City of **Saskatoon**

Toward natural asset management in the

# City of Saskatoon

Saskatchewan

**Summary of inventory results and recommendations**
**February 2022**

This document features interactive elements! Clicking on a heading or sub-heading in the Table of Contents (ToC) will take you directly to that page. Also, clicking on page numbers in the footer will bring you back to the ToC.

# Municipal Natural Assets Initiative

M NAI.CA

Making Nature Count

## Invest in Nature

The Municipal Natural Assets Initiative (MNAI) is a Canadian not-for-profit that is changing the way municipalities deliver everyday services - increasing the quality and resilience of infrastructure at lower costs and reduced risk. The MNAI team provides scientific, economic and municipal expertise to support and guide local governments in identifying, valuing and accounting for natural assets in their financial planning and asset management programs, and developing leading-edge, sustainable and climate-resilient infrastructure.

## Disclaimer

While reasonable efforts have been made to ensure the accuracy of the report's content, any statements made are made only as of the date of the report and such information and data are subject to uncertainties, inaccuracies, limitations and to changes based on future events. Municipal Natural Assets Initiative makes no representations, warranties or guarantees (express, implied, statutory or otherwise) regarding the data on which the information is based or the information itself, including quality, accuracy, usefulness, fitness for any particular purpose, reliability, completeness or otherwise, and assumes no liability or responsibility for any inaccuracy, error or omission, or for any loss or damage arising in connection with or attributable to any action or decision taken as a result of using or relying on the information in the report.

# Table of Contents

# 1 Purpose

This document summarizes the results of a project to develop a natural asset inventory for the City of Saskatoon and documents steps the local government can take to proceed to a full natural asset management initiative.

# 2 Introduction

## What are municipal natural assets

The term *municipal natural assets* refers to the stock of natural resources or ecosystems that a municipality, regional district, or other form of local government could rely upon or manage for the sustainable provision of one or more local government services[1].

## Why manage natural assets

A growing number of local governments recognize that it is as important to understand, measure, manage and account for natural assets as it is for engineered assets. Doing so can enable local governments to better provide *core* services such as stormwater management, water filtration, and protection from flooding and erosion, as well as *additional* services such as those related to recreation, health, and culture. Outcomes of what is becoming known as *municipal natural asset management* can include cost-effective and reliable delivery of services, support for climate change adaptation and mitigation, and enhanced biodiversity.

## How to manage natural assets

There are numerous ways for local governments to manage natural assets. The Municipal Natural Assets Initiative (MNAI) uses methodologies and tools rooted in standard asset management and provides a range of advisory services to help local governments implement them. MNAI has developed the methods and tools with significant investments, piloting, refinement, peer review, and documentation of lessons in multiple Canadian provinces. MNAI's mission is to make natural asset management a mainstream practice across Canada, and in support of this, for local governments to accept and use the methodologies and tools in standard ways across the country.

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1   *mnai.ca/media/2018/02/finaldesignedsept18mnai.pdf*

## What is a natural asset inventory?

Natural asset inventories provide details on the types of natural assets a local government relies upon[2], their condition, and the risks they face. As depicted in Figure 1 and explained in detail in the Annex, a natural asset inventory is the first component of the Assessment phase. The Assessment phase, in turn, is the first of three phases of a full natural asset management project. By itself, an inventory will not give a sense of asset value but is an essential first step in the full natural asset management project.
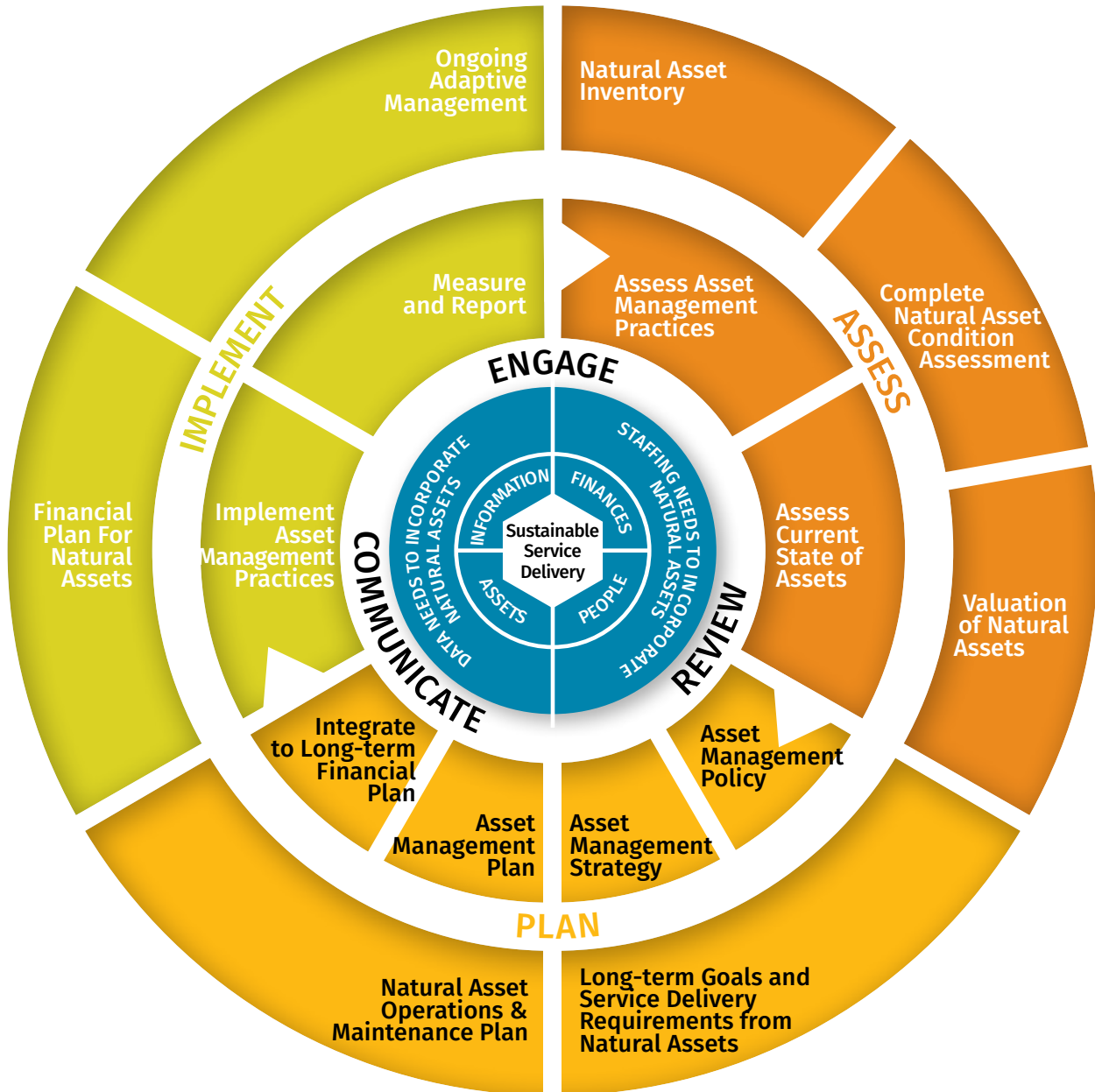


