sites: Ashworth Holmes Park, Bowerman Residence, City Gardener's Site, City Greenhouses, Five Corners, Fred Mitchell Memorial Gardens, International Peace Plaza, Kinsmen Park, Kiwanis Memorial Park, Little Chief Service Station, Marr Residence, Mendel Building, Moose Jaw Trail, Next of Kin Memorial Avenue, Northeast Swale, Nutana (Pioneer Cemetery), Patterson Garden Arboretum, Saskatoon Forestry Farm Park & Zoo, Sutherland Memorial Hall, Victoria Park, Weir, Wilson School

Ecosystem Services

Cultural diversity ~ Spiritual and religious values ~ Knowledge systems ~ Educational values ~ Inspiration ~ Aesthetic values ~ Community building and social relations ~ Sense of place ~ Heritage values ~ Destinations and tourism



FINDINGS AND ACTIONS

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- The cultural uses of green space have not been comprehensively assessed by the City. Some cultural mapping has already taken place, but work has mainly focused on built infrastructure.
- An intangible (living) cultural heritage assessment would help clarify how the community interacts with the Green Network and where gaps need to be addressed. Wanuskewin is applying for UNESCO World Heritage Site designation; this assessment would support their application.
- Public feedback indicates that traditional land uses (e.g. sweet grass collection and berry picking) are occurring in the Green Network and that there is interest in protecting sites to maintain these uses as well as identifying additional opportunities elsewhere.
- The Indigenous Technical Advisory Group recommends a comprehensive assessment to understand traditional knowledge systems, food
 systems, and land uses as they relate to Green Network planning. Identifying traditional land uses has also been identified as a need by
 the Saskatoon North Partnership for Growth planning group.
- Cultural spaces often have place-based significance to specific groups. Because culture exists on a continuum of both people who were here historically and those here today, the Indigenous Technical Advisory Group notes that it's important not to represent living and historic cultures separately.
- Some heritage and archaeological sites have been documented in the Green Network. For example, the 1983 *Saskatoon Perimeter Archaeological Survey* by Dr. Ernie Walker describes known archaeological resources in the area surrounding the City's boundary at that time. Maintaining an inventory of such sites is important for Green Network management.
- Saskatoon is home to people from all around the world, yet all voices are not consistently represented in designing the Green Network.
- Internal feedback indicates that inclusion and equity are being considered in green space design. However, engagement participants indicate that there are still gaps in this practice. Not everyone feels safe or welcome in the Green Network, and factors such as gender diversity, age, and accessibility have not been considered consistently across all green spaces.
- The City is working towards further Indigenous partnerships in support of the Truth and Reconciliation Commission's *Calls to Action*. This can be reflected in the *Strategy* by committing to meaningful consultation and building respectful relationships with local Indigenous groups while developing the *Strategy's* actions and during implementation.
- Meewasin is similarly working to support the *Calls to Action* of Education (e.g. embedding Indigenous stories within education and interpretation narratives), Commemoration (e.g. naming and recognition within the valley), and Equity for Aboriginal People in the Legal System (e.g. pursuing Treaty Land Entitlement Partnership opportunities, planting sweet grass for community harvest).

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EQUITY AND INCLUSION
Action 1: Design the Green Network to reflect our collective history, honour cultural diversity, and create a sense of belonging for all.

1.1: Complete an Intangible Cultural Heritage Assessment to better understand community uses of the Green Network.

1.2: In partnership with the community, complete a Traditional Land Use and Traditional Knowledge assessment to identify cultural elements in the Green Network, and establish ways to conserve, honour, and revitalize these elements.

1.3: Continue meaningful engagement with affected groups to design the Green Network through an equity and inclusion lens.

Figure 10: The zhongshan ting in Victoria Park

ACTION 1



Wayfinding and Interpretive Features

Current state

Wayfinding and interpretive features are elements that communicate the value or significance of a site. These features are largely managed by the City, and in the case of amenities in the river valley, by Meewasin. These features are an important aspect of the Green Network, telling the story of Saskatoon through the perspective of many voices.

Figure 11a: Creative wayfinding signage at Richard St Barbe Baker Afforestation Area



Inventory

Features include signage, amenities, landmarks, interpretive features, and public art. A complete inventory of these features, including locations of specific features, should be compiled in a comprehensive database.

Ecosystem services

Cultural diversity ~ Spiritual and religious values ~ Knowledge systems ~ Educational values ~ Inspiration ~ Aesthetic values ~ Community building and social relations ~ Sense of place ~ Heritage values ~ Destinations and tourism

Figure 11b: Public art in the Green Network provides year-round opportunities for the community to get outside.



- Public art and interpretive features in the Green Network can tell stories from many voices about how we came to be here.
- Currently, not all peoples' stories are represented in the Green Network. There is an opportunity for Green Network site names and interpretive features to better reflect all local cultures, and groups who are often underrepresented such as LGBTQ2S+ communities.
- The Indigenous Technical Advisory Group has recommended that site names, wayfinding, and interpretive features reflect the local community and that stories are told in the community's own words. For example, it was recommended that the City accept naming, signage wording, and design ideas from the community, including representation from many languages.
- Meewasin has also identified this as a priority in the design of its interpretive features.

STORIES OF THE GREEN NETWORK

ACTION 1

- Well designed interpretive features can improve overall user experience of the Green Network and contribute to city uniqueness and the community's sense of place.
- The City's *Culture Plan* recommends the City support site-specific identity through First Nation and Métis cultural and heritage expression in wayfinding signage.

Action 1: Design the Green Network to reflect our collective history, honour cultural diversity, and create a sense of belonging for all.

1.4: Work with the community to tell the story of Saskatoon's Green Network from many voices through public art, interpretive features, and other mediums.







Community Spaces

Current state

Community spaces are sites in the Green Network that support community building and placemaking. These sites are distinct from cultural spaces, which have a stronger cultural or spiritual component. However, community and cultural spaces often intersect. Community uses in the Green Network include active and passive recreation, community gardening, citizen science activities, dog walking, festival participation, and tourism.

Inventory

Community spaces shown on Map 6 include:

Festival Sites: Large gathering areas that attract 4,500-75,000 participants each, that require civic services and permits, and that have potential to impact green infrastructure.

Off leash recreational areas: Open spaces where dogs with a valid license are permitted to be off-leash while under the control of their owner.

Urban agriculture sites: discussed in more detail starting on page 37.

The Great Trail: discussed in more detail in Open Space.

Pedestrian Priority Streets: discussed in more detail in Open Space.

Special Use Spaces: Open spaces such as cemeteries, golf courses, and campgrounds.

Business Improvement Districts: A commercial area designated by bylaw for management, beautification, and promotion purposes.

Formal Green Spaces: parks and other green spaces discussed in more detail in Open Space.

Ecosystem services

Cultural diversity ~ Spiritual and religious values ~ Public safety ~ Knowledge systems ~ Educational values ~ Inspiration ~ Aesthetic values ~ Recreation ~ Community building and social relations ~ Sense of place ~ Heritage values ~ Destinations and tourism

Figure 12: A temporary "parket" on 20th Street West at Parking Day, 2014.



• Green infrastructure can support community building in the Network by improving residents' access to and experience of green spaces.

In high density urban areas, it can be difficult to find space to add green infrastructure. Offering green infrastructure education or incentives to community members and business owners could increase uptake of green infrastructure from residents.

Some green infrastructure education is already occurring. For example, the City's Healthy Yards program supports best practices in environmentally friendly yard care, gardening, and composting, including through a demonstration site and workshops at the Saskatoon Food Bank & Learning Centre's Garden Patch. These types of supports can be continued and expanded.

- The City's Storm Water Management Credit Program currently provides an incentive for property owners to reduce storm water charges by implementing green infrastructure (e.g. green roofs, bioswales). These types of programs could be expanded upon.
- Public engagement results indicate that Saskatoon citizens want to be more involved in Green Network management, but confusion about policies or lack of information prevents them from doing so.
- Few mechanisms currently encourage public management of green spaces. Internal engagement indicates municipal staff support increased citizen engagement, but that a framework is required to encourage citizen-driven projects while ensuring such projects are sustainable and fully implemented.
- Some citizens and groups are already involved with the City in green space management. The Saskatoon Nature Society and Native Plant Society share citizen science data such as long-term bird counts and vegetation surveys. CHEP Good Food coordinates the community garden program with both the City and citizen groups.
- Community gardens are one example of citizen-managed green space already supported by the City. Other municipalities support public use of green space through "de-pave" events, bioblitzes, public art installations, green alleys, food forests, and traditional land uses.
- The Indigenous Technical Advisory Group recommended a biocultural approach to green space management, recognizing the interaction and mutual benefit of cultures within nature.

Action 2: Inspire citizen-driven transformation of the Green Network.

- 2.1: Develop and provide education materials about the Green Network to increase community awareness and ownership.
- 2.2: Seek opportunities to incentivize green infrastructure in private and commercial areas.

2.3: Develop a program and funding model to support community-led green infrastructure projects, citizen science, and bio-cultural management.

CITIZEN INVOLVEMENT

ACTION 2

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Urban Agriculture

Current state

Urban agriculture is largely community-driven food production taking place in the city. Public engagement indicates strong interest in urban agriculture, including increasing community garden spaces, boulevard gardening, rooftop gardening, food forests, and vacant lot gardens. The *Junction Improvement Strategy* recommended implementing urban agriculture projects in that area. The City has an opportunity to increase its support for these types of programs by streamlining approval processes and land use agreements or providing start up funding.

Inventory

Map 7 shows the locations of urban agriculture sites in the Green Network including:

Allotment Gardens: Plots of land used for food production, operated by the City, and rented out to individuals.

Community Gardens: Plots of land where community volunteers work together to produce vegetables, fruit, native plants, and some non-invasive ornamentals. Gardeners take responsibility for organizing, maintaining, and managing the garden. Participation is open to all people and supports community building. Saskatoon has a network of over 50 community gardens in public spaces such as parks, school yards, church grounds, vacant lots, and brownfields. These sites are operated in partnership with CHEP Good Food, local citizen groups, and the City.

Civic Food Production: Food production taking place at City facilities. Cosmo and Lawson Civic Centres have been adding edible ornamentals into their annual planting beds for the last several years.

Food Forests and Orchards: Public spaces used for fruit and perennial food production. Food forests are designed to mimic processes in natural forests. They are more self-sustaining than orchards, which are more intensively managed. There are few standalone food forests and orchards in Saskatoon currently. Most operate as part of a larger community garden.

Vacant Lot Gardens: Non-profit community organizations with a significant food security mandate can apply to use vacant City-owned property for food production. Prominent examples include the Garden Patch, a downtown site operated by the Saskatoon Food Bank & Learning Centre that offers gardening education, community events, and produces food for emergency food baskets. Another example is the askîy project, an urban agriculture internship operated by CHEP Good Food out of a vacant brownfield in "the Junction" of Riversdale, West Industrial, and Pleasant Hill.

Ecosystem services

Food and fiber ~ Genetic resources ~ Biochemicals, medicines ~ Ornamental resources ~ Biological control ~ Pollination ~ Spiritual and religious values ~ Public safety ~ Knowledge systems ~ Educational values ~ Inspiration ~ Aesthetic values ~ Community building and social relations ~ Sense of place ~ Habitat provision ~ Biodiversity ~ Photosynthesis and primary production ~ Soil formation and retention ~ Nutrient and water cycling

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- Cities typically have not taken on food security work directly, instead supporting external partners in urban food production. Areas that Canadian cities have focused on include promoting food security, food sovereignty, and access to healthy food through support for community gardens; public produce projects; integrated pest management education; edible landscaping; and grants to non-profit urban agriculture projects.
- Many parks in built-up areas have no available space for urban agriculture, but there are opportunities to increase urban agriculture on centre medians, boulevards, vacant lots, and rooftops. The City supports urban agriculture through the *Community Garden Guidelines*, the *Boulevard Gardening and Maintenance Guidelines*, the Healthy Yards Program, and the Vacant Lot and Adaptive Reuse Incentive Program. There is an opportunity to increase support for partners to encourage uptake.
- The City currently supports CHEP Good Food to deliver the community garden program, including through a grant to support new community garden establishment. The amount of grant money has stayed consistent while the number of community gardens has increased, creating a funding challenge when new community gardens are established..

FOOD PRODUCTION IN THE GREEN NETWORK

- The Saskatoon Food Council has recommended that the City work with community partners to develop a comprehensive food strategy. This includes the recommendation, from the *Saskatoon Regional Food System Assessment and Action Plan*, to "garden everywhere and expand capacity in urban agriculture". A food strategy would clarify how food production integrates with the Green Network.
- Access to food and food production opportunities are unevenly distributed across the city. For example, some neighbourhoods have
 identified food deserts (areas where it is difficult to buy affordable food). Some new garden groups have had difficulty finding community
 garden space in neighbourhood parks because programmable space has already been allocated. Urban agriculture taking place on vacant
 lots may also be subject to short-term lease agreements, adding uncertainty to those operations.
- Support for partners working towards Indigenous food systems is also needed. Indigenous community members and researchers have advised that traditional foods and land uses are difficult to access or maintain in Saskatoon. The 2020 report *Towards Improving Traditional Food Access for Urban Indigenous People* recommends addressing this gap through the incorporation of traditional medicines and foods into parks and public lands, and the dedication of urban land to Indigenous food practices.
- Multiple community groups (e.g. CHEP Good Food, Saskatoon Food Council, Saskatoon Food Bank & Learning Centre) are working towards food security and sovereignty. Partnerships with these groups could be strengthened to increase this work across the city.
- Public feedback indicates significant interest in a community-led food forest on public land. Other municipalities such as Edmonton and Seattle have examples of such projects.

FOOD POLICIES

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Action 3: Increase food production in the Green Network.

3.1: Update policies to improve urban agriculture outcomes and community or regional partnerships.

3.2: Work with partners to develop a comprehensive food strategy, including implementation of the Saskatoon Regional Food System Assessment and Action Plan.

3.3: Work with and support partners to incorporate food and fruit production or traditional food systems into high priority urban areas.

3.4: Identify potential sites and partners to develop a food forest pilot project.

Figure 13: The Garden Patch is an urban agriculture site operated by the Saskatoon Food Bank and Learning Centre out of a vacant lot off 3rd Avenue. **Figure 14:** The askîy project, an urban agriculture internship operated by CHEP Good Food, runs its kiscikânis site out of a vacant brownfield in the Junction (photo and text credit: CHEP Good Food).







ACTION 3

Table 3: Summary of Community Actions

Community Actions	Phase*	Responsibility			
		Primary	Secondary	Partners	
Action 1: Design the Green Network to reflect our collective history, honour cultural diversity, and create a sense of belonging for all. Action 1 should take place throughout the Green Network. Community partnerships and cultural assessments are required to identify specific priority areas.					
1.1: Complete an Intangible Cultural Heritage Assessment to better understand community uses of the Green Network.	2	Sustainability		Local First Nations, Heritage Society, Meewasin, and many others	
1.2: In partnership with the community, complete a Traditional Land Use and Traditional Knowledge assessment to identify cultural elements in the Green Network, and establish ways to conserve, honour, and revitalize these elements.	2	Sustainability, Indigenous Initiatives	P&D		
1.3: Continue meaningful engagement with affected groups to design the Green Network through an equity and inclusion lens.	1	Sustainability Community Development	All		
1.4: Work with the community to tell the story of Saskatoon's Green Network from many voices through public art, interpretive features, and other mediums.	2		Indigenous Initiatives		
Action 2: Inspire citizen-driven transformation of the Green Network. Community partnerships and an intangible cultural heritage assessment is required to identify priority areas.					
2.1: Develop and provide education materials about the Green Network to citizens to increase community awareness and ownership.	1	Sustainability	Parks, P&D, Saskatoon Land, Saskatoon Water	Meewasin, SES, Local Businesses, and many others	
2.2: Seek opportunities to incentivize green infrastructure in private and commercial areas.	1				
2.3: Develop a program and funding model to support community-led green infrastructure projects, citizen science, and bio-cultural management.	1				
Action 3: Increase food production in the Green Network. There is considerable public interest in increasing urban agriculture city-wide. The <i>Junction Improvement Strategy</i> recommends improving food security and urban growing practices in redevelopment projects. Food deserts are also a priority area.					
3.1: Update policies to improve urban agriculture outcomes and community or regional partnerships.	3	Sustainability	P&D, Parks, Community Development, Indigenous Initiatives	Saskatoon Food Council, CHEP Good Food, SFBLC, Meewasin	
3.2: Work with partners to develop a comprehensive food strategy, including implementation of the <i>Saskatoon Regional Food System Assessment and Action Plan.</i>	2				
3.3: Work with and support partners to incorporate food and fruit production or traditional food systems into high priority urban areas.	2				
3.4 Identify potential sites and partners to develop a food forest pilot project.	1	<u> </u>			
*Phases: proposed initiation of actions. 1: near term (within 2 years); 2: medium term (within 3 to 9 years); 3: long term (over 10 year).					



Governance The Green Network is governed with an emphasis on partnerships and triple bottom line solutions.

GOVERNANCE: INVENTORY, FINDINGS, AND ACTIONS

Good governance is fundamental to the Green Infrastructure Strategy and essential to achieving the Green Network vision. Governance of the Green Network applies to both the policies that determine green infrastructure management, and the physical provision of green space in Saskatoon. As the City develops an interconnected Green Network, work is needed to align policies and supporting standards and guidelines, identify appropriate green space service levels, improve equity, strengthen partnerships, and identify priority areas for action. The City's Official Community Plan and the Sector Planning program provide an overall framework for development in Saskatoon. Ensuring appropriate policies and directions exist in these, and supporting documents, helps maintain a strong governance framework. The City's *Triple Bottom Line Policy*, which considers the environmental, social, and economic dimensions of decision-making, provides a tool that can further inform both Green Network planning and the policies, standards, and guidelines which guide this planning. Developing stronger partnerships with external groups such as Meewasin is another opportunity to strengthen the governance framework.

What's discussed in this section?

An analysis of the regulatory context for green infrastructure as well as the distribution, ownership, and management of the Green Network. Meewasin has been identified as a partner in implementation of the *Strategy*, and are discussed as well.

GOVERNANCE INVENTORY:

- Regulatory context
- Green Network distribution
- Green Network ownership and management
- Meewasin



Table 4: Green Infrastructure Strategy regulatory context. The following is a list of some bylaws, policies, and plans that relate to green infrastructure. These policies should be considered in Green Network management, particularly those strongly related to each theme.

Municipal Bylaws, Policies, Plans, and Guidelines	Policy's relation to each theme				
	Community	Open Space	Ecology	Storm Water	
Bylaws					
Official Community Plan, Bylaw 8769					
Storm Water Management Utility Bylaw					
Zoning Bylaw					
Policies					
Civic Heritage Policy					
Environmental Policy					
Public Art Policy					
Recreational Use of Storm Water Retention Ponds Policy					
Tree Protection Policy					
Triple Bottom Line Policy					
Wetlands Policy					
Plans and Strategies					
Accessibility Action Plan					
Brownfield Strategy					
Culture Plan					
Local Actions: Saskatoon's Climate Adaptation Strategy					
Low Emissions Community Plan					
Recreation and Parks Master Plan					
Storm Water Management Business Plan and Funding Strategy					
Strategic Plan, 2013-2023					
Guidelines and Programs					
ayisiyiniwak: A Communications Guide					
Boulevard Gardening Guidelines					
Community Garden Guidelines					
Contractor Environmental Guidelines					
Low Impact Development Design Guidelines					
Natural Area Standards					
Park Development Guidelines					
Park and Recreation Levy					
Vacant Lot and Adaptive Reuse Incentive Program					

Legend: HIGH | MEDIUM | LOW

Table 4 continued: Green Infrastructure Strategy regulatory context. The following is a list of some Federal, Provincial, and Meewasin policies and plans that relate to green infrastructure. These policies should be considered in Green Network management, particularly those strongly related to each theme.

Federal and Provincial Policies and Plans	Policy's relation to each theme				
	Community	Open Space	Ecology	Storm Water	
Canada Water Act					
Canadian Environmental Protection Act					
Conservation Easements Act					
Duty to Consult (Treaty 6)					
Environmental Assessment Act					
Environmental Management and Protection Act					
Management and Reduction of Greenhouse Gases Act					
Meewasin Valley Authority Act					
Partnership for Growth Regional Green Network Study Area					
Planning and Development Act					
Species At Risk Act					
Statements of Provincial Interest Regulations					
Water Appeal Board Act					
Weed Control Act					
Wildlife Act					
Meewasin Policies and Plans					
Meewasin Development Review Policy					
Meewasin Land Policy					
The Meewasin Valley Project (The Moriyama Plan)					
Meewasin Valley-wide Resource Management Plan					
Natural Areas Inventory					
Northeast Policy					

Legend: **HIGH | MEDIUM | LOW**

Regulatory Context

Current state

Consideration of the legal framework that governs green space is important for implementation of the *Strategy*. Saskatoon has many bylaws, policies, standards, and plans relating to Green Network design and management (see Table 4). Municipal documents such as the *Official Community Plan* and the *Park Development Guidelines* provide a framework for how green space is distributed and developed. Other regulatory tools provide more detailed guidance on how green space is developed and managed.

Inventory

See Table 4 for a high level inventory of Saskatoon's policy context as it relates to the Strategy's themes.



FINDINGS AND ACTIONS

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- Saskatoon's Green Network is governed by many civic plans, standards, and policies. The *Official Community Plan* (OCP) defines the legal framework of all other civic policies. Alignment between all City management documents is needed to ensure that policies and standards relating to green space management are enforceable and achievable. Work is needed to align policies for more cohesive management. Future policy updates must be in alignment with the OCP.
- Many City divisions are involved in Green Network planning and management. Concurrent initiatives (e.g. *Storm Water Master Plan, Low Emissions Community Plan, Forestry Farm Park and Zoo Master Plan,* Naturalized Parks Program) provide an opportunity to partner across divisions.
- Data management has been identified as a gap in planning processes. Compiling and maintaining data related to green infrastructure will help make Green Network planning more cohesive, meet policy obligations, increase the City's capacity and knowledge base, and measure the success of initiatives.
- Decisions regarding land use investment and management are difficult, and consideration of a range of factors and voices is essential. Creating a cohesive, proactive approach to Green Network planning will help ensure decisions are transparent and investments are maximized.
- The *Triple Bottom Line Policy* helps City divisions frame their initiatives through a sustainability lens, simultaneously pursuing environmental health and integrity, social equity and cultural wellbeing, economic prosperity, and fiscal responsibility.
- Public feedback indicates significant interest in planning the Green Network through an equity and inclusion lens.
- The Green Network supports and is managed by a diversity of community members with many worldviews. Trust-building and respect for all knowledge systems is essential to good relationships. Adopting an ethical space framework during *Strategy* implementation would help ensure that relationships are nurtured on multiple levels.
- Action 4: Invest in the Green Network within the City of Saskatoon.
- 4.1: Improve Green Network planning by updating City work plans, policies, and initiatives to increase green infrastructure across Saskatoon.
- 4.2: Compile City-wide data sets for more effective data management and create data sharing agreements with other agencies.
- 4.3: Adopt an ethical space and triple bottom line approach to Green Network governance, planning the Green Network through sustainability, inclusion, and equity frameworks.

TRIPLE BOTTOM LINE

REGULATORY APPROACH



Green Network Distribution

Current state

The Green Network analysis found that Saskatoon's green and open spaces comprise almost half of the city's footprint. As shown on Map 9, the current Green Network includes significant natural assets (e.g. South Saskatchewan River and its surrounding riparian vegetation), formal green spaces (e.g. parks), informal green spaces (e.g. roadway greens and medians), and other enhanced assets (e.g. arable land).

Much of the Green Network is publicly-accessible but not all. For example, arable land is included in the Green Network analysis because it is a significant portion of the current city footprint (see Figure 15) and provides substantive ecosystem services to the Green Network. However, public access to these lands is restricted. The inclusion of arable land in this analysis highlights ecosystem services and partnership opportunities, but should not be interpreted as City interest in acquiring these sites.

The Green Network analysis did not include green spaces in built-up areas such as privately-owned yards or commercial sites, although these spaces provide important support services to the Green Network (e.g. providing stepping stone habitat for pollinators and birds; retaining rainwater to delay its release into the storm system).

Inventory

Figure 15: The Green Network as a proportion of the City footprint²⁵.



²⁵ Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

- Our Green Network makes up almost half of the city's footprint. However, the level of service and maintenance budgets for informal green space is inconsistent and often insufficient. More work is required to determine an appropriate level of service and budget for these spaces, so we can better understand the funding gap.
 - The *Recreation and Parks Master Plan* states that green spaces are essential to the public's wellbeing, and provide essential services. The plan recommends that green space funding should be part of public investment, that sustained resources should be allocated, and that the City should be building staff capacity through training.
- Our valuation of ecosystem services provided by the Green Network is inconsistent. Work has started on a Natural Capital Asset Valuation framework to define the value of ecosystem services provided by the Green Network.

Action 4: Invest in the Green Network within the City of Saskatoon.

- 4.4: Define an appropriate service level and associated funding for the Green Network to prioritize future investments.
- 4.5: Evaluate the ecosystem services of the Green Network through the Natural Capital Asset Valuation process.



PROVISION AND INVESTMENT

ACTION 4

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Green Network Ownership & Management

Current state

As shown on Map 10, a variety of stakeholders including First Nations, Institutions, and Business Improvement Districts own or manage parts of the Green Network. Creating an interconnected Green Network through spaces under various ownership and management models will require proactive planning and strong partnerships with other landowners and managers.

An analysis of natural assets ownership and management, shown in Figures 16, is particularly relevant to Green Network planning. Many natural assets are owned by the City but managed by, or co-managed with, Meewasin. More discussion about Meewasin can be found starting on page 57.

Inventory

Figure 16a: Saskatoon natural assets ownership²⁶.



Figure 16b: Saskatoon natural assets management²⁶.



²⁶ Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.



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- Green infrastructure, particularly natural assets, generally don't align with political boundaries. Developing a Green Network requires connecting green infrastructure through urban and sometimes privately-owned spaces. To connect our Green Network across multiple jurisdictions and boundaries, innovative and cooperative planning will be required, both within City administration and with external and regional partners.
- Saskatoon's total footprint is still relatively small compared to other municipalities, leaving room to integrate green infrastructure into our planning processes now.
- Preliminary feedback suggests that both internal and external stakeholders believe Saskatoon has significant opportunity to plan a fully connected and accessible Green Network.
- There is opportunity to increase regional connectivity by working with the Saskatoon North Partnership for Growth (P4G) Green Network group.
- The City has already partnered with other organizations on Green Network management. There is opportunity to build on these partnerships and create new ones.
- Developing joint use agreements with school divisions to design green space for storm water and recreational purposes has been identified as one priority.
- Business Improvement Districts have observed that a higher tree canopy increases foot traffic to businesses; they would like to work with the City to maintain a high quality tree canopy in their districts.
- Wanuskewin is working towards applying for UNESCO World Heritage Site Designation. This would be an important milestone for the region, and the City is supporting their application by leasing land to Wanuskewin for bison reintroduction, and helping to maintain their viewshed, which extends into city limits.
- Opimihaw Creek, which flows through Wanuskewin Heritage Park, contains significant archaeological artifacts. Creek water levels should be maintained at their present levels to preserve these artifacts.
- Indigenous Protected and Conserved Areas (IPCAs) are being developed elsewhere in Canada, providing an example of a partnership framework and Indigenous governance model that could occur in Saskatoon.

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GREEN NE

PARTNERSHIPS

Action 5: Develop a cooperative governance approach to Green Network provision and management.

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ACTION

- 5.1: Work with research and education institutions such as the University of Saskatchewan and school divisions, conservation agencies, landowners, and other stakeholders on green space management and education.
- 5.2: Work with regional partners to coordinate Green Network development and management in urban areas that intersect with the region.
- 5.3: Work with Wanuskewin to conserve their viewshed and support management of Opimihaw Creek.
- 5.4: Partner with Indigenous communities and organizations to explore traditional land management and governance models for the Green Network.

Figure 17: Opimihaw Creek, which flows through Wanuskewin Heritage Park, contains significant archaeological artifacts. Creek water levels should be maintained at their present levels to preserve these artifacts.