*Figure 1: The Asset Management Process. MNAI has adapted this for use with natural assets.*

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2    *Note that many local governments rely on services from natural assets they do not own.*

# 3  Local government context

## 3.1.  General
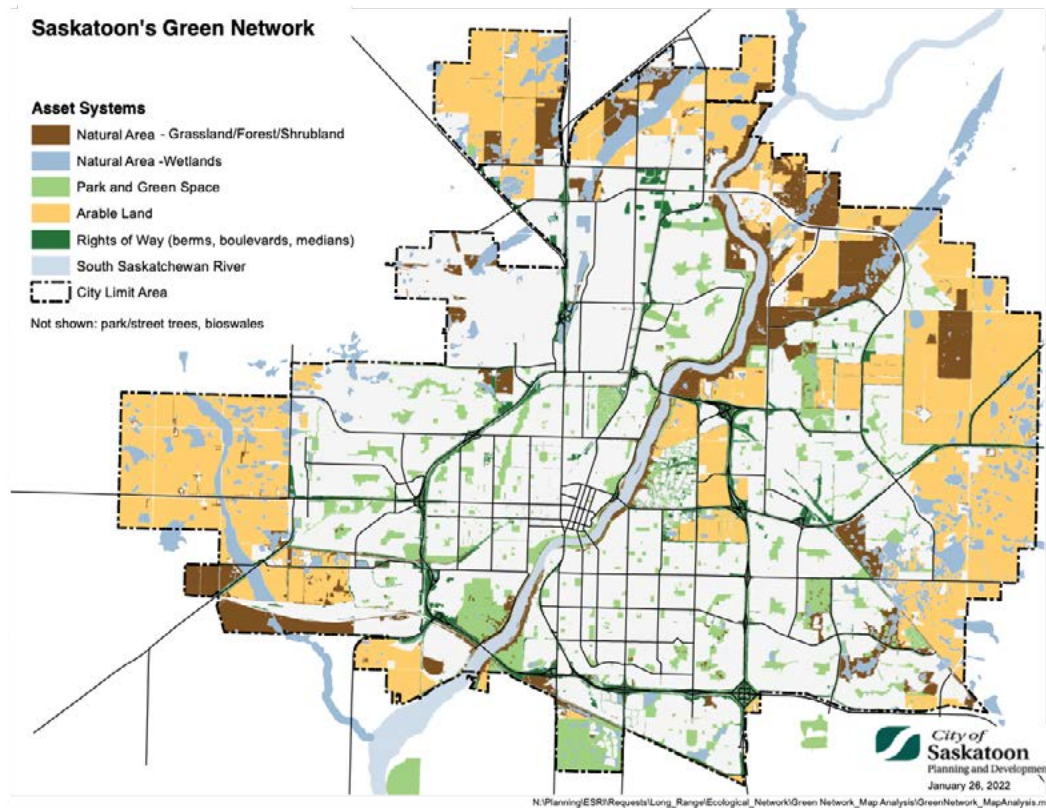


*Figure 2:*
*City of Saskatoon*

The City of Saskatoon (population ~331,000) is the largest city in the province of Saskatchewan. Saskatoon is a commercial, cultural, and educational centre located on Treaty Six Territory and the Traditional Homeland of the Métis. European settlement began in the 1880s. Indigenous people have been living in and travelling through the Saskatoon area for thousands of years.

Saskatoon lies along a bend in the South Saskatchewan River in the mixed prairie ecoregion. It is a hub for water, rail, and highway crossings in all directions.

The City of Saskatoon's interest in natural asset management is three-fold. First, they wish to develop standardized approaches to understanding the ecosystem services that their natural areas provide, identify priority services, and determine the service value and condition of natural assets. Second, the City of Saskatoon wants to assign service levels to natural assets and identify related levels of investment required to achieve service targets. Finally, it would like to incorporate natural assets into financial planning to ensure sufficient funding for the long-term, reliable provision of ecosystem services.

The inventory project with MNAI builds on earlier work completed in 2019 with the Meewasin Valley Authority through which they developed an overall footprint of natural areas. The City of Saskatoon's pilot Natural Capital Asset

Valuation[3] project uses this earlier inventory as a basis for identifying and valuing natural assets.

The City of Saskatoon identifies the South Saskatchewan River, wetlands, urban forest, grasslands and parks as priority natural assets. Priority services from these include safe drinking water, electricity, storm water management, removal of pollutants, mitigation of urban heat island effects, recreation, carbon sequestration, and habitat for species at risk.

## 3.2. Asset management readiness assessment

As part of inventory development, MNAI helps local governments determine their overall state of asset management maturity. To do this, MNAI has adapted the Federation of Canadian Municipalities (FCM)'s asset management readiness assessment tool[4] to help local governments measure their progress on both asset management and natural asset management in four competency areas, with each area describing outcomes based on five levels of progress or maturity.

The completed readiness assessment helps local governments prioritize actions that increase their effectiveness in managing all assets, including natural ones.

### Competency 1: Policy & Governance

The City of Saskatoon has an Asset Management Policy in place that includes natural assets. The City of Saskatoon's corporate Climate Adaptation Strategy has actions to consider green infrastructure as an alternative to grey infrastructure. Other supporting documents aligned with the corporate Asset Management Policy include the Official Community Plan (which references natural assets), the Green Infrastructure Strategy, and the Urban Forestry Management Plan. The City of Saskatoon's policy objectives for natural assets and green infrastructure are starting to guide its actions, particularly related to natural areas and urban forestry.

The City of Saskatoon has a road map and defined performance measures to monitor progress for some service areas. Its Asset Management Program is underway and key activities include updating asset management plans for various service areas. While the City of Saskatoon has identified the benefits of natural assets and associated ecosystem services at a high level, staff noted the need to develop specific objectives and include them in the road map. The City of Saskatoon has identified short-term actions to support natural asset management.

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3   *City of Saskatoon - Natural Capital Asset Valuation Pilot Project. (2020, May).*
    *www.saskatoon.ca/sites/default/files/documents/ncav-report-final-2.pdf*

4   *See fcm.ca/sites/default/files/documents/resources/tool/asset-management-*
    *readiness-scale-mamp.pdf for details*

## Competency 2: People & Leadership

An asset management coordinator and terms of reference for the role are in place, but committees are not yet formalized. Potential resources have been identified but a cross-functional asset management team is not yet established.

Asset management plans for multiple service areas have been presented to council and well received, with funding approved for related activities; however, council is not following an explicit roadmap relating to required improvements. Council has supported the City of Saskatoon's Green Infrastructure Strategy and approved its Urban Forest Management Plan, but it is not yet aware of the full resourcing and commitment that would be required to integrate additional natural asset management objectives. The City of Saskatoon has a Green Infrastructure Strategy Implementation Plan that will help inform the future asset management roadmap and budget related to strengthening asset data and information.

## Competency 3: Data & Information

City of Saskatoon staff estimate it is at an early stage of competency related to data and information about engineered assets. There is basic inventory data for most major assets, including information on properties such as size, material, location, and installation date. The City of Saskatoon is moving its data to a centralized location, has defined critical assets, and has some condition information for them. It is more advanced in specific service areas with, for example, expanded inventory data and information about condition and performance. The tangible capital asset registry has not yet been linked to the asset registries used for asset management planning; this is because data quality is not yet sufficient to warrant such integration. Some service areas have formally defined levels of service. More work is needed to determine technical levels of service such as the timing of inspections. Service levels for park maintenance and design are in place. There is some variation around how technical and customer levels of service have been defined in some service areas and competencies vary depending on the specific service area. For example, staff currently rely on professional judgment for information about levels of service for its storm water utility linear system.

With respect to data and information about natural assets, the City of Saskatoon has collected baseline data through its Natural Areas Inventory, its Urban Forestry Management Plan, its Wetland Inventory and its Natural Capital Asset Valuation. The Parks Department manages a tree inventory that includes information about the condition and performance of park, boulevard, and median trees,[5] but there is limited data about other natural assets that the City of Saskatoon is responsible for managing. A very good inventory with condition data exists for the urban forest; there is less information about the

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5    *The existing tree inventory does not include the locations or condition information for trees in natural or afforestation areas.*

co-benefits and ecosystem services it provides. As a result, these benefits are not associated with any level of service defined for the urban forest. While the City of Saskatoon has a basic inventory of wetlands and natural areas, it does not yet have levels of service assigned to grasslands and wetlands and has not integrated an asset management lens to the natural areas it manages. The City of Saskatoon is not yet formally managing groundwater or soils, either. To-date, the data collected is limited to what was studied through the Natural Capital Valuation project (see above).

## Competency 4: Planning & Decision-making

The City of Saskatoon's departments follow a similar, informal asset investment planning approach whereby investment needs and priorities are evaluated based on a mix of structured and ad hoc practices and criteria. It is moving towards developing a more structured asset investment planning approach in which departments set priorities using similar criteria based on organizational goals and objectives.

Asset management plans are in place for some assets and services and are more comprehensive for services like water. The City of Saskatoon has a three-year capital plan that outlines investment needs, but these plans are not yet fully integrated with or representative of full lifecycle management needs for various assets. It reassesses priorities annually. Most capital planning addresses short-term issues and priorities.

With respect to natural asset management, the City of Saskatoon is furthest ahead with urban forest and parks operations, mainly due to its Urban Forestry Management Plan. However, there is currently no funding secured to implement the recommendations outlined in that Plan. The City of Saskatoon is further behind on planning for other natural assets such as grasslands and wetlands. Management activities for them have not yet appeared in capital and operating budgets and levels of service have not been defined for most natural areas. The Sustainability and Parks Departments and Meewasin (an external organization) manage most activities that are budgeted for.

# 4  Natural asset inventory

## 4.1.  Inventory overview

MNAI's natural asset inventories have two main components to express natural asset information: an asset registry (which is a tabular representation of the data) and an online dashboard. MNAI provided the registry to the City of Saskatoon in an Excel file and the dashboard as a website address. Information on the condition of the assets is a subset of the inventory and is depicted in both the registry and dashboard.

## 4.2.  Inventory data

To establish the inventory, MNAI obtained data from the City of Saskatoon (directly and through open sources) and the Environmental Systems Research Institute (ESRI). MNAI combined the spatial data layers to establish a comprehensive depiction of natural assets. Table 1 describes the data sources used to develop the inventory and complete the condition assessment.

| TABLE 1: SUMMARY OF DATA SOURCES | | | |
|---|---|---|---|
| DATASET NAME | DESCRIPTIVE NAME | SOURCE | PURPOSE |
| CityLimit | City of Saskatoon Boundary | City of Saskatoon Open Data | Used to delineate study area for the natural asset inventory. The final natural asset inventory is based on this boundary. |
| NAI_Inc_Built | Natural Asset Inventory with Built-up Areas | City of Saskatoon | This is used as the main source of data for the natural asset inventory.<br><br>The subcategory level 1 was used to create the asset categories. |
| NAI_City_Sub2 | Natural Asset Inventory Secondary Sub-Category | City of Saskatoon | This dataset was inserted into the main natural asset inventory to obtain a more detailed perspective on natural assets. For example, this dataset contains individual plantings and other smaller assets not shown at the first sub-category level. The detailed subcategory classes were also used to complete the adjacent land use condition assessment. |
| Catchments | Saskatoon Catchments | City of Saskatoon | Assets were split at catchment boundaries to summarize natural assets by catchment in the dashboard. |
| NeighbourhoodArea | Saskatoon Neighbour-hoods | City of Saskatoon | Assets were split at neighbourhood boundaries to summarize natural assets by neighbourhood in the dashboard. |