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Meewasin

Current state

Meewasin manages a significant portion of Saskatoon's Green Network. Approximately 6,700 hectares of the river valley is part of their Conservation Zone, much of which is inside city limits and publicly accessible. Approximately one third of Saskatoon's natural assets, including portions of the Northeast Swale, are within Meewasin's Conservation Zone. Many natural assets are co-managed with the City (see Figure 16b). The City has an opportunity to partner with Meewasin in the conservation, education, and development of Green Network sites identified in the *Natural Areas Inventory*²⁷. Note, as shown on Map 11, Meewasin's Conservation Zone encompasses many built-up areas, and does not correspond exactly with Saskatoon's natural assets.

Inventory

Sites within Meewasin's Conservation Zone, as shown on Map 11, are described below:

City of Saskatoon sites within Meewasin's Conservation Zone:

Cosmopolitan Park, Diefenbaker Park, Factoria, Gabriel Dumont Park, GD Archibald Memorial Park, Gordie Howe Management Area, Kinsmen Park, Kiwanis Memorial Park, Meewasin Park, Richard St Barbe Baker Afforestation Area, River Landing, Rotary Park, Saskatoon Forestry Farm Park & Zoo, Sutherland Beach, Victoria Park, the Weir

Meewasin Conservation Easement: St Joseph High School

Meewasin managed and co-managed sites: Beaver Creek Conservation Area, Chief Whitecap Park, Cranberry Flats Conservation Area, Crocus Prairie, Chappel Marsh Conservation Area, Northeast Swale

Meewasin owned sites: Peggy McKercher Conservation Area, Saskatoon Natural Grasslands

Northeast Policy Priority Areas: Small Swale, Northeast Swale Extension, North Riverbank

Areas of interest: George Genereux Afforestation Area, Holmwood Area Wetland Complex, Hudson Bay Swale, Richard St Barbe Baker Afforestation Area Extension, Wanuskewin Heritage Park Bison Fields Extension, West Swale

Ecosystem Services

Food and fiber ~ Genetic resources ~ Fresh water ~ Air quality maintenance ~ Carbon storage ~ Erosion control ~ Water purification and waste treatment ~ Pollination ~ Educational values ~ Inspiration ~ Aesthetic values ~ Recreation ~ Community building and social relations ~ Sense of place ~ Heritage values ~ Destinations and tourism ~ Habitat provision ~ Biodiversity ~ Oxygen production ~ Nutrient and water cycling

²⁷ Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

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- Meewasin and City staff have identified a lack of clarity on roles and responsibilities as well as funding gaps for existing Green Network sites that are co-owned or co-managed. Regular communications between City and Meewasin staff would allow a more coordinated alignment of priorities.
- Meewasin has 40 years of land conservation and resource management experience, which can be leveraged to improve management of natural assets beyond the river valley.
- Building capacity for Green Network management through a common vision between the City and Meewasin is more effective than working separately. A framework for collaboration would clarify scope, roles, responsibilities, resources, and processes.
- Meewasin has identified areas of interest (see Map 12) where there could be additional opportunities for increased collaboration with the City. Opportunities could include sharing knowledge and expertise, mobilizing volunteers, or an expansion of Meewasin's Conservation Zone.
- Meewasin's Conservation Zone allows them to review development and activities within the zone, requiring developments to comply with
 conservation objectives. An expansion of Meewasin's Conservation Zone may provide an extra layer of protection or development review
 for natural assets. This would require amendments to formal agreements with the City, and would be subject to the *Meewasin Valley Authority Act*. Benefits of Meewasin's development process include access to scientific expertise and design professionals on volunteer
 committees. This has historically increased community buy-in on decisions.
- Meewasin's Valley-wide Resource Management Plan identifies actions needed to strengthen ecological sites. The City has an opportunity to collaborate with Meewasin in this work.
- Historically, the City and Meewasin have streamlined development processes to strengthen joint outcomes. There is opportunity for this work to continue.

Action 6: Redefine the partnership with Meewasin to achieve collective goals related to conservation, education, and development in the Green Network.

- 6.1: Establish regular meetings to review plans and priorities to strategically align mutual work.
- 6.2: Collaborate on conservation, naturalization, and the development of trails, interpretive infrastructure, and amenities in areas of interest.
- 6.3: Leverage and support Meewasin's educational and public outreach programming and volunteer base to increase conservation, ecology, and natural and cultural resource awareness.
- 6.4: Seek opportunities to collaborate on external funding.
- 6.5: Update the Meewasin-City service agreement and other documents as needed to reflect the above initiatives.

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Figure 18: Targeted conservation grazing is an important ecosystem management tool that Meewasin utilizes, in addition to prescribed burning and integrated weed management, to manage native grasslands. Here, sheep are grazing at the Northeast Swale to maximize biodiversity outcomes such as grassland bird habitat and species diversity.

Table 5: Summary of Governance Actions

Governance Actions	Phase*	Responsibility			
		Primary	Secondary	Partners	
Action 4: Invest in the Green Network within the City of Saskatoon. Action 4 should take place through	nout the	Green Network.			
4.1: Improve Green Network planning by updating City work plans, policies, and initiatives to increase green infrastructure across Saskatoon.	3	Sustainability	P&D		
4.2: Compile City-wide data sets for more effective data management and create data sharing agreements with other agencies.	1		All	Meewasin, many others	
4.3: Adopt an ethical space and triple bottom line approach to Green Network governance, planning the Green Network through sustainability, inclusion, and equity frameworks.	1		All	Local First Nations	
4.4: Define an appropriate service level and associated funding for the Green Network to prioritize future investments.	3		Parks		
4.5: Evaluate the ecosystem services of the Green Network through the Natural Capital Asset Valuation process.	3			Meewasin	
Action 5: Develop a cooperative governance approach to Green Network provision and management. Action 5 should take place throughout the Green Network.					
5.1: Work with research and education institutions such as the University of Saskatchewan and school divisions, conservation agencies, landowners, and other stakeholders on green space management and education.	1	_ Sustainability	Saskatoon Water, P&D	U of S	
5.2: Work with regional partners to coordinate Green Network development and management in urban areas that intersect with the region.	3			P4G, Meewasin	
5.3: Work with Wanuskewin to conserve their viewshed and support management of Opimihaw Creek.	1		Indigenous Initiatives	WHP, P4G, Meewasin	
5.4: Partner with Indigenous communities and organizations to explore traditional land management and governance models for the Green Network.	3			Many	
Action 6: Redefine the partnership with Meewasin to achieve collective goals related to conservation, education, and development in the Green Network. Action 6 should take place in significant natural areas and partnership areas of interest.					
6.1: Establish regular meetings to review plans and priorities to strategically align mutual work.	1		P&D, Parks, Saskatoon Water		
6.2: Collaborate on conservation, naturalization, and the development of trails, interpretive infrastructure, and amenities in areas of interest.	2	Sustainability and Community			
6.3: Leverage and support Meewasin's educational and public outreach programming and volunteer base to increase conservation, ecology, and natural and cultural resource awareness.	1			Meewasin	
6.4: Seek opportunities to collaborate on external funding.	1	Services			
6.5: Update the Meewasin-City service agreement and other documents as needed to reflect the above initiatives.	1				
*Phases: proposed initiation of actions. 1: near term (within 2 years); 2: medium term (within 3 to 9 years); 3: long term (over 10 year).					



Open Space The Green Network links all Saskatoon residents to high quality, interconnected green space.

OPEN SPACE: INVENTORY, FINDINGS, AND ACTIONS

The world is quickly becoming more urbanized. The United Nations estimates that by 2050, 70% of the human population will live in cities. This trend is being experienced locally, with the *Plan for Growth* projecting that Saskatoon will grow to half a million people by 2050. At the same time, access to green space is increasingly recognized as a strong influence on mental, physical, and emotional well-being, leading some cities to view green infrastructure through a public health lens. However, not everyone in Saskatoon has the same access to green space. Some residents face distance, connectivity, or accessibility barriers. The *Park Space Deficiency Strategy* found that many parks are serving more people than they were designed to and that there are park program gaps and shortfalls²⁸. Green infrastructure can provide multiple benefits to address some of these challenges.

What's discussed in this section?

Saskatoon's open spaces are largely comprised of enhanced assets such as formal and informal green spaces, and the urban forest. Engineered assets such as trails and greenways play a supporting role by providing people access to nature, increasing connectivity, and improving the built environment for improved quality of life.

28 City of Saskatoon. (2007). Strategy to Address Park Space Deficiencies.

OPEN SPACE INVENTORY:

- Formal and informal green space
- Green space distribution
- Trails and greenways
- Urban forest






Formal and Informal Green Space

Current state

Formal green spaces, shown on Map 13, account for approximately 5.5% of Saskatoon's footprint. These include parks, recreational areas, and special use areas. Formal green space is usually designated as Municipal Reserve or Utility Parcel. In some cases, City-owned lands managed as formal green space may not have either designation. A third category, Environmental Reserve, is allowed by the *Planning and Development Act* but has not yet been applied to any space in Saskatoon. Generally, Municipal Reserves such as parks have dedicated funding and maintenance budgets and a higher level of service than other green spaces.

Approximately 3.5% of the city is informal green space such as roadway greens. Informal green spaces often have less dedicated funding and a lower level of service than formal green space.

Inventory

Formal green spaces shown on Map 13 include:

Parks: City-owned spaces typically used for active and passive recreation.

Special use areas: sites such as cemeteries, golf courses, and campgrounds.

Off-leash recreational areas: sites where dogs with a valid license are permitted to be off-leash while under the control of their owner.

Institutional land: privately-owned sites used for research or education. Some institutional land, such as the University campus, is publicly accessible.

Utility Parcels and Sites: City-owned green space containing a utility, which often function as a park.

Informal green spaces shown on Map 13 include:

City-owned sites like boulevards, buffers, centre medians, and other green spaces within right-of-ways. Vacant lots and brownfields are also included in the inventory.

Ecosystem Services

Food and fiber ~ Ornamental resources ~ Water regulation ~ Pollination ~ Cultural diversity ~ Spiritual and religious values ~ Public safety ~ Aesthetic values ~ Recreation ~ Community building and social relations ~ Sense of place ~ Destinations and tourism ~ Biodiversity ~ Photosynthesis and primary production

Figure 19: Some residents are using informal green spaces within right-of-ways to practice urban agriculture (Photo credit: Lisa Taylor).





- Engagement results indicate that, while Saskatoon residents value the Green Network, they feel work is needed to address accessibility and connectivity barriers, improve park quality, and increase the overall amount of park space. Stakeholders also report challenges such as incompatible uses, and shortages of programmable spaces and recreational areas.
- The City's irrigated park areas, skating rinks, bookable facilities, and other park assets have been inventoried by different work groups, but there is currently no centralized database for these assets. Centralizing this data within the City would help determine where there are service gaps in formal green space.
- Green space shortages can lead to conflict when activities in a space complete with each other or are not adequately buffered. This can also lead to conflicts between recreational needs and conservation needs.
- Renewal can help address these issues by ensuring existing spaces are high quality and meet community needs.
- Park retrofits are currently underway through a Building Better Parks partnership between Parks and Recreation, Community Development, and Facilities. There is an opportunity to consider green infrastructure installations during park retrofits.
- The City is developing a prioritization model to select sites to upgrade over the next several years.



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- Informal green space such as centre medians and other green spaces within right-of-ways are not the responsibility of any one division
 within the City. The service level provided to these spaces is lower than with formal green space, and there is no comprehensive inventory
 of these sites' condition or upgrade needs. Increased coordination within the City will help fill this gap.
- There are currently over 600 vacant lots in Saskatoon, some of which are City-owned. The City is actively encouraging infill development through the *Plan for Growth* and initiatives such as the Vacant Lot and Adaptive Reuse Incentive. As a result, some of these sites will eventually be developed. However, some of these spaces may present opportunities to increase green infrastructure on either a short-term or long-term basis through uses such as community gardens.
- Medians are important to the city's overall beauty and environmental health, yet they are difficult areas to maintain, as they are not irrigated, are exposed to harsh environmental conditions, and absorb significant amounts of magnesium chloride. Council, in September of 2019, approved the option to improve standards, streamline operations, and develop a median and boulevard asset management strategy as recommended in the *Maintenance of Centre Medians Report*.
- Some uses of green space are incompatible with the service that space was designed for. These uses have potential to degrade green spaces, to generate conflict in the community, and to create negative or unsafe perceptions of an area.
- Renewal of informal spaces could reduce incompatible uses, meet community open space needs, and improve walkability.
- Priority sites for upgrade include parks identified in the *Park Space Deficiency Strategy, Local Area Plans,* and other key sites identified by stakeholders. However, no long-term resourcing has been identified to support upgrades of non-park green spaces.
- Upgrades to informal green space would require resourcing, as well as cross-divisional planning involving Transportation, Roadways, Planning and Development, Sustainability, and Parks.

Action 7: Renew formal and informal green space in the Green Network to meet citizen needs.

- 7.1: Identify high priority formal and informal green spaces to upgrade or redevelop.
- 7.2: Increase coordination within the City, and with the community, to encourage informal green space renewal.
- 7.3: Implement park upgrade plans starting in high priority areas.

FORMAL GREEN SPACE RENEWAL

ACTION 7



Green Space Distribution

Current state

INFRASTRUCTURE OPPORTUNITIES

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GREEN

As shown on Map 14, high quality green space is not distributed evenly across the city. The Official Community Plan, Bylaw 8769 identifies a ratio of four (4) hectares of public open space for everyone one thousand (1000) persons as a desirable standard for Saskatoon. Many individual neighbourhoods fall below this general allocation. The Park Space Deficiency Strategy has also

29 City of Saskatoon. (2007). Strategy to Address Park Space Deficiencies.

identified that many of the City's parks are serving more citizens than they were designed to²⁹. In some cases this can be attributed to differing priorities or development considerations at the time a neighbourhood was developed. In other cases it can be the result of larger district or multi-district parks, which serve multiple neighbourhoods, being sited outside of a neighbourhood's boundary.



FINDINGS AND ACTIONS

- Areas with low green infrastructure distribution can be prioritized for Green Network expansion. Priority areas include neighbourhoods with low overall green space, areas with limited accessibility to natural areas, areas with low tree canopy cover, or areas with a strong urban heat island effect.
- Opportunities to expand the Green Network could include tree planting in informal green spaces, small-scale Low Impact Development installations, naturalized features, or urban agriculture.
- Given the variety of land owners and managers in the Green Network discussed in Governance, there are opportunities to incentivize landowners or other citizens to increase green infrastructure outside the existing Green Network.

Action 8: Expand the Green Network by creating new publicly available green space or increasing green infrastructure.