## TABLE 1: SUMMARY OF DATA SOURCES

| DATASET NAME | DESCRIPTIVE NAME | SOURCE | PURPOSE |
|---|---|---|---|
| SLSN | Single Line Network Dataset | City of Saskatoon Open Data | Used to summarize length of roads within a 100m buffer of each asset and to perform road density condition assessment. |
| Wetlands_20130904_ table_added | Wetlands with Associated Attributes | City of Saskatoon | Used to assign the type of wetland (permanent vs storm water pond) to wetland assets. |
| City of Saskatoon Pathways & Meewasin Valley Authority Trails | City of Saskatoon Pathways & Meewasin Valley Authority Trails | City of Saskatoon | Used to summarize the length of trails running through each asset. |
| Publicly Accessible Sites | Publicly Accessible Sites | City of Saskatoon | Used to summarize area of publicly accessible sites overlapping with natural assets. Also used to assign the name(s) of relevant public sites to natural assets where those public sites overlapped with a natural area. |
| MinicipalWardArea | Municipal Wards | City of Saskatoon Open Data | Used to assign assets to their relevant ward to allow for exploring natural assets by ward in the dashboard. |
| Park | Park | City of Saskatoon Open Data | Used to summarize area of natural assets considered park land that would be maintained by the City of Saskatoon. |
| CityofSaskatoon_ Outfalls_2017 | City of Saskatoon Outfall Locations | City of Saskatoon | Used to summarize count of outfalls within natural assets and add outfall IDs to assets so that the 2 datasets could be linked. |
| Table8_SNA_SEA_NN_ Analysis | Nearest Neighbour Patch Analysis for Natural and Enhanced | City of Saskatoon | This condition assessment dataset was linked to the natural asset inventory via a unique identifier. Assets within a natural/ enhanced patch are assigned the nearest neighbour distance of the patch they fall within. |
| Zoning_Oct2021 | Zoning Parcels | City of Saskatoon | Used to assign zoning categories to assets based on the greatest area of overlap between the two datasets. |
| Esri 2020 Landcover | Esri 2020 Landcover | ESRI | Used to create a buffer of landcover classes surrounding the City of Saskatoon boundary file to avoid edge effects while completing the condition assessments. |

The inventory project defined a total of 22,742 individual assets covering 11,149 hectares (ha), as noted in Table 2. An asset is defined as a continuous area of the same land cover type. For example, an intact forested area would be defined as one asset, but a forested area that is bisected by a road would constitute two assets. The majority of the asset area in Saskatoon was cropland, followed by grassland and wetland. Note that individual trees in the urban forest (that are included in the Park's tree inventory) have not yet been connected to the natural asset inventory presented below. This could be a next step in advancing the inventory in the future.

| TABLE 2: SUMMARY OF NATURAL ASSETS BY TYPE | | |
|---|---|---|
| **NATURAL ASSET TYPE** | **NUMBER OF ASSETS** | **TOTAL AREA (HA)** |
| **Aquatic** South Saskatchewan River | 155 | 388 |
| **Cropland** | 173 | 4,674 |
| **Forested and Shrubland** | 4,021 | 577 |
| **Formal Greenspace** | 12,666 | 1,047 |
| **Informal Greenspace** | 2,994 | 806 |
| **Grassland** | 724 | 1,285 |
| **Naturally Non-Vegetated** | 86 | 4 |
| **Outdoor Recreation** | 210 | 332 |
| **Tame Forage** | 365 | 679 |
| **Vegetated Margin** | 177 | 150 |
| **Wetland** | 1,171 | 1,206 |
| **Total** | **22,742** | **11,149** |

Figure 3 shows the spatial distribution of the natural assets.
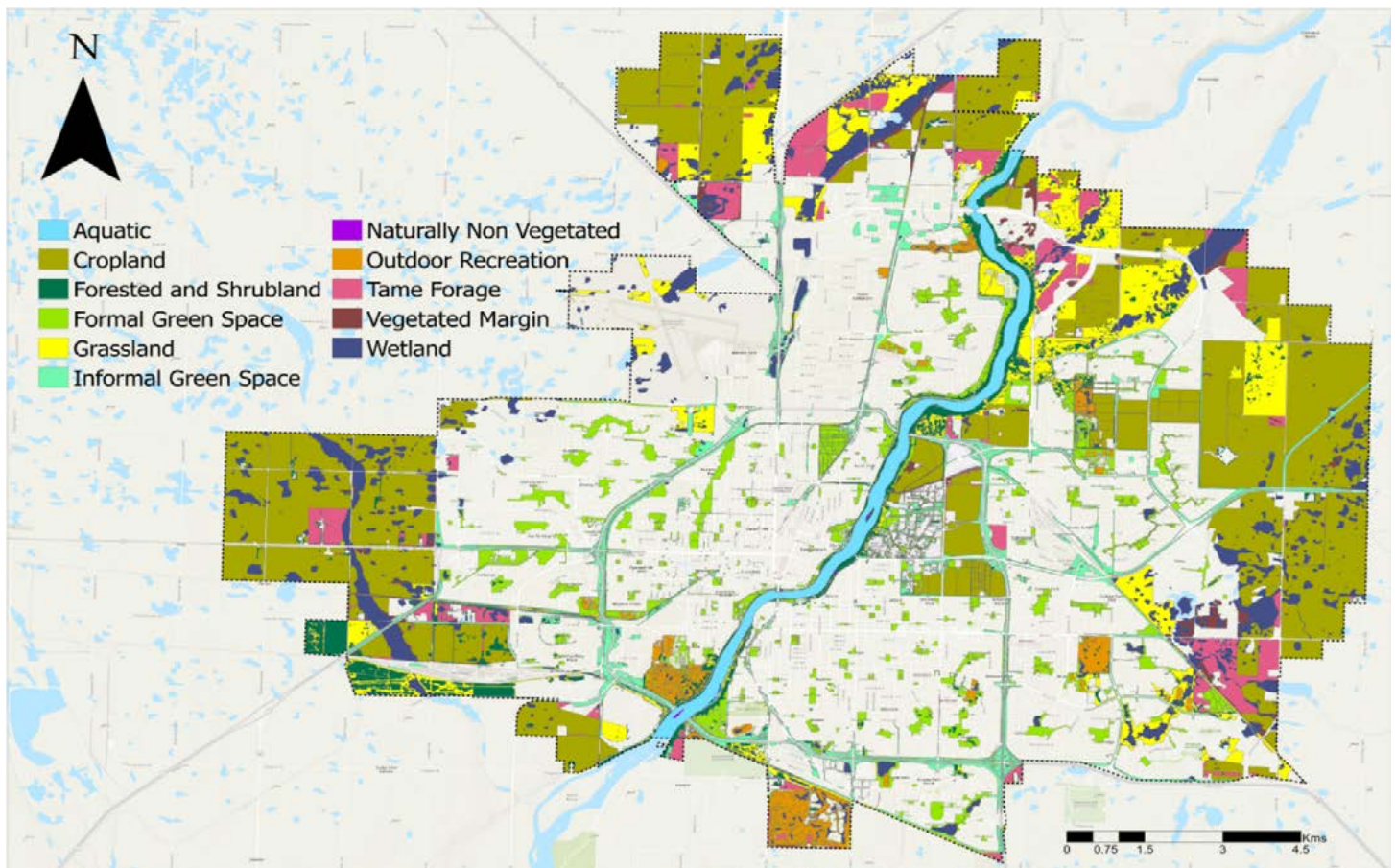


*Figure 3: Spatial distribution of natural assets.*

## 4.3.  Asset registry

Each asset within the inventory has a unique identification number that allows users to select and analyze individual assets and manipulate the corresponding data as required. For example, changes in condition can be noted for individual assets. Information on each asset is housed in an asset registry. Table 3 is an excerpt from the City of Saskatoon's online registry showing natural asset characteristics and details. Additional detail is provided in the online dashboard.

**Natural Asset Registry**

| Asset ID | Asset Type | Sub-Asset ID | Asset Area (ha) | Asset Area in Neighbourhood (ha) | Neighbourhood | Ward Name | Catchment | Majority Zoning | C of S and Meewasin Trail Length (km) | Public Site Area (ha) | Public Site Name | Count of Outfalls | Outfall ID | Adjacent Land Use Score | Permeability Score | Relative Size Score | Road Density Score | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FGS10451 | Formal Green Space | FGS10451-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10452 | Formal Green Space | FGS10452-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10453 | Formal Green Space | FGS10453-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10454 | Formal Green Space | FGS10454-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10455 | Formal Green Space | FGS10455-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10456 | Formal Green Space | FGS10456-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10457 | Formal Green Space | FGS10457-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10458 | Formal Green Space | FGS10458-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10459 | Formal Green Space | FGS10459-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS10460 | Formal Green Space | FGS10460-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - A | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 3 | 5 | 1 | 1 | 10 |
| FGS110 | Formal Green Space | FGS110-1 | 0.00 | 0.00 | Evergreen | Sutherland - Erindale | University Heights - | RMTN1 | 0.00 | 0.00 | | 0 | 12821 | 5 | 5 | 1 | 1 | 12 |
| **Total** | | | | 11149.16 | | | | | 65.79 | 1,924.98 | | 90 | | | | | | |

## 4.4. Online dashboard

Inventories may provide more insights when characterized visually in a dashboard, which enables users to explore different aspects of the data. For instance, natural asset information can be quickly summarized by neighbourhood or catchment, or, if users want to dive into the specifics of forest assets, they can quickly filter the data to focus on that particular asset. Figure 4 is a screenshot from the dashboard that MNAI provided to the City of Saskatoon. The full version can be accessed at *go.greenanalytics.ca/Saskatoon*.
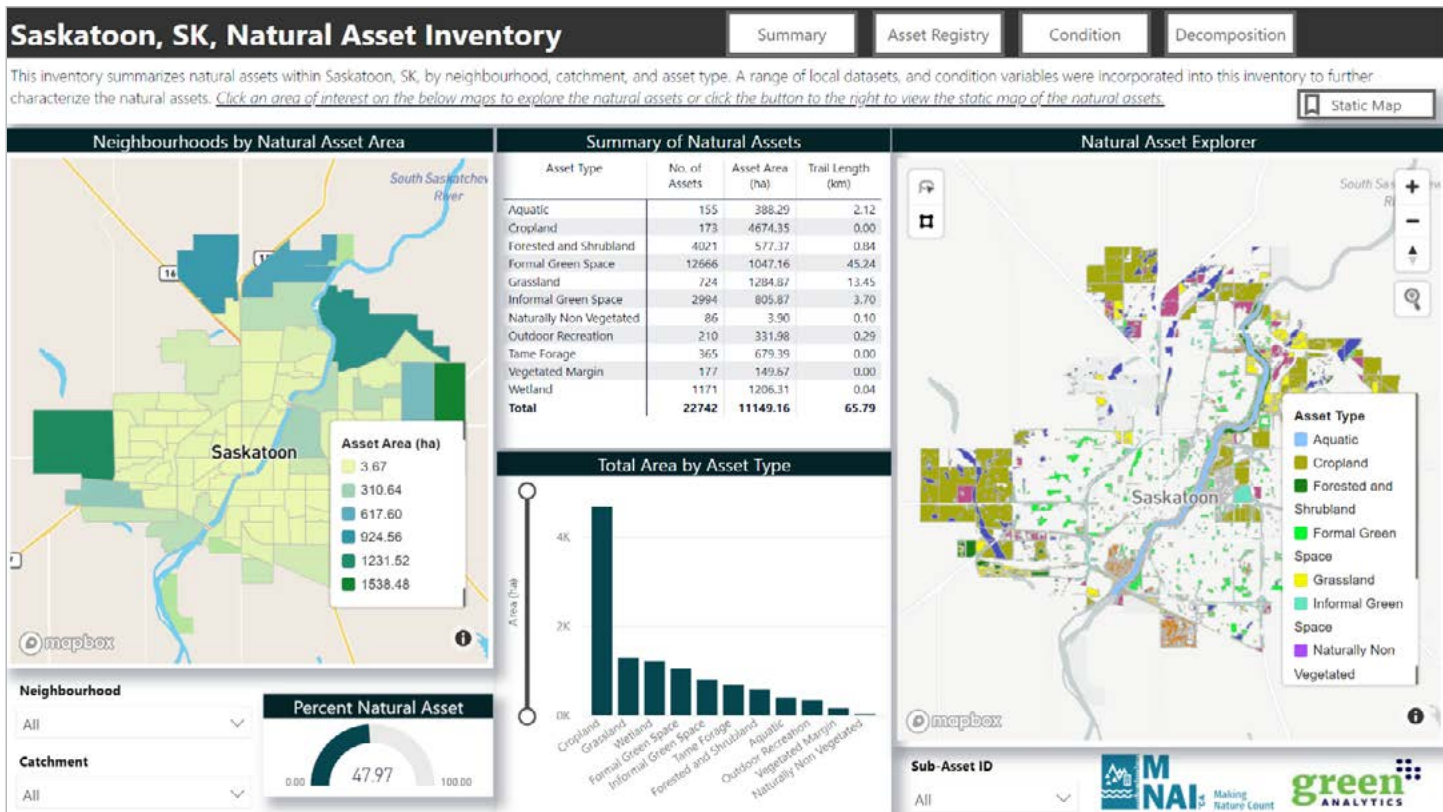
*Figure 4: Screenshot of main inventory summary.*