- 8.1: Identify green infrastructure opportunities outside the existing Green Network.
- ACTION 8.2: Secure key sites through purchase, donation, or partnership with other landowners, stakeholders, or citizen groups,
 - 8.3: Design and implement green infrastructure expansion in areas of interest.





Trails and Greenways

Current state

Approximately 18% of Saskatoon residents live beyond the 5-minute walk (roughly 400 meters) to a park or green space recommended by the World Health Organization³⁰. On Map 15, these areas are shown as walkability gaps. Trails and greenways are the main entry point of the public to the Green Network, and so are an important consideration in green infrastructure planning.

Inventory

Saskatoon's trails and greenways shown on Map 15 include: **Trail Network:** Network of trail and pathway systems that overlay the Green Network.

Greenways: Linkages that enhance connectivity of species or ecological processes between natural areas. The Greenway at the Northeast Swale serves as a trail system, ecological buffer between the Swale and surrounding neighbourhoods, and storm water management feature.

The Great Trail: the network of multi-use trails, formerly known as the Trans Canada Trail, that connects citizens across Canada.

Pathways: Infrastructure provided for active transportation such as walking and biking.

Pedestrian Priority Streets: integrated spaces that balance the needs of pedestrians, bicyclists, and low-speed motor vehicles.

Sidewalks: The city has approximately 1,200 kilometres of sidewalks.

Streetscaped Areas: Streets with enhanced level of amenities.

Green Bridge: A structure with park-like features located above a roadway that allows pedestrians, cyclists, or wildlife to cross without interacting with vehicles or the road.

Street Light Network: Publicly managed roadway and park lighting that allows safer movement of vehicles and pedestrians at night, reduces night time accidents, enhances a sense of personal security, and encourages night time use of lit areas.

Ecosystem Services

Public safety ~ Aesthetic values ~ Recreation ~ Community building and social relations ~ Destinations and tourism



³⁰ Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

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- While walking catchment is calculated based on average walking speed, lower mobility individuals may take longer to access park space. . When gaps in universal accessibility (e.g. lack of curb cuts) are considered, the percentage of citizens outside the walking catchment increases.
- Not all parks are universally accessible; some have major barriers, such as limited pedestrian crossings to access park space. .
- Major considerations for walkability include complete and connected sidewalks, safe crossings, and major destinations within walking distance of residential areas.
- Trails and greenways can be designed with nature-friendly features, such as wildlife crossings and pollinator strips.
- The City's Active Transportation Plan found that almost half of Saskatoon residents want to walk or cycle more often, both for commuting and recreation.
- The Green Network could become a major component of the City's active transportation network. Many existing paths and trails already ٠ traverse green spaces.
- Transportation and Construction (T&C) division has identified a need to find the overlap between the active transportation network, park trail systems, and Meewasin's trail network. Such work would require coordinated trail data collection and management, which in turn would allow the Green Network to become more connected.
- T&C works primarily within road right-of ways, and has limited jurisdiction of Green Network trails, which are largely managed by Parks or Meewasin. Increasing contiguity between the active transportation network and the Green Network would require collaboration between T&C, Parks, and Meewasin.
- When designing an active transportation network, multi-modal considerations are key. Many residents use a variety of transportation • modes, including transit, walking, and biking. Considering Green Network access is an important consideration in designing major routes.
- ٠ Additional priorities identified by stakeholders include connections between Bus Rapid Transit routes and the Green Network, increasing green infrastructure in significant connecting streets, and prioritizing parking spots for car sharing vehicles or electric vehicle charging stations near green space.

Action 9: Increase walkability and active transportation throughout the Green Network. **ACTION 9**

- 9.1: Identify and address accessibility and connectivity barriers to and within the Green Network.
- 9.2: Increase access to and within the Green Network, with an emphasis on walkability and multi-modal transportation.

ACTIVE TRANSPORTATION

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TRAILS AND GREENWAYS



Urban Forest

Current state

As of 2017, Saskatoon had an average canopy cover of 9%, with 12% in built-up areas. The urban forest canopy is distributed unevenly throughout the city, ranging from 2% to 39% across neighbourhoods³¹. Some variation is due to smaller trees in newer neighbourhoods, and some is due to limited planting sites or pest-related tree removal.

Inventory

The Urban Forest canopy represented on Map 16 includes: Afforestation Areas: Afforestation areas are discussed in more detail in the Ecology section.

Civic Facility Trees: Trees located on civic facility sites such as Leisure Centres, Cemeteries, Golf Courses, Libraries, and Fire Halls.

Fruiting/Orchard/Food Forest Trees: Trees that produce edible fruit or other food crops and are accessible to the public to harvest and support wildlife.

Park Trees: Trees located in City parks

Native Tree Stands: Natural stands of aspen and other species, and shelter belts that have been retained and incorporated into open spaces.

Riparian Forest: Trees in the South Saskatchewan River Valley or bordering wetlands.

Roadway Shelterbelt Trees: Trees planted along major roadways, such as Circle Drive and interchange greens.

School Ground Trees: Trees on school properties. Some may have been planted by the former Schools Plant Legacies in Trees (SPLIT) program.

Public Trees in Residential Areas: Trees in residential right-of-ways including median trees, boulevard trees adjacent to the curb, boulevard trees along the back-of-sidewalk, and trees in buffers.

Public Trees in Commercial Areas: Trees planted on public property in squares and plazas or in amenity strips of the right-of-way in Business Improvement Districts, industrial areas, and other commercial areas. These areas have a concentration of business offices, cultural venues, and pedestrian traffic.

Trees on Private Property: trees on residential, commercial, industrial or institutional property.

Ecosystem Services

Food and fiber ~ Wood and fuels ~ Genetic resources ~ Ornamental resources ~ Air quality maintenance ~ Carbon storage ~ Water regulation ~ Erosion control ~ Pollination ~ Storm protection ~ Spiritual and religious values ~ Inspiration ~ Aesthetic values ~ Sense of place ~ Heritage values ~ Destinations and tourism ~ Habitat provision ~ Biodiversity ~ Photosynthesis and primary production ~ Oxygen production ~ Soil formation and retention ~ Nutrient and water cycling

³¹ Diamond Head Consulting. (2019). Urban Forest Canopy Inventory and Assessment.

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- Trees are living assets that provide many social, environmental, and economic benefits. They provide shade, support wildlife habitat, regulate climate, mitigate storm water, and beautify our community. Quantifying these ecosystem services will help determine how best to manage the urban canopy.
- For example, the 2019 Urban Forest Canopy Inventory and Assessment identified that Saskatoon's urban forest provides almost \$1.5 million in annual carbon sequestration. This does not include additional substantive ecosystem services such as pollution removal, storm water management, and habitat provision³².
- Invasive pests and diseases, redevelopment in established areas, aging canopy, and increased heat and drought stress from climate change are threatening the urban forest. Street trees face difficult growing conditions, including compacted soil and salt load from nearby streets.
- Sustaining the existing canopy is just as important as expanding the canopy. There is a need to ensure that continued funding is available for establishment and maintenance, including irrigation and adequate pruning cycles.
- Because of significant energy reserves, it can take 5 to 7 years before large trees deteriorate from damage caused by nearby development. The City's *Trees on City Property Policy* only protects publicly managed trees within the Urban Forest inventory. It does not cover trees on private property or within natural areas, and is only enforceable when damage from development is immediately evident.
- Informal green spaces (e.g. right-of-ways) may provide an opportunity for naturalized tree plantings. There is general community interest in naturalized tree plantings and afforestation, but also concerns about vandalism and public safety.
- Where complete connectivity of the Green Network is not possible, trees can provide important stepping stone habitat for birds and pollinators.
- There are opportunities to expand the urban forest in informal green spaces. However, there are service level and funding gaps to parts of the non-inventoried urban forest including some civic facilities, the riparian forest, and existing afforestation areas. Partnerships and funding support could be strengthened to enhance the urban forest in these areas.
- Other municipalities are setting targets for their urban canopies. Edmonton and Calgary, which are in comparable ecoregions to Saskatoon, have set canopy goals of 20%.
- Several community groups, including the SOS Elms Coalition and Friends of the Saskatoon Afforestation Areas, are taking an active role in stewardship of the urban forest.

EXPANDING THE CANOPY

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³² Diamond Head Consulting. (2019). Urban Forest Canopy Inventory and Assessment.

Action 10: Protect and grow the urban forest.

ACTION 10

- 10.1: Ensure existing trees are protected, including through policy and bylaw updates.
- 10.2: Review and improve existing programs related to tree watering, maintenance, inventory, and planting techniques.
- 10.3: Continue to trial new tree species and increase biodiversity.
- 10.4: Design sustainable tree planting sites to ensure adequate soil volume, quality, and space for trees.
- 10.5: Develop community education and outreach programs to increase public awareness, stewardship, and partnerships.

Figure 20: City and Meewasin staff tour the Richard St Barbe Baker Afforestation Area in 2019.



Table 6: Summary of Open Space Actions

Open Space Actions	Phase*	Responsibility						
		Primary	Secondary	Partners				
Action 7: Renew formal and informal green space in the Green Network to meet citizen needs. Action 7 should take place in areas determined through the Parks prioritization process. The Pierre Radisson Park complex has been identified as one opportunity.								
7.1: Identify high priority formal and informal green spaces to upgrade or redevelop.	2	Parks	Sustainability	Meewasin				
7.2: Increase coordination within the City, and with the community, to encourage informal green space renewal.	2	Sustainability	Parks	Community groups				
7.3: Implement park upgrade plans starting in high priority areas.	3	Parks	RCD, Sustainability					
Action 8: Expand the Green Network by creating new publicly available green space or increasing green infrastructure. Action 8 should take place in areas with low green infrastructure distribution.								
8.1: Identify green infrastructure opportunities outside the existing Green Network.	3	- Sustainability	Community Services, Parks, Saskatoon Land, Saskatoon Water	Meewasin, other green space owners and managers				
8.2: Secure key sites through purchase, donation, or partnership with other land owners, stakeholders, or citizen groups.	3							
8.3: Design and implement green infrastructure expansion in areas of interest.	3							
Action 9: Increase walkability and active transportation throughout the Green Network. Action 9 should take place throughout the Green Network.								
9.1: Identify and address accessibility and connectivity barriers to and within the Green Network.	2	Transportation	Sustainability, Parks	Meewasin				
9.2: Increase access to and within the Green Network, with an emphasis on walkability and multi- modal transportation.	2							
Action 10: Protect and grow the urban forest. Action 10 should take place in priority areas as determined by the Urban Forest Management Plan.								
10.1: Ensure existing trees are protected, including through policy and bylaw updates.	1							
10.2: Review and improve existing programs related to tree watering, maintenance, inventory, and planting techniques.	1		Sustainability,					
10.3: Continue to trial new tree species and increase biodiversity.	3		P&D	Meewasin				
10.4: Design sustainable tree planting sites to ensure adequate soil volume, quality, and space for trees.	2	Parks						
10.5: Develop community education and outreach programs to increase public awareness, stewardship, and partnerships.	1		Sustainability	SOS Elms, Friends of the Afforestation Areas				
*Phases: proposed initiation of actions. 1: near term (within 2 years); 2: medium term (within 3 to 9 years); 3: long term (over 10 year).								



Ecology The Green Network conserves biodiversity, supports high quality habitat, and increases climate change resilience.

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ECOLOGY: INVENTORY, FINDINGS, AND ACTIONS

Nature provides ecosystem services that are more difficult and costly to replicate than to conserve. Although species and ecosystems are under increasing pressure from habitat fragmentation, invasive species, and climate change, carefully designed cities can become hubs for conservation and biodiversity. The *Green Infrastructure Strategy* is fundamentally an ecosystems-based approach to open space management, incorporating principles of connectivity and systems thinking into asset management. Managing for biodiversity through green infrastructure also has significant co-benefits, such as increased resilience to climate change, community access to nature, and unique, recognizable city environments.

What's discussed in this section?

Saskatoon's ecology inventory includes significant natural areas and naturalized parks that provide core areas of biodiversity and habitat. Enhanced or engineered assets such as greenways and nature friendly design support ecosystem function and increase connectivity between natural assets.

Ecology: the study of the relationship between life forms – including people – and the environment.

ECOLOGY INVENTORY:

- Significant natural areas
- Arable land
- Naturalized parks and features
- Nature friendly design
- Soil assets





Significant Natural Areas

Current state

Natural assets are the foundation of Saskatoon's ecology inventory, providing vital habitat and other ecosystem services to both people and wildlife. As shown in Figure 21, natural assets currently comprise 14% of the city's footprint and include aquatic, forest and shrubland, and grassland systems. Some natural assets were identified as significant natural areas by technical experts due to current or potential species diversity, habitat provision, or other ecosystem services. These sites support the over 500 distinct native and naturalized species documented within city limits, demonstrating the potential for urban environments to support biodiversity. However, this diversity is at risk from habitat fragmentation, climate change, and invasive species. Improving management of the City's significant natural areas, in partnership with external groups like Meewasin, will help create a vibrant city wherein all residents have access to nature.

Inventory

Significant natural areas shown on Map 18 include: Aquatic assets such as wetlands, the river, and riparian ecosystems

Grasslands such as the Northeast, Small, and West Swales, Saskatoon Natural Grasslands, and Kernen Prairie

Forest and shrublands such as Richard St Barbe Baker and George Genereux Afforestation Areas, sites planted in the 1970s which have since naturalized

Food and fiber ~ Wood and fuels ~ Genetic resources ~ Biochemicals, medicines ~ Fresh water ~ Air quality maintenance ~ Climate regulation ~ Carbon storage ~ Water regulation ~ Erosion control ~ Biological control ~ Pollination ~ Storm protection ~ Spiritual and religious values ~ Educational values ~ Inspiration ~ Aesthetic values ~ Community building and social relations ~ Sense of place ~ Heritage values ~ Destinations and tourism ~ Habitat provision ~ Biodiversity ~ Photosynthesis and primary production ~ Oxygen production ~ Soil formation and retention ~ Nutrient and water cycling

Figure 21: City of Saskatoon natural assets as a proportion of the city footprint.³³



Ecosystem Services

³³ Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

- Maintaining an inventory of natural assets and monitoring ecosystem health will improve long term, consistent decision making regarding these assets. Meewasin has created an inventory of known natural assets for the City but upkeep of the inventory has not been resourced. Understanding what and where our natural assets are will allow us to make more effective management decisions. Further work is also needed to identify an appropriate service level to fund and maintain natural assets.
- The City needs to improve processes for inventorying and assessing natural assets within green spaces undergoing redevelopment to better understand impacts from those redevelopments.
- Archaeological and paleontological artifacts have been found in and around some natural areas. These should be included in natural area inventories.
- Natural area screenings are conducted during the development process, but review and vetting of results could be enhanced. Screenings
 are often limited to a specific season within development boundaries without fully considering ecological structure or processes. Natural
 area screenings need to be informed by breadth of knowledge to adequately protect areas and produce high quality green spaces.
 Broadening the criteria for natural area screenings creates an opportunity to gain knowledge from community partners and develop a
 comprehensive screening strategy.
 - Most natural assets in Saskatoon have no protective land designation, no official boundary, and no sustained management funding. These are barriers to conserving natural assets.
- Other municipalities are protecting their significant natural areas. For example, *Calgary's Biodiversity Policy* includes a commitment to "Retain, acquire and maintain large contiguous or connected natural areas, with supportive built environments, providing connections with the greater region".
- There is an international movement to protect significant natural areas. The federal government has set a target to protect 17% of Canada's
 natural areas by the end of 2020. There is an opportunity for the City to align with this target locally and coordinate with partners such as
 Meewasin. Other international initiatives such as Cities With Nature and Nature Need Half could provide Saskatoon with best practice and
 policy support for such measures if adopted.
- The City has not yet set targets for green infrastructure or biodiversity. Setting and monitoring targets can help direct and prioritize work, show progress over time, and lead to deliberate actions and rational budgeting. The adoption of a *Biodiversity Action Plan*, like those adopted by other cities, would help identify targets.
- Through the *Planning and Development Act, 2007*, an approving authority (i.e. a City or Rural Municipality) can require the dedication of
 ecologically sensitive lands as Environmental Reserve (ER). ER is intended to conserve natural areas but has not yet been used by the City
 of Saskatoon.
- Tools such as Meewasin's Conservation Zone, Federal Protected Area Status, land ownership, and Conservation Easements are also available for the long-term protection of significant natural areas. Meewasin's Conservation Zone may already fulfill some requirements for IUCN Protected Area Status.
- Wanuskewin has started work on native habitat restoration for bison reintroduction. They are considering applying for status as an Indigenous Protected and Conserved Area.

IDENTIFYING NATURAL ASSETS

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I G N I F I C A N T

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- 14% of Saskatoon's footprint is comprised of natural and naturalized assets. The City has drafted *Natural Area Standards* to help incorporate natural assets into development while conserving ecosystem function. However, resourcing to implement the *Standards* has not been identified.
- Tools to support land use decisions about natural assets are under development. For example, when a natural asset is added to the City's inventory, land use decisions inform whether the natural asset should be avoided or developed. When natural areas are to be avoided or partially avoided, impacts from surrounding development should be minimized.
- The City should set criteria for assessing the value of natural assets and similarly for compensating for their loss if developed. Understanding the ecosystem services they provide will inform decision making about land use.
- The Natural Capital Asset Valuation framework, currently in development, will better define the value of ecosystem services. Building knowledge about the value of these assets helps make the Green Network a tangible entity that can be considered in the same way as other assets.
- Some natural assets, such as the Northeast Swale, are being actively managed, while others are not. Meewasin has identified resource management strategies for many natural areas through its *Valley-Wide Resource Management Plan*, although implementation of the plan is not fully funded. Development and implementation of site-specific management plans would improve ecosystem function.
- There are many benefits to appropriate management of natural assets, including increased resilience to climate change, carbon sequestration, improved water quality, and reduced risk of flooding. Natural assets are unique and require a level of site-specific management. Site-specific management plans have been completed for some, but not all, natural areas.
- There is an opportunity to expand management tools to account for site-specific sensitivities, such as light, noise, and local soil
 composition. This information would enable the City to more accurately identify acceptable levels of disturbance and how best to mitigate
 these. Such proactive measures are key to maintaining resilient ecosystems.
- Incompatible uses that inhibit ecosystem function and reduce ecological integrity have degraded some natural areas. Site-specific
 protection would help reduce incompatible uses.

Action 11: Protect, restore, and manage significant natural areas.

INTEGRATING AND VALUATING NATURAL ASSETS

SITE-SPECIFIC MANAGEMENT

ACTION 11

- 11.1: Identify natural areas and make management decisions for these sites regarding avoidance, minimization, or compensation.
- 11.2: Protect significant natural areas using a variety of available protection tools.
- 11.3: Integrate natural assets into the urban fabric while conserving ecosystem function.
- 11.4: Develop and implement site-specific management plans, including restoration of natural areas when required.

Map 19: Arable Land Arable Land Formal Green Space

Arable Land

Current state

ARABLE LAND

ACTION 11

Arable Land is generally non-public land used for food production on a larger scale than other urban agriculture. It provides a wide variety of ecosystem services beyond food production. Arable land currently comprises 23% of the city's footprint, although much of this land is within Sector Plans and identified for future development. The *Natural Areas Inventory* found that arable land is the largest contiguous undeveloped landscape in the city.

Inventory

Map 19 shows the current footprint of arable land within city boundaries.

Ecosystem Services

Food and fiber ~ Wood and fuels ~ Genetic resources ~ Biochemicals, medicines ~ Climate regulation ~ Carbon storage ~ Water regulation ~ Erosion control ~ Water purification and waste treatment ~ Biological control ~ Pollination ~ Habitat provision ~ Photosynthesis and primary production ~ Oxygen production ~ Soil formation and retention ~ Nutrient and water cycling

FINDINGS AND ACTIONS

- The University of Saskatchewan is one of the largest owners of arable land in the city. Of these lands, the University has identified some that will be maintained for agricultural research, and some that are intended for future urban development. The lands intended for future urban development have also been identified as strategic infill sites in the City's *Plan for Growth* and *Official Community Plan*, *Bylaw 8769*.
- Stakeholders have expressed interest in retaining arable land within the city when possible. But land use decisions must consider the City's *Plan for Growth* and the desire to maintain a contiguous and compact urban form. Supporting development within strategic infill areas can help preserve arable land while allowing city growth to continue. As development proceeds, strategies to maintain connections among natural areas to maintain ecosystem services should be considered.

Action 11: Protect, restore, and manage significant natural areas.

11.5: In partnership with landowners, direct development in a way that helps retain and protect high quality arable land connecting to the regional agricultural network.

Figure 22: Hyde Park was developed in collaboration with the City, Ducks Unlimited, and the community. It represents much of the prairie landscape including wetlands and riparian areas, wildflower beds, native prairie grasses, and many bird species. It also includes interpretive signage and storm ponds that receive storm water from the surrounding neighbourhoods.

Naturalized Parks and Features

Current state

Naturalized parks currently make up about 15 percent of Saskatoon's total parks. These sites contribute to biodiversity and connectivity in the larger Green Network. For example, naturalized features in built-up areas create stepping stone habitat between larger natural areas.

Inventory

Naturalized Parks: In recent decades the City has created or is managing over a dozen Naturalized Parks and natural areas. These are biodiverse spaces featuring drought-resistant native plants, and requiring less maintenance, mowing, irrigation, and no fertilizer. These parks represent multiple ecosystems, such as native prairie, wetlands, and aspen parkland. As shown on Figure 23, these sites contribute to biodiversity.

Figure 23: Top 10 Saskatoon Nature Watching Sites (total number of observations)³⁴.



Naturalized Features: Smaller natural features, such as native tree stands or wildflower plantings, may be found throughout the Green Network, not necessarily in designated natural areas. These are spaces with natural assets either retained during development or planted afterwards. Such features can support the ecological function of natural landscapes.

Greenways: Linkages that enhance connectivity of species or ecological processes between natural areas. Linkages can be natural, such as the riparian zone around the river, or semi-natural, such as the greenway adjacent to the Northeast Swale.

Ecosystem Services

Food and fiber ~ Genetic resources ~ Fresh water ~ Air quality maintenance ~ Climate regulation ~ Erosion control ~ Water purification and waste treatment ~ Biological control ~ Pollination ~ Storm protection ~ Educational values ~ Inspiration ~ Aesthetic values ~ Community building and social relations ~ Sense of place ~ Heritage values ~ Destinations and tourism ~ Habitat provision ~ Biodiversity ~ Photosynthesis and primary production ~ Oxygen Production ~ Soil Formation and retention ~ Nutrient and water cycling



- Naturalization or restoration of existing underused and un-programmed green spaces, particularly informal green spaces, would enhance ecosystem services, improve long-term maintenance, and increase connectivity without removing land from other uses. Informal green spaces such as utility corridors, easements, and green bridges can support biodiversity by increasing connectivity or incorporating natural features.
- The Naturalized Park team's mandate could be expanded to include more restoration projects. Even on smaller scales naturalization can increase ecosystem services. Expanding the Naturalized Parks program would allow the City to naturalize more areas and provide community outreach.
- Increasing naturalization projects would require a corresponding increase in native plant production. There is an opportunity to increase native plant production at the City and to partner with Meewasin, since they are already producing native plants.
- While some engagement participants were supportive of park naturalization and natural areas, others voiced concerns about the potential spread of nuisance species. Expanding public education about naturalization and increasing management of naturalized areas could address such concerns.
- Saskatoon Airport Zoning Regulations restrict open water storage within their 4,000 metre buffer. This needs to be considered in any naturalization work falling within that buffer.
- Ecosystem health is improved through greater connectivity between natural ares. Connecting the Green Network, even in built-up areas, will improve ecological outcomes.
- Some natural areas are fragmented from the Green Network. Fragmentation hinders movement between habitat patches, impacting ecosystem health and species richness. Fragmented ecosystems support smaller and fewer populations than connected ecosystems and are more susceptible to invasive species. Not all natural areas are owned by the City, impeding the potential for network connectivity.
- The Natural Areas Inventory included an analysis of Green Network connectivity, and found that connections between natural areas could be improved by including enhanced assets such as parks. The Inventory will help inform priority areas to improve the network's connectivity. As shown earlier on Figure 6, network connectivity can be improved by increasing the contiguity, proximity, or size of naturalized features.
- Current planning is connecting green spaces within new neighbourhoods better than ever before. Improving connections between neighbourhoods and established areas, as well as to the region, would further increase species movement between open spaces. This, in turn, would increase habitat, support larger populations, and maintain biodiversity and species richness.
- The Saskatoon North Partnership for Growth (P4G) Regional Land Use Map includes a *Green Network Study Area*. Connecting to the regional network would significantly decrease fragmentation of natural areas.
- As Saskatoon expands, future growth will encroach on natural areas, thereby impacting ecosystem services and increasing fragmentation. Growth beyond Meewasin's Conservation Zone leaves natural areas outside their jurisdiction more vulnerable.

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Action 12: Connect and naturalize the Green Network in built-up areas.

ACTION 12

- 12.1: Naturalize parks, storm water infrastructure, and other open space where appropriate.
- 12.2: Purchase or acquire land in strategic areas to enhance biodiversity outcomes and increase connectivity.
- 12.3: Increase the City's use of native species in restoration and naturalization work.

12.4: Coordinate with regional partners to connect the City's Green Network to the Regional Green Network whenever possible.





Figure 24: The Evergreen Pedestrian Bridge is an important sustainability feature in Evergreen, promoting an interconnected community. The bridge was inspired by the Banff National Park wildlife crossings and features white markers on its transparent safety panels that reduce the risk of bird collisions. The Pedestrian Bridge demonstrates how engineered infrastructure can incorporate nature friendly design for the benefit of people and wildlife.

Nature Friendly Design

Current state

There are many stressors on natural assets including light, noise, invasive species, and pollutants³⁵. These stressors create cumulative impacts to natural areas, but also impact people. For example, noise stress has recently been identified as a risk factor for heart disease. Nature friendly design refers to engineered assets that support ecosystem function by reducing these stressors or increasing connectivity within the network.

Inventory

The City does not currently have a comprehensive inventory of nature friendly design, although several divisions have been working to incorporate these features into their work.

Examples of nature friendly design found in Saskatoon include:

Green bridge: A structure with park-like features located above a roadway, railway, or other obstacle that allows pedestrians, cyclists, or wildlife to cross without interacting with vehicles or the road. Green bridges can incorporate naturalized or wildlife friendly features, such as the bird friendly design at Evergreen Pedestrian Bridge (see Figure 24).

Wildlife friendly design: Engineered assets such as tall buildings and roadways can support or impede wildlife movement in the city. For example, bird friendly glass can significantly reduce the risk of bird collisions with buildings; wildlife crossings on strategic roadways such as the North Commuter Parkway can reduce traffic collisions with wildlife; wildlife friendly fencing can aid wildlife movement throughout the Network. **Street light network:** Publicly managed roadway and park lighting that allows for safer movement of vehicles and pedestrians at night. Street lights can be designed to be wildlife and dark-sky friendly. For example, almost a quarter of the City's light fixtures are full cut off, meaning they do not emit light above the horizon.

Forebay: An engineered settling pond built adjacent to an aquatic asset (e.g. wetland or river) to reduce runoff and contaminants entering the waterbody.

Green roof: A planted feature on flat-roofed buildings designed to reduce air conditioning needs and storm water runoff. Incorporating native species into green roofs can provide important stepping stone habitat for native pollinators. Green roofs are also an example of Low Impact Development, and can provide co-benefits to our storm water infrastructure.

Ecosystem Services

Air quality maintenance ~ Climate regulation ~ Erosion control ~ Water purification and waste treatment ~ Storm protection Aesthetic Values ~ Community building and social relations ~ Destinations and tourism ~ Habitat provision

³⁵ Meewasin. (2017). Meewasin Valley-wide Resource Management Plan.