## 4.5.  Condition of natural assets

Documenting the condition of natural assets is a key aspect of natural asset inventories. A natural asset condition assessment provides an understanding of both the ecological health of natural assets, and the ability of natural assets to provide services. This information, in turn, can support the effective management of natural assets, be reflected in the registry and the dashboard, and updated over time.

MNAI completed a desktop-based condition assessment and built it into the inventory to provide an initial understanding of the status of the natural assets for the City of Saskatoon. As part of a full natural asset management project, MNAI would expand this assessment to include additional metrics related to condition (e.g., relative biodiversity, riparian and wetland health/function, soil condition, connectivity, and others) and possibly include site visits to confirm and verify the condition ratings. The desktop exercise completed as part of this inventory is a reasonable first step in assessing condition and can be used as a foundation for future work in this area.

Table 5 summarizes the condition assessment steps and indicators. MNAI chose these indicators for their relative ease of measurement (given time and budget constraints) and for their relevance to measuring the ecological health and service delivery capabilities of natural assets. They are proxy metrics for these broader condition considerations. For example, larger asset size implies more connectivity of natural areas, higher road density implies more fragmentation

and higher hydrologic impairment of water flows, and more permeability implies greater ability to store water, which means more effective stormwater management. The adjacent land use metric measures and distinguishes natural assets that are next to other natural assets from natural assets that are next to built infrastructure. How and the extent to which a given natural asset is influenced by the drainage in the adjacent landscape varies depending on factors such as the local topography and soils, orientation (e.g., upland versus lowland, position in the watershed) and the size and nature of the feature itself. However, it is well-established that the condition of a natural asset in an urban context tends to be negatively impacted when more of the surrounding land uses are impervious (i.e., paved, concrete or buildings) because this tends to alter pre-existing drainage and infiltration pathways, which can cause a natural area to receive much more or much less drainage than prior to being in an urban context. Urban runoff also typically carries a host of sediments and contaminants, and when such runoff is directed to natural areas and not properly treated, it can negatively impact the feature and its functions for plants and wildlife.

| TABLE 4: CONDITION ASSESSMENT APPROACH AND INDICATORS | | |
|---|---|---|
| **Indicator** | **Description & Methods for Quantification** | **Data used to Quantify Indicator*** |
| **Relative asset size** | For each natural and semi-natural asset type, total area is calculated, and a rank is assigned to the assets within each class based on its percentile score. Natural assets within the top third of the ranking (e.g., the largest assets within a class) received a 3, those within the middle third of the ranking received a 2, and those within the bottom third of the ranking received a 1. | Natural asset inventory |
| **Road density** | Measures the density of the roads in and around the assets according to high density (assets with more than 2km of roads per km squared), medium density (assets with between 1km and 2km of roads per km squared) and low density (assets with less than 1km of road per km squared). | Natural asset inventory plus spatial representations of roads |
| **Surface permeability** | The permeability of surfaces is ranked on a scale of nil to high depending on the type of landcover present.<br><br>Urban areas, roads and industrial areas are ranked as nil. Assets within impervious surfaces are assigned as low permeability.<br><br>Agriculture and shrublands are ranked as medium.<br><br>Wetlands, waterbodies and forests are ranked as high. | Natural asset inventory, spatial representations of land uses and roads, as well as the Global Man-made Impervious Surfaces Dataset from NASA *data.nasa.gov/dataset/ Global-Man-made-Impervious-Surface-GMIS-Dataset-Fr/dkf4-4bi3* |

## TABLE 4: CONDITION ASSESSMENT APPROACH AND INDICATORS

| Indicator | Description & Methods for Quantification | Data used to Quantify Indicator* |
|---|---|---|
| **Adjacent land use** | Considers the distance to, and the nature of, the area surrounding natural assets. Intense land uses (e.g., airports) in close proximity to natural assets result in a poor rating, while distant land uses that are less intense (e.g., agriculture) result in a good rating. If there are no human land uses within 100 m of the assets, the assets are scored 10. If there are intensive land uses within 100 m of the assets, the score is 0. | Natural asset inventory plus spatial representation of land use as well as intensity rankings of land uses |

*\* Data sources provided in Table 1 unless noted here.*

Once conditions were allocated to each asset, an overall score was derived for the project area. The maximum possible score for an asset was 40, based on a possible 10 points for each of 4 categories:

- Road density as low (10), medium (5) or high (1).
- Surface permeability rated as high (10), medium (5), low (1), or nil (0).
- Adjacent intensive land use (0 for intense land uses, otherwise 10).
- Relative asset size where the largest 3rd areas receive 10, 5 for middle 3rd, and 1 point for the lowest 3rd.