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- Light and noise are significant stressors to natural areas and wildlife. Public feedback has also indicated that some areas of the city are over illuminated or too noisy for residents. Addressing these stressors through thoughtful design, wildlife or dark sky friendly lighting, and low noise zones while considering public safety could reduce stress to both people and ecosystems.
- Other municipalities are adopting wildlife and bird friendly standards into development processes as a best practice. Engagement participants expressed support for further exploration of dark sky and low noise zones as well as development of bird friendly standards.
- Existing nature friendly design such as wildlife crossings have not yet been inventoried or mapped. This has been identified as a gap in the inventory because they might have important ecological and community considerations.
- In partnership with the Urban Wildlife Information Network, a long-term monitoring project is being set up in Saskatoon to identify wildlife habitat and movement corridors. This work could inform priority areas for nature friendly design.
- Natural assets are at risk from point and non-point source pollution such as storm water runoff. Saskatoon Water conducts water quality
 testing of outfalls discharging storm water into the South Saskatchewan River. Water quality results are reported to the Water Security
 Agency. In partnership with the University of Saskatchewan, an initiative is underway to better characterize storm water and evaluate
 monitoring needs. Further work is needed to track the source of pollutants and minimize its impacts.
- Ongoing monitoring is important to understanding ecosystem health. Meewasin's *Valley-wide Monitoring Framework* will track ecosystem health, biodiversity, and function. The City can feed this data into performance measures to enable ongoing refinement and measure progress of *Green Infrastructure Strategy* initiatives.
- Continuous monitoring would also inform natural asset management. Meewasin's *Valley-wide Resource Management Plan* identifies strategies to manage natural assets within the river valley and reduce ecosystem stressors.
- Soil assets are an important consideration in Green Network planning, underpinning almost all aspects of the Green Network, and providing many ecosystem services. For example:
 - Low weight growing mediums that absorb water and nutrients are an important factor in the success of green roof plantings.
 - Soil nutrient levels in natural areas can hasten or slow the spread of invasive species.
 - Different soil types have different permeability, which can influence the effectiveness of Low Impact Development.
 - City staff have noted that parks with good quality soil have decreased irrigation and fertilization needs. Similar results have been noted by University staff using compost in their green spaces.
- Almost 60% of Soil Organic Matter (SOM) is carbon. Some soils have a strong potential for carbon sequestration, with subsequent benefits for climate adaptation. The University of Saskatchewan is researching soil carbon sequestration and could be a partner in future work.
- Healthier soil supports a more resilient soil food web, which can in turn support more resilient vegetation.
- Managing soil assets across the City will in turn support all other green infrastructure work.

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MONITORING AND IMPROVING ECOLOGICAL HEALTH

SOIL MANAGEMENT

- The City supports soil building at the two compost depots, and by supporting the Saskatchewan Waste Reduction Council's Compost Coaches.
- The City's Contractor Environmental Guidelines and the Natural Area Standards recommend best practices for soil handling. The Corporate Climate Adaptation Strategy identified the need to increase soil and mulch in planted areas to improve storm water retention and plant viability. These best practices still need to be operationalized.

Action 13: Improve biodiversity and ecosystem health throughout the Green Network.

- 13.1: Develop dark sky and low noise zones, prioritizing sites to reduce ecological stress.
- 13.2: Develop and integrate wildlife friendly standards into development, including bird friendly standards in highly built-up areas.
- 13.3: Reduce point and non-point source pollution to natural assets.
- 13.4: Establish ongoing biodiversity monitoring and reporting with partners.
- 13.5: Improve management of the City's soil assets.

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SOIL MANAGEMENT

ACTION 13

Figure 25: The City's two Compost Depots support soil management by keeping yard waste out of the Landfill, and producing a high quality product that keeps Saskatoon parks and community gardens healthy and beautiful.



Table 7: Summary of Ecology Actions

Ecology Actions	Phase*	Responsibility						
		Primary	Secondary	Partners				
Action 11: Protect, restore, and manage significant natural areas. Action 11 should take place in significant natural areas identified in the <i>Natural Areas Inventory</i> .								
11.1: Identify natural areas and make management decisions for these sites regarding avoidance, minimization, or compensation.	2	Sustainability, P&D		U of S, Meewasin				
11.2: Protect significant natural areas using a variety of available protection tools.	1			Meewasin, DUC				
11.3: Integrate natural assets into the urban fabric while conserving ecosystem function.	3	Sustainability	P&D, Saskatoon Water					
11.4: Develop and implement site-specific management plans, including restoration of natural areas when required.	1		Parks					
11.5: In partnership with landowners, direct development in a way that helps retain and protect high quality arable land connecting to the regional agricultural network.	3		P&D, Saskatoon Land	U of S, P4G, Meewasin				
Action 12: Connect and naturalize the Green Network in built-up areas. Action 12 should take place where Network connectivity gaps are identified in the Natural Areas Inventory and in green spaces identified by the Parks Naturalization program.								
12.1: Naturalize parks, storm water infrastructure, and other open space where appropriate.	2	Sustainability, Parks	Saskatoon Water					
12.2: Purchase or acquire land in strategic areas to enhance biodiversity outcomes and increase connectivity.	3	Sustainability, P&D	Saskatoon Land	Meewasin				
12.3: Increase the City's use of native species in restoration and naturalization work.	3	Parks, Sustainability						
12.4: Coordinate with regional partners to connect the City's Green Network to the Regional Green Network whenever possible.	3	Sustainability, P&D	Saskatoon Water	P4G				
Action 13: Improve biodiversity and ecosystem health throughout the Green Network. Action 13 should take place throughout the Green Network. Wildlife friendly retrofits should be prioritized adjacent to natural areas.								
13.1: Develop dark sky and low noise zones, prioritizing sites to reduce ecological stress.	2	Sustainability Parks, Sustainability	P&D, SL&P	Meewasin				
13.2: Develop and integrate wildlife friendly standards into development, including bird friendly standards in highly built-up areas.	1		P&D, C&D, Transportation, Parks, Facilities	BIRDS, Meewasin				
13.3: Reduce point and non-point source pollution to natural assets.	2		Saskatoon Water	Meewasin, PFSRB				
13.4: Establish ongoing biodiversity monitoring and reporting with partners.	1		- Parks -	Meewasin, U of S, UWIN				
13.5: Improve management of the City's soil assets.	2			U of S				
*Phases: proposed initiation of actions. 1: near term (within 2 years); 2: medium term (within 3 to 9 years); 3: long term (over 10 year).								



Storm Water More rain is managed where it falls. Storm water is recognized as an important resource.

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STORM WATER: INVENTORY, FINDINGS, AND ACTIONS

The South Saskatchewan River is a defining feature of Saskatoon, providing recreation opportunities, a central corridor for wildlife, and a sense of community. Surrounding wetlands that feed into the river, such as those found in the Northeast Swale, provide important ecosystem services including habitat and water quality improvements. Aquatic assets are the foundation of our municipal water infrastructure, which provides clean drinking water to the entire city and surrounding areas, removes our snow melt, and redirects rain water runoff. Understanding how aquatic assets interact with the City's grey infrastructure is integral to improving Green Network management.

What's discussed in this section?

The aquatic assets including our river and wetlands that support the storm water system, the grey storm water assets they interface with, and opportunities for Low Impact Development such as green roofs and bioswales.

STORM WATER INVENTORY:

- Aquatic assets
- Low Impact Development
- Grey storm water assets



Map 21: Aquatic Assets Aquatic Assets Dry Storm Water Pond 5 Wet Storm Water Pond 2 ٢
102

Aquatic Assets

Current state

The South Saskatchewan River, from the Cree word kisiskāciwanisīpiy, meaning "swift flowing river", is part of a larger watershed that includes at least 1,200 hectares of wetlands within city limits alone³⁶.

Inventory

Aquatic assets shown on Map 21 include:

South Saskatchewan River: the community's main source of drinking water, habitat, and recreation.

Wetlands: Saskatoon's wetlands can be naturally occurring, naturalized, or constructed. These aquatic assets are an important component of both our natural ecosystems and engineered green infrastructure.

Storm Ponds: There are 29 wet storm ponds in Saskatoon, which provide retention and treatment of storm water runoff. An additional 8 dry ponds are designed to manage storm water prior to its release into the storm water system to minimize the risk of flooding.

Ecosystem Services

Fresh Water ~ Climate regulation ~ Carbon storage ~ Water regulation ~ Erosion control ~ Water purification and waste treatment ~ Storm protection ~ Educational values ~ Aesthetic values ~ Sense of place ~ Destinations and tourism ~ Habitat provision ~ Nutrient and water cycling **Figure 26:** Many of the City's storm water ponds are used for recreational purposes. Activities such as skating, broomball and hockey are permitted during the winter; non-motorized boating (i.e. paddle boats, canoes) is permitted during the summer. All users of the ponds do so at their own risk..





³⁶ Meewasin. (2019). Natural Areas Inventory for the City of Saskatoon.

- Natural waterbodies and drainage paths are well suited to absorb, store, and filter storm water. Incorporating these features into greenfield and brownfield development areas would allow water to be treated near its source, be used as a resource, and provide recreation opportunities. The *Storm Water Master Plan* identifies integrating existing wetlands and drainage courses into development as an effective and preferred course of action.
- The draft Natural Area Standards recommend minimizing impacts to natural features, such as wetlands, whenever possible.
- The Saskatoon North Partnership for Growth (P4G) is refining maps for a regional Green Network, starting with the area north of the city. This work includes flood mapping, wetlands classification, and identification of areas requiring further analysis.
- Climate change is impacting Saskatoon's precipitation trends. Green infrastructure can enhance and support the storm water system to
 manage these changing risk levels. For example, healthy soils and vegetation can act like a sponge, soaking up rainwater where it falls,
 and reducing the runoff that reaches the storm system. The integration of green infrastructure with the city's grey infrastructure will help
 make the city more resilient in changing climate conditions.
- Storm water is often released into the environment without pollution management. As water runs over urban surfaces, it picks up bacteria, heavy metals, nutrients, and particulates. Green infrastructure imitates nature to improve runoff quality. For example, swales and overland drainage structures filter and improve the quality of water entering the river and storm ponds. Vegetation on slopes can help minimize slope instability and decrease sedimentation into the river.
- While green infrastructure can cost more than grey infrastructure, it provides additional environmental and social benefits that grey infrastructure does not. For example, well managed green infrastructure tends to increase in value over time, while grey infrastructure tends to depreciate. Green infrastructure can also simultaneously provide municipal services such as storm water management, and ecosystem services such as habitat provision.
- The West Swale is interrupted by major highways and railway tracks, and connectivity of the drainage path between the West Swale and Chappell Marsh is obstructed. This has potential ecological impacts on the nearby Chappell Marsh Conservation Area. Potential contamination of surrounding ecosystems from nearby land uses may also be a factor. Green infrastructure solutions should be considered when planning in this area.
- WETLAND POLICY

INTEGRATED STORM WATER MANAGEMENT

- Natural area screenings and the Natural Areas Inventory have identified over 1,200 hectares of wetlands within city limits, some of
 which could be used for storm water management. This work aligns with the City's Wetland Policy, which states that significant wetland
 resources should be conserved.
- The Wetland Policy was adopted in 2013 to guide land use and development decisions related to the avoidance, minimization, or compensation of wetlands and riparian areas. The impact of the policy on land use is only starting to be evident. Evaluation of the Policy's impact and subsequent updates should continue.

Saskatoon is part of the prairie pothole region, and over 1,100 discrete wetlands have been identified within current city limits. Current flood prone areas (see Figure 27a) in the City were often historically part of large wetland complexes (see Figure 27b). Without considering local hydrology and other environmental factors in future developments, we risk creating similar problems.

Figure 27a: Red circles represent current flood prone areas. The larger orange circle represents historic wetland complex³⁷.



Figure 27b: Historic air photo showing wetland complex.



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³⁷ City of Saskatoon. (2019). Flood Protection Plan.

- Naturalized storm ponds are effective at improving water quality, while providing habitat and other ecosystem services. Due to the availability of water and nutrients, storm pond shorelines attract cattails and other semi-aquatic species. Where ponds have not been designed with planted shorelines, ongoing removal is required to maintain the non-vegetated edge.
- Naturalizing more storm pond shorelines could reduce the need for ongoing cattail removal maintenance. Naturalization work could be completed in partnership with Meewasin or Ducks Unlimited Canada, who have expertise in this area. Consequences of volume reduction for storm water storage should be considered for these types of restoration projects; a storm model can help with the analysis.
- Community feedback indicates mixed support for storm pond naturalization. Residents value the recreational opportunities provided by storm ponds, but sometimes these are no longer possible once a pond has been naturalized. Community feedback will be an important consideration in any evaluation of naturalizing existing storm ponds.
- Public safety is an important consideration in storm pond naturalization. Design of these features should include a thorough safety analysis.
- The South Saskatchewan Watershed extends past city boundaries. It is important to consider a regional approach to watershed management, including engagement with stakeholders such as Ducks Unlimited Canada and watershed authorities.
- Opimihaw Creek, which flows through Wanuskewin Heritage Park, contains important archaeological artifacts and is culturally significant. Maintenance of the current creek water levels needs to be considered in surrounding watershed management to ensure these artifacts are preserved.

Action 14: Integrate natural waterbodies and drainage courses into development using green infrastructure.

- 14.1: As the city expands, incorporate wetlands and natural drainage paths into the storm water network in greenfield development areas.
- 14.2: Identify how green infrastructure can increase the storm system's capacity to respond to intense rain events.
- 14.3: Evaluate opportunities to increase naturalization of existing storm ponds to improve water quality and habitat, while balancing community recreation and other uses.
- 14.4: Consult with affected organizations when designing storm water infrastructure to mitigate impacts to natural areas and cultural elements within the watershed.

NATURALIZATION

REGIONAL WATERSHED PLANNING

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ACTION 14





Low Impact Development

Current state

Low Impact Development (LID) is a design approach that manages storm water runoff by mimicking natural processes to increase the water's infiltration or evapotranspiration. The City has developed *Low Impact Development Design Guidelines* to support LID installations, but uptake has been relatively low.

Inventory

There is no comprehensive inventory of LID in Saskatoon. Known LID installations shown on Map 22 include:

Bioswales: Landscape elements designed to concentrate or remove silt and pollution from surface runoff water. A swaled drainage course has gently sloped sides (less than 6%) and is filled with vegetation, compost, or riprap.

Ditches: Narrow channels in the ground, typically used for drainage beside a road or field.

Drainage Swales: Graded, vegetated, and shallow channels built to move storm water. Swales are a low cost, low maintenance option for removing sediments, nutrients and pollutants. They can replace storm sewer pipes in some cases.

Green Roofs: A planted feature on flat-roofed buildings designed to absorb rainfall. Incorporating native species into green roofs can provide important stepping stone habitat for native pollinators.

Rain Gardens: A garden bed that slows down and temporarily holds storm water runoff from roofs, driveways, or lawns (see Figure 28). The City's *Rain Garden How-To Guide* has detailed instructions for homeowners to build their own.