The total condition score was then converted into a rating scale:

- **Good –** assets with a score of 30 or higher
- **Fair –** assets with a score between 20 to 29
- **Poor –** assets with a score between 10 to 19
- **Very Poor –** assets with a score lower than 10

Figure 5 summarizes the natural asset condition assessment results as per the online dashboard.
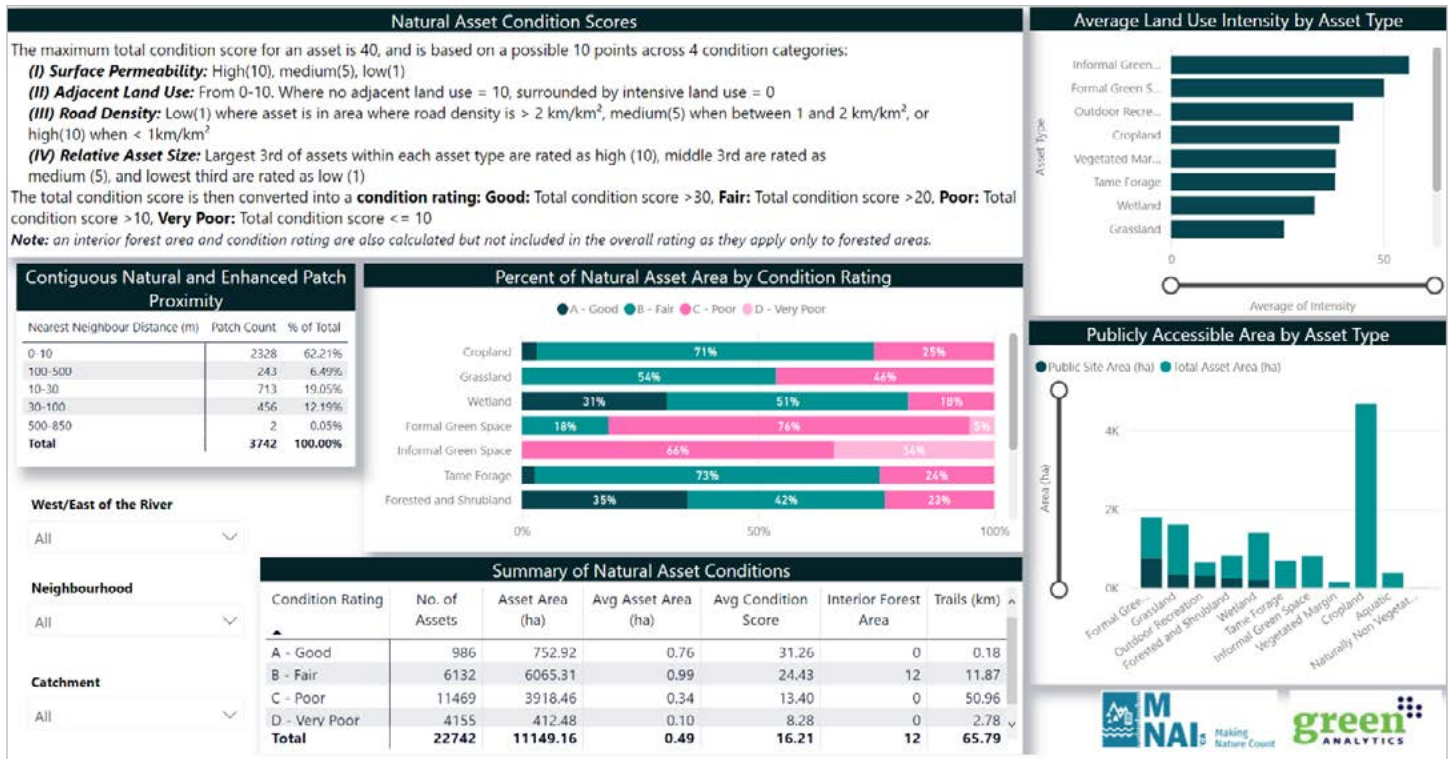


*Figure 5: Screenshot of condition assessment details.*

Overall, about 753 ha (or 7 per cent) of natural assets were assessed in good condition and 6,065 ha (or 54 per cent) were assessed in fair condition.

Table 5 summarizes condition ratings and Figure 6 summarizes condition by natural asset type. Additional insights on the condition results can be obtained through the "Decomposition" tab of the online dashboard.

## TABLE 5: SUMMARY OF NATURAL ASSET CONDITION RATINGS

| Condition Rating | Number of Assets | Total Area (ha) | Average Condition Score |
|---|---|---|---|
| Good | 986 | 753 | 31.26 |
| Fair | 6,132 | 6,065 | 24.43 |
| Poor | 11,469 | 3,918 | 13.40 |
| Very Poor | 4,155 | 412 | 8.28 |
| Total | 22,742 | 11,149 | 16.21 |