Ecosystem Services

Climate regulation ~ Carbon storage ~ Water purification and waste treatment ~ Pollination ~ Storm protection ~ Educational values ~ Aesthetic values ~ Sense of place ~ Destinations and tourism ~ Habitat provision ~ Nutrient and water cycling

Figure 28: An example of a downtown Saskatoon rain garden.



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- As shown on Map 22, significant portions of built-up areas have hard surfaces, calculated as the average amount of hard surface by land use. Some land use zoning averages more than 70% hard surface. These areas are prone to increased storm water runoff, the urban heat island effect, and reduced infiltration. Research indicates increasing green infrastructure and soil volumes in these spaces can reduce runoff and have a tangible cooling effect on the surrounding air temperatures.
- Storm water management for strategic infill and redevelopment relies on delayed release of storm water through onsite storage to ensure flows do not exceed storm sewer capacities. Source control of storm water runoff through Low Impact Development can improve storm water quality and reduce the risk of localized flooding.
- Some larger multi-modal areas such as BRT corridors and Downtown have been identified as opportunities for green infrastructure to align with other corporate priorities (e.g. *City Centre Plan*). Introducing Low Impact Development to these areas is both a best practice and a way to connect people to greenery on their daily commutes.
- Current LID installations are not comprehensively inventoried or mapped. Many LID installations are pilot projects implemented ad hoc by numerous work groups. Without post-construction evaluation, data sharing, or knowledge transfer, our understanding of the possibilities is incomplete. Additionally the impact, if any, of infiltration into ground water and other quality monitoring is not documented.
- The Mine Overlay Site Testing (MOST) facility at the University of Saskatchewan is piloting best practices for green roofs and other green infrastructure in cold climates. Other municipalities in Canada have also gained experience with LID. The City has an opportunity to partner to increase uptake of green storm water infrastructure.
- Intense rain events have caused flooding in some of the City's older developed areas. The *Flood Protection Plan* addresses ways to reduce these risks such as constructing dry storm ponds in existing parks.
- Low Impact Development (LID) Guidelines were written as a first step to encourage resilient site design. The guidelines incorporate current, innovative design solutions that mimic naturalized water balances and restore processes often lost in an urban environment.
- The City has an opportunity to encourage integrated storm water management though the *LID Guidelines*. Benefits would include empowering the City to lead by example, improving internal coordination, facilitating shared learning with the community, and building resilient storm water infrastructure for both every day and extreme events.
- However, guidelines, unlike standards, are not mandatory or enforceable. Other policies and bylaws, such as the Zoning Bylaw and High Performance Building Policy, could potentially be updated to reduce regulatory barriers and promote LID or onsite storm water management.
- Current policy requires developers to manage storm water onsite so that development does not negatively impact the storm system's capacity. LID is an option for onsite storage. Downtown is an exception to onsite storage through the Streamlining Downtown Development initiative.
- The new Storm Water Utility Credit provides incentives for multi-residential and commercial properties to retain more storm water onsite, such as through green infrastructure installations.

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- Current regulations limit some uses of raw and grey water, such as for landscape irrigation. However, there are options for raw water use that would reduce the demand on potable water without comprising human health and safety. The City is exploring the use of raw water while continuing to safeguard human health protections and considering best practices in other jurisdictions.
- Strategic water reuse could reduce the amount of water drawn from the river as well as the amount of waste water discharged back to the river.

Action 15: Increase the use of Low Impact Development.

- 15.1: Incorporate Low Impact Development pilots into City projects to show leadership, prioritizing high-pedestrian areas such as BRT corridors and Downtown.
- 15.2: Continue partnering with research institutions and conservation agencies to determine best practices for Low Impact Development.
- 15.3: Update bylaws and regulations to allow more permeable surfaces.
- 15.4: Encourage commercial, institutional, and residential installation of Low Impact Development and onsite storm water management through education and incentives.
- 15.5: Pilot raw water use projects.

RAW WATER

15

ACTION



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Grey Storm Water Assets

Current state

Grey storm water assets are the engineered system of pipes, drains, ditches, and detention ponds designed to manage storm water runoff, particularly peak flow. Storm water runoff includes rainwater and snowmelt that flows across the land and enters the grey storm water system. Grey storm water assets are an important consideration in green infrastructure planning because of the interface they can have with green infrastructure. For example, preliminary data indicates the forebay at the Northeast Swale is reducing contaminant loading to the surrounding wetlands.

Inventory

As shown on Map 23, grey storm water assets that interface with green infrastructure include:

- 8 dry ponds
- 29 wet ponds, 9 of which are naturalized
- 12 km of culverts
- 114 outfalls

Some storm water assets exist on a spectrum between grey and green infrastructure. For example, storm ponds can sometimes be naturalized to provide stronger ecosystem services.

Ecosystem Services

Fresh water ~ Storm protection ~ Recreation

Figure 29: Design Storm is the standard that defines the amount of rainfall runoff that storm system components are designed to manage. Most ponds hold the 1-in-100-year storm, which was modelled using a storm recorded on June 24, 1983, during which 96.5 mm of rain fell over 7 hours. The underground storm sewer is designed for the 1-in-2 year storm.

Intensity-Duration-Frequency (IDF) Curves

University of Saskatchewan and Saskatoon Airport

1926 to 1986 (61 years)



Table 8: Summary of Storm Water Actions

Storm Water Actions	Phase*	Responsibility			
		Primary	Secondary	Partners	
Action 14: Integrate natural waterbodies and drainage courses into development using green infrastructure. Action 14 should take place in wetlands and drainage courses that will serve future growth areas. More areas will be identified and added to the inventory as new information comes available. Storm ponds with non-vegetated shoreline should also be considered.					
14.1: As the city expands, incorporate wetlands and natural drainage paths into the storm water network in greenfield development areas.	3	P&D, Saskatoon Water	Sustainability	Meewasin	
14.2: Identify how green infrastructure can increase the storm system's capacity to respond to intense rain events.	3	Saskatoon Water, Sustainability		U of S	
14.3: Evaluate opportunities to increase naturalization of existing storm ponds to improve water quality and habitat, while balancing community recreation and other considerations.	3	Saskatoon	Sustainability, Parks	Meewasin, DUC	
14.4: Consult with affected organizations when designing storm water infrastructure to mitigate impacts to natural areas and cultural elements within the watershed.	3	vvater	Sustainability	Meewasin, many	
Action 15: Increase the use of Low Impact Development. Action 15 should take place in areas with high percentage of hard surface; areas along key corridors, downtown, and strategic infill areas; and flood prone areas.					
15.1: Incorporate Low Impact Development pilots into City projects to show leadership, prioritizing high-pedestrian areas such as BRT corridors and Downtown.	2	Sustainability,	P&D	U of S	
15.2: Continue partnering with research institutions and conservation agencies to determine best practices for Low Impact Development.	2	Saskatoon Water	Parks	U of S, PFSRB, Meewasin, MOST	
15.3: Update bylaws and regulations to allow more permeable surfaces.	2	Sustainability, P&D	Saskatoon Water		
15.4: Encourage commercial, institutional, and residential installation of Low Impact Development and onsite storm water management through education and incentives.	2	Saskatoon Water, Sustainability		Businesses	
15.5: Pilot raw water use projects.	2	Sustainability	Saskatoon Water, Parks		
*Phases: proposed initiation of actions. 1: near term (within 2 years); 2: medium term (within 3 to 9 years); 3: long term (over 10 year).					



ACHIEVING AN INTERCONNECTED GREEN NETWORK

Creating an interconnected Green Network will benefit all people in Saskatoon, and our co-inhabitants. Implementing the *Green Infrastructure Strategy* will ensure that:

- The Green Network is a place of community building, where all residents feel safe and welcome. The community is healthier, having access to high quality, interconnected green space.
- The City forms strong partnerships with the community to co-create and govern the Green Network, connecting it through multiple land uses.
- Natural assets are regenerating, and provide many ecosystem services that support municipal needs, connect the community to nature, and improve mental and physicall wellbeing.
- Enhanced assets like parks are primarily used for recreation but also play a role in ecological connectivity, food production, and storm water absorption.
- The urban forest purifies our air, sequesters carbon, and buffers the Green Network from climate extremes.
- Dense urban areas are retrofitted with small scale green infrastructure such as rain gardens and green roofs to improve livability and network connectivity.

- Built infrastructure such as buildings and roadways are designed with nature friendly considerations such as bird friendly glass and wildlife crossings.
- Green storm water infrastructure supports the grey storm water system while managing rainfall as a resource, providing habitat, and increasing climate resilience.

Through the actions identified in the preceding sections we will achieve a comprehensive, resilient, and regenerative Green Network. Considering land use planning and development through a systems approach will allow the City to provide sustainable habitat to both people and nature.



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Figure 30: Summary of Visions & Actions.

Implementing the Actions identified in the *Green Infrastructure Strategy* will create an interconnected Green Network, and allow Saskatoon to reach the Green Network vision.



VISION:

SASKATOON'S GREEN NETWORK PROVIDES SUSTAINABLE HABITAT FOR PEOPLE AND NATURE.

Community : The Green Network facilitates placemaking, honours culture, and inspires community-led transformation	Governance: The Green Network is governed with an emphasis on partnerships and triple bottom line solutions.	Open Space : The Green Network links all Saskatoon residents to high quality, interconnected green space.	Ecology: The Green Network conserves biodiversity, supports high quality habitat, and increases climate change resilience.	Storm Water : More rain is managed where it falls. Storm water is recognized as an important resource.
 Actions: 1. Design the Green Network to reflect our collective history, honour cultural diversity, and create a sense of belonging for all. 2. Inspire citizen-driven transformation of the Green Network. 3. Increase food production in the Green Network. 	 Actions: 4. Invest in the Green Network within the City of Saskatoon. 5. Develop a cooperative governance approach to Green Network provision and management. 6. Redefine the partnership with Meewasin to achieve collective goals related to conservation, education, and development in the Green Network. 	 Actions: 7. Renew formal and informal green space in the Green Network to meet citizen needs. 8. Expand the Green Network by creating new publicly available green space or increasing green infrastructure. 9. Increase walkability and active transportation throughout the Green Network. 10. Protect and grow the urban forest. 	 Actions: 11. Protect, restore, and manage significant natural areas. 12. Connect and naturalize the Green Network in built-up areas. 13. Improve biodiversity and ecosystem health throughout the Green Network. 	 Actions: 14. Integrate natural waterbodies and drainage courses into development using green infrastructure. 15. Increase the use of Low Impact Development.

Figure 31: After almost 150 years, bison were reintroduced to their ancestral home at Wanuskewin Heritage Park in early 2020. The return of the bison marks an important step in the conservation of a once-threatened species, and a renewal of local peoples' relationship with the land.

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Implementation

The *Green Infrastructure Strategy* provides a framework to inform future decision making regarding development, management, and improvements in Saskatoon's Green Network. It also provides guidance for future work planning and budget forecasting. As the *Strategy* is implemented, initiatives that address the actions will be prioritized through further stakeholder and community input. Initiatives will be brought forward to Council for deliberation throughout implementation to direct priorities and funding.

Partnerships

City departments and external groups are already doing vital work to manage and improve Saskatoon's green infrastructure. A partnership approach emphasizing projects that meet the needs of multiple groups will ensure that funding and resources are leveraged, expertise across the community is engaged, and management of green space is maximized to its full potential.

Internal City processes are changing to consider land use and other planning more holistically. The *Plan for Growth* establishes a framework for our growth to half a million people while balancing quality of life, sustainability, and economic development. The *Triple Bottom Line Policy* provides a lens to balance environmental, social, cultural, and economic benefits in our decision making. The Naturalized Parks program is improving the ecological function of sites within the City. The *Green Infrastructure Strategy* supports the increase of green infrastructure into all aspects of urban development related to these other City plans and strategies.

External partners are also considering their own land use and management. Meewasin is exploring partnerships to expand its

conserved corridor with a focus on conservation, education, and development. Regional initiatives such as the Saskatoon North Partnership for Growth (P4G) Green Network Study provide an opportunity to work together at a regional level by connecting with their Green Network. Wanuskewin Heritage Park is actively pursuing a formal submission to UNESCO for inscription on the World Heritage List, which would be the first and only such site in Saskatchewan if accepted. Strong connections to local municipal governments are a requirement for that application. The University of Saskatchewan is working with the City to create a Sector Plan for its endowment lands. Neighbourhoods adjacent to the Northeast Swale are being designed to integrate and interface with the Northeast Swale in an environmentally sensitive manner. Urban Reserves and Treaty Land Entitlement Areas are an important component of Indigenous economic revitalization. Many of these partners have an interest in or are already managing pieces of green infrastructure.

Projects & Operations

Projects and programs that relate to the actions will be implemented as funding becomes available and as existing resources and processes at the City allow. *Strategy* implementation can occur through high investment, multifunctional projects, or in small chunks as part of existing work plans. Seeking opportunities to integrate green infrastructure into projects and increasing our investment in the Green Network will mean achieving the interconnected Green Network earlier. But when big investments are not possible, work towards the Green Network can still proceed by piloting green infrastructure in other projects and programs.

Monitoring the Strategy

Enhancing the Green Network is a continuous process for which the *Green Infrastructure Strategy* is a starting point. Monitoring provides a way to identify and respond to evolving innovation, best practices, and changing climate conditions. Monitoring is also a way to integrating knowledge and research into municipal operations and to align green infrastructure with business planning and budget cycles, which takes time and resources. Refreshing the *Strategy* on a cyclical basis, approximately every 10 years, will keep it current.

Tracking the *Strategy* over time using Key Performance Indicators (see Table 2) will ensure progress towards the Green Network vision. The *Green Infrastructure Strategy* team will report updates and progress on **www.Saskatoon.ca\greeninfrastructure** and on the City's environmental dashboard. We will also check in with the community regularly to ensure the Green Network vision and actions continue to meet community needs.

Figure 32: Green Infrastructure Strategy planning cycle



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Staff

Staff are critical to implementing the *Green Infrastructure Strategy* within the City and with partners beyond. Green infrastructure staff are currently recognized as resources and are consulted with to exchange knowledge, raise awareness of the *Strategy*, and build buy-in for potential initiatives. Securing at least one centralized green infrastructure staff resource for long term implementation of the *Strategy* will allow knowledge sharing, relationship building, and communication to continue across numerous divisions and organizations. This will ultimately ensure that the *Strategy* is influencing and optimizing decisions on green infrastructure asset management.

In addition to dedicated green infrastructure staff, uptake and implementation of the *Strategy* across the City of Saskatoon will require staff resources in multiple divisions to assist in operationalizing the *Strategy*. This will allow identification of existing resources and processes that can be changed to achieve the interconnected Green Network.

Funding

To sustain implementation of the *Green Infrastructure Strategy*, actions, funds, and resource allocations are required. Development of the *Strategy* relied on one-time funding from the Reserve for Capital Expenditures and the Storm Water Utility. This funding model creates uncertainty around future resourcing, work planning, and grant submissions. There is a need for ongoing funding, which could be achieved through various mechanisms. For example:

External Funding Opportunities: Success of the *Strategy* will rely on a readiness to take advantage of external funding opportunities that arise. For example, recent federal investments in natural area protection and urban forestry represent possibilities for the City to strengthen these areas. Such grant opportunities often have a fast turnaround time and are highly competitive.

Environmental Sustainability Reserve: In 2019, City Council established an Environmental Sustainability Reserve to ensure that funding for environmental initiatives such as the *Low Emissions Community Plan* can be leveraged with other funding opportunities. This reserve could also be used for implementation of the *Strategy*.

Compensation Funds: As per the City's *Wetland Policy*, the City can receive compensation funds from the loss of wetlands to development. Such funds could be used for future green infrastructure if appropriate criteria are established.

Carbon Offsets: Carbon offsets are a potential funding tool to cover the cost of tree planting or other carbon sequestering green infrastructure. A carbon offset is a credit for greenhouse gas reductions achieved by one party that can be purchased and used to compensate for the emissions of another party. The Government of Saskatchewan is currently developing a framework for carbon offsets, anticipated to be available in early 2021. Offset programs exist to reward carbon emissions reduction that are outside business as usual or legally mandated activities. There is limited information about the offset framework currently; further investigation is needed to determine how development of the Green Network can benefit from this type of funding.



APPENDIX 1: DEFINITIONS

Afforestation Areas

Sites where a forest has been established where there was no previous tree cover. Previously established afforestation areas in Saskatoon such as Richard St Barbe Baker and George Genereux tend to naturalize over time, becoming important habitat sites.

Biodiversity

The richness and variety of living organisms and habitats within an ecosystem, including urban ecosystems.

Bioblitz

An intense period of biological surveying by groups of scientists, naturalists, and volunteers. Local bioblitzes are often hosted by conservation groups such as Meewasin and the Native Plant Society. Data is uploaded to Citizen Science platforms such as the Saskatchewan Conservation Data Centre and iNaturalist.

Biocultural Management

An approach to conservation that grounds ecosystem management in local knowledge, practices, and cultural relationships.

Brownfield

An abandoned, vacant, derelict, or underutilized commercial or industrial property that, because of its past use, may have perceived or actual contamination.

Carbon Sequestration

The process of capturing carbon dioxide from the atmosphere and storing it as carbon. This document specifically refers to biological carbon sequestration, whereby there is a net removal of carbon dioxide from the atmosphere and subsequent storage in natural carbon sinks such as vegetation (e.g. grasslands, forests) and soils.

Connectivity

The degree that movement between open spaces is facilitated or impeded. Connectivity is measured by the physical continuity of open space and, ecologically, by how well species are distributed throughout an area. Connectivity increases the amount of suitable habitat, supports larger populations, and helps maintains biodiversity and species richness.

Conservation

The sustainable use, protection, and management of natural areas and assets to prevent decline or loss. Conservation does not attempt to preserve natural areas and assets in a particular ecological state.

Cultural diversity

Most commonly refers to differences between cultural groups, although it is also used to describe differences within cultural groups, (e.g. diversity within the Cree culture includes Plains Cree, Woodlands Cree and Swampy Cree). Underlying current usage is an emphasis on accepting and respecting cultural differences through the recognition that one culture is not intrinsically superior to another (Source: ayisiyiniwak: A Communications Guide, City of Saskatoon, 2019).

Culture

The customs, history, values and languages that make up the heritage of a person or people and contribute to that person's or peoples' identity. First Nations peoples use the term culture to refer to their traditional teachings: beliefs, history, languages, ceremonies, customs, traditions, priorities (how life should be) and stories (Source: ayisiyiniwak: A Communications Guide, City of Saskatoon, 2019).

Ecological Integrity

The ability of an ecosystem to support and maintain ecological processes such as nutrient cycling, water purification, climate regulation, carbon sequestration, and a diverse community of organisms.

Ecosystem Services

The array of benefits provided by green infrastructure. Examples of ecosystem services include provisioning (e.g. fresh water), regulating (e.g. climate regulation), cultural (e.g. recreation), and supporting (e.g. photosynthesis).

Ethical Space

Decision making within a framework that creates a place for knowledge systems to interact with mutual respect, kindness, generosity, and other basic values. All knowledge systems are equal; no single system has more weight or legitimacy than another.

"Ethical space is not a new concept; it existed as a fundamental principle of engagement between Indigenous Peoples and settler governments until 150 years ago. It supported the creation of the original set of Treaties. defining equitable relationships between Indigenous and settler societies, and gave life to the principle of coexistence, since it was the space that Indigenous Peoples first entered into with settlers. However, the assimilation policies that began about 150 years ago served to undermine the spirit and intent of the Treaties (and, consequently, of the ethical space). The spirit of equitable engagement and ethical space is only now resurfacing through reconciliation efforts." (Source: We Rise Together, 2018).

Food Desert

Areas of the city with limited access to affordable, nutritious food, typically due to transportation challenges (e.g. more than a 10 minute walk from grocery store), food prices, or income.

Food Forest and Orchard

Public spaces used for fruit and perennial food production. Food forests are designed to mimic processes in natural forests. They are more self-sustaining than orchards, which are more intensively managed. There are few standalone food forests and orchards in the city currently. Most operate as part of a larger community garden.

Fragmentation

The process whereby large habitats or natural areas are broken into smaller patches and isolated from each other, often as a result of development and land use change. Fragmentation impacts ecosystem health and species richness. Smaller habitat patches support smaller wildlife populations and are more susceptible to invasive species.

Grasslands

Ecosystems dominated by native grasses and forbs, and which may contain some shrub and tree communities. Native grasslands support rare species of plants and animals, offer many ecosystem services including carbon sequestration, and provide important connectivity to wide-ranging mammals and migrating birds. Native grasslands are among the most endangered habitats in the world. Conservation of native grasslands aims for a minimum of 25% of vegetation to be native grassland species, and includes both the ongoing management of high quality grasslands, and the restoration of degraded grasslands through active resource management.

Green Infrastructure

A system of natural, enhanced, and engineered assets that provide municipal and ecosystem services by protecting, restoring, or emulating nature.

Green Network

When green infrastructure is designed holistically, it becomes an interconnected Green Network that enhances the urban environment and improves quality of life.

Grey Infrastructure

A centralized system of engineered assets that deliver municipal services such as water management and transportation. Grey infrastructure is needed in urban areas, but its effectiveness can be enhanced by green infrastructure.

Invasive Species

A species that is non-native to an ecosystem and whose presence causes or is likely to cause harm to economic, environmental, or human health.

Indigenous Peoples

All inhabitants indigenous to their lands and territories, and their descendants; native or belonging naturally to a place; of, pertaining to or concerned with the aboriginal inhabitants of a region (Source: ayisiyiniwak: A Communications Guide, City of Saskatoon, 2019).

Intangible Cultural Heritage

The inherited traditions from the past and the contemporary practices in which diverse cultural groups take part. It is an important factor in maintaining cultural diversity (Source: UNESCO).

Kinship

The kinship which is embodied in the treaty relationship consists of three characteristics:

1. First, the principle of mutual respect and the duty of nurturing and caring describes the kind of relationship that would exist between mother and child

- 2. Second, the principle of non-interference describes the relationship of brothers
- Third, the principle of noncoercion, happiness and respect describes the relationship of cousins (Source: ayisiyiniwak: A Communications Guide, City of Saskatoon, 2019).

Low Impact Development

A land planning and engineering design approach that manages storm water runoff by emphasizing on-site features and systems that lower runoff quantity, lower peak runoff volumes and flow rates, and improves runoff water quality. LID improves and maintains natural hydrologic processes on site such as absorption, infiltration, evaporation, evapotranspiration, filtration through soils, pollutant uptake by select vegetation, and biodegradation of pollutants by soil microbes. LID includes technologies and techniques such as bioretention and rain gardens, bioswales, green roofs, permeable pavements, and rainwater harvesting for reuse.

Native and Naturalized Species

Species that occur naturally in the Saskatoon region. Due to the increasing threats to local biodiversity, protection and use of native species is preferred in green infrastructure projects. However, a great deal of urban biodiversity is non-native, and some non-native plants have tolerance to high-stress urban environments such as soil compaction and salinization.

Natural Area

An area containing natural assets that work together to provide ecosystem services (e.g. habitats, nutrient cycling, water purification, climate regulation, carbon sequestration) and social benefits (e.g. recreational, aesthetic, cultural). Significant natural areas in Saskatoon make up the ecological core of the Green Network due to their connectivity, habitat provision, cultural significance, or ecological health. Specific sites are identified by technical experts including Meewasin.

Natural Assets

Ecological resources that are native to the Saskatoon region including the South Saskatchewan River, grasslands, woodlands, wetlands, and soil systems. These sites often contain important cultural and archaeological features.

Placemaking

A design approach to improving public spaces by increasing the connections between people and the places they share.

Riparian

The transitional zone between terrestrial and aquatic areas of a wetland or watercourse. Riparian vegetation and soil are strongly influenced by the presence of water.

South Saskatchewan River

The major river (1,392 km long) that Saskatoon is located on. It flows through Alberta and Saskatchewan.

Stepping Stone Habitat

Patches of habitat, such as naturalized features, in the urban landscape that provide shelter, food or rest to wildlife. Increasing the number, size, or proximity of stepping stone habitat improves the overall ecological function of a landscape.

Stewardship

A responsible way to interact with, use, manage, restore, and protect natural and cultural resources.

Storm Ponds

Storm ponds provide both retention and treatment of storm water runoff. A wet pond is a permanent pool of water. Dry ponds are designed to manage storm water prior to its release into the larger storm system to minimize the risk of local flooding.

Storm Sewer Main Network Lateral & Branch

Lateral and branch sewers are the upper ends of the municipal sewer system. Laterals dead-end at their upstream end, with branch sewers collecting the storm water from several lateral sewer lines. The minimum size for a storm lateral is 300 mm diameter.

Main sewers are collectors for lateral and branch sewers from an area of several hundred acres, a specific neighbourhood, or a housing development. They convey storm water to larger trunk sewer lines.

Trunk sewers are the main arteries of the collection system. They collect and convey storm water from numerous main sewer lines. The minimum size of a storm trunk is 1,350 mm diameter.

Culverts connect channels through an obstacle blocking the channel (e.g. a road). Culverts are often corrugated steel but may also be concrete or other material.

Storm Sewer Outfall

Point where a pipe discharges to the river or other body of water.

Sustainability

Development that is responsive to operational requirements and environmental needs, while balancing long-term financial, environmental, cultural, and social factors. Sustainability within the City of Saskatoon is viewed through a Triple Bottom Line lens, which considers environmental health and integrity, social equity and cultural wellbeing, economic prosperity, and fiscal responsibility.

Swale

Swales are post-glacial channel scars containing a mix of native prairie and wetland. They are defined by the deposition of glacial till soil, which results in rocky ridges and a high water table that produces wet depressions in the landscape (Source: Meewasin Valley-Wide Resource Management Plan). This document also refers to bioswales and drainage swales as a type of Low Impact Development.

Traditional Land Uses

The historic and current cultural, spiritual, and physical connection of Indigenous people to the land and all the gifts it provides.

Traditional and Local Ecological Knowledge

The evolving knowledge acquired by Indigenous and local peoples over hundreds or thousands of years through direct contact with the environment. This knowledge is specific to a location and includes the relationships between plants, animals, natural phenomena, landscapes, and timing of events. It represents an accumulating body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings with one another and with the environment (Source: US Fish and Wildlife Service).

Watercourse

A natural or constructed channel through which water flows, including drainage ditches, streams, creeks, and rivers.

Wetland

Land having water at, near, or above the land surface; land saturated with water long enough to promote aquatic processes as indicated by saturated or hydric soils, aquatic vegetation, and various kinds of biological activity adapted to a wet environment. Wetlands can hold water temporarily or permanently, with water levels fluctuating over the course of a single year and over many years with climatic cycles. Wetlands in Saskatchewan are lost at a rate of 11.3 hectares per day (Source: Ducks Unlimited Canada). There are three types of wetlands in Saskatoon:

- 1. Natural: Naturally occurring wetland.
- 2. Naturalized: Wetland that has been altered and replanted with naturally occurring wetland vegetation.
- 3. Constructed: A constructed and/ or modified water body that fluctuates with water drainage but holds water at all times. They are designed to mimic the functions of naturally occurring wetlands, including filtering pollutants from storm water runoff and providing habitat with associated buffers/riparian areas.

Wetland Complex

A combination of individual wetlands and surrounding riparian areas that have complementary functions and greater significance when viewed together rather than individually. Wetland complexes are the main ecological feature of the prairie pothole region. Wetland complexes support ecosystem biodiversity and productivity.

Wildlife Habitat

Natural environments that support the basic requirements for food, water, reproduction, and protection of species. Certain wildlife habitats may be important at particular times of the year. Wildlife habitats include habitat for insects, birds, amphibians, reptiles, and mammals.

Worldview

A comprehensive view or philosophy of life, the world and the universe. Worldview can be described as a philosophy or view of life that shapes how we interact and respond to the world around us. Our own worldview influences, shapes and interprets what we experience and provides us with a sense of vision for the future (Source: ayisiyiniwak: A Communications Guide, City of Saskatoon, 2019).

Viewshed

The geographical area visible from a location. It includes all surrounding points in line-of-sight with the location and excludes points beyond the horizon or obstructed by terrain and other features (e.g. trees).

APPENDIX 2: ACKNOWLEDGMENTS

To ensure Saskatoon is a great place for everyone to live, work, learn, and play, care must be taken to allocate and manage land in a balanced way. Saskatoon has a diversity of people and stakeholders with many different needs. As such, it was important to consult a variety of technical experts, internal stakeholders, and community members to ensure the *Strategy* reflects many people's vision for Saskatoon's Green Network. The City of Saskatoon would like to thank everyone who took the time to provide feedback and expertise.

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