Legend: ● A - Good ● B - Fair ● C - Poor ● D - Very Poor

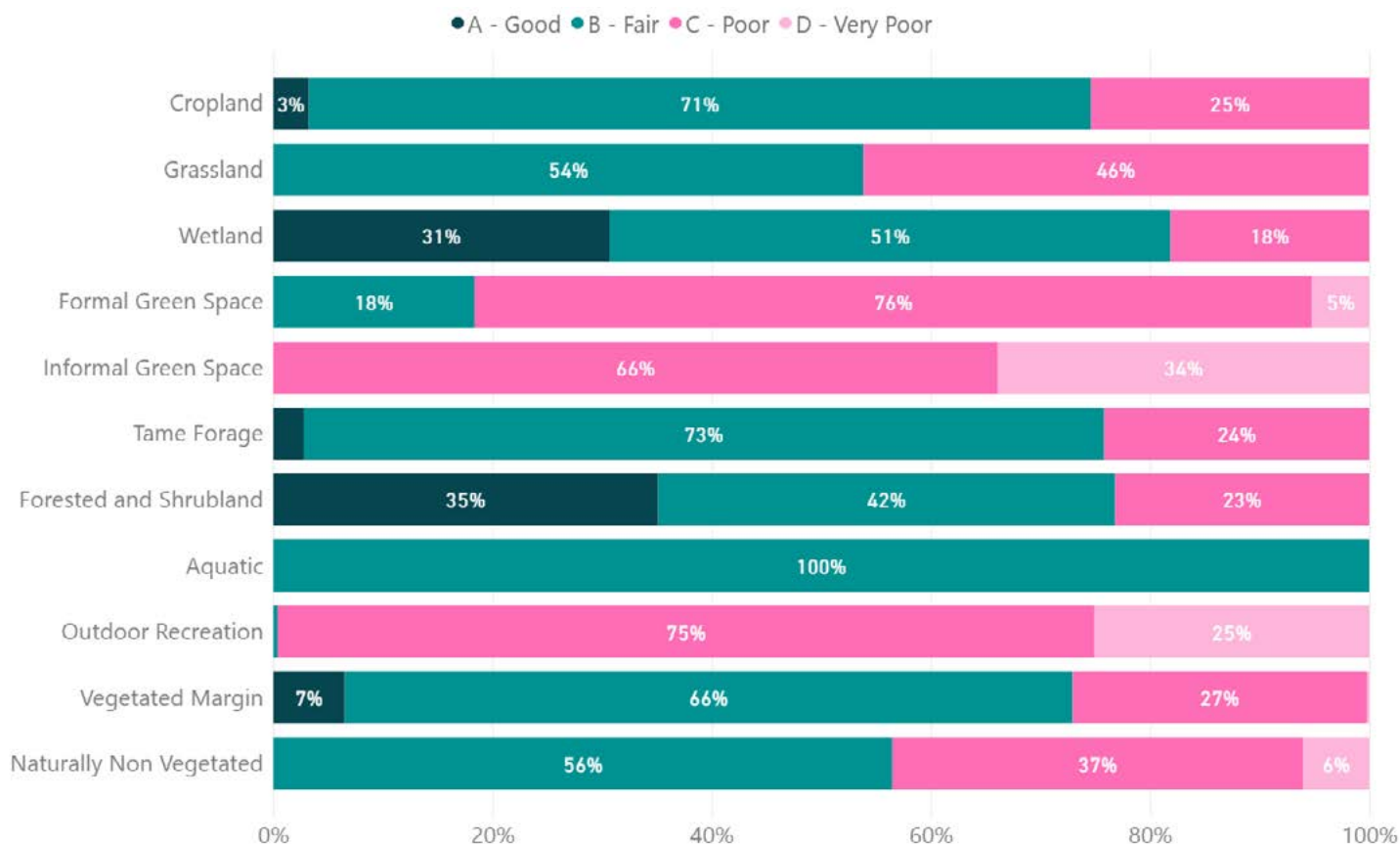| Asset Type | A - Good | B - Fair | C - Poor | D - Very Poor |
|---|---|---|---|---|
| Cropland | 3% | 71% | 25% | |
| Grassland | | 54% | 46% | |
| Wetland | 31% | 51% | 18% | |
| Formal Green Space | | 18% | 76% | 5% |
| Informal Green Space | | | 66% | 34% |
| Tame Forage | 3% | 73% | 24% | |
| Forested and Shrubland | 35% | 42% | 23% | |
| Aquatic | | 100% | | |
| Outdoor Recreation | | | 75% | 25% |
| Vegetated Margin | 7% | 66% | 27% | |
| Naturally Non Vegetated | | 56% | 37% | 6% |

*Figure 6: Summary of condition rating by natural asset type.*

## 4.6.  Maintaining the inventory

Inventories are not static. Both the registry and the dashboard can be expanded as new information becomes available. For example, asset condition might improve as a result of restoration efforts, or new studies may add insights on the condition of the assets. New data can be reflected in the asset registry and subsequently in the online dashboard as it becomes available. Furthermore, the level of desired detail may evolve as asset management readiness increases or as areas of natural asset management focus emerge. That said, inventories should grow in detail and sophistication only insofar as they remain aligned with the capacity of the communities to maintain them and the uses to which they will be put. Their evolution and development should be a function of the monitoring, reporting and lessons of the asset management cycle and be driven by the imperative of ensuring sustainable, cost-effective delivery of services to the community, which is the core of asset management.

# 5  Risk identification

## 5.1.  Risk identification tool overview

Identifying risks facing natural assets can help local governments prioritize their management of natural assets. To this end, MNAI provides local governments with a tool entitled *Risk Identification Process in the Development of Natural Asset Inventories* and guidance in self-administering it.

Risk management is a four-stage process that includes risk identification, analysis of probability and consequence, development of risk mitigation strategies, and control and documentation. The use of the risk identification tool informs the first and second stages of risk management by identifying the top risks to natural assets and their associated services, plus a high-level analysis of impacts and consequences.

Risk types relevant to natural asset management typically include:

- **Service risk:** the risk of an asset failure that directly affects service delivery.

- **Strategic risk:** the risk of an event occurring that impacts the ability to achieve organizational goals.

- **Operations and maintenance risk:** risks related to poor asset controls and oversight, which can lead to poor record-keeping and poor monitoring of asset.

- **Financial risk:** risks related to the financial capacity of the City of Saskatoon to maintain municipal services.

- **Political risk:** risks related to the nature of municipal politics.

## 5.2.  Using the risk identification tool

Using the risk tool, the City of Saskatoon considered possible risks that the loss of natural asset functions could pose to built infrastructure, personal health and safety, and private property, including:

- Climate change

- Poor planning and/or lack of prioritization

- Species at risk

- Urban encroachment

- Lack of resources and staffing for natural asset management

- Development

- Loss of biodiversity

- Invasive species

- Lack of protection bylaws, lack of protected-status designation

- Flood control
- Water quality
- Damage to grey & green infrastructure
- Incompatible uses
- Erosion/sediments
- Litter & illegal dumping
- Staff capacity
- Pollutants
- Soil health
- Fire risk
- Availability of plant material/stock
- Aging grey/built infrastructure
- Inadequate funding
- Lack of public acceptance

Each risk was then ranked low, medium, or high according to the probability of an impact occurring, and the relative magnitude of its negative consequences. To assess impact and consequence, the City of Saskatoon considered four questions:

**i/** what impact is likely to happen?

**ii/** what is the consequence of that impact happening?

**iii/** is it tolerable?

**iv/** what can be done to mitigate the probability of impact and/or consequence?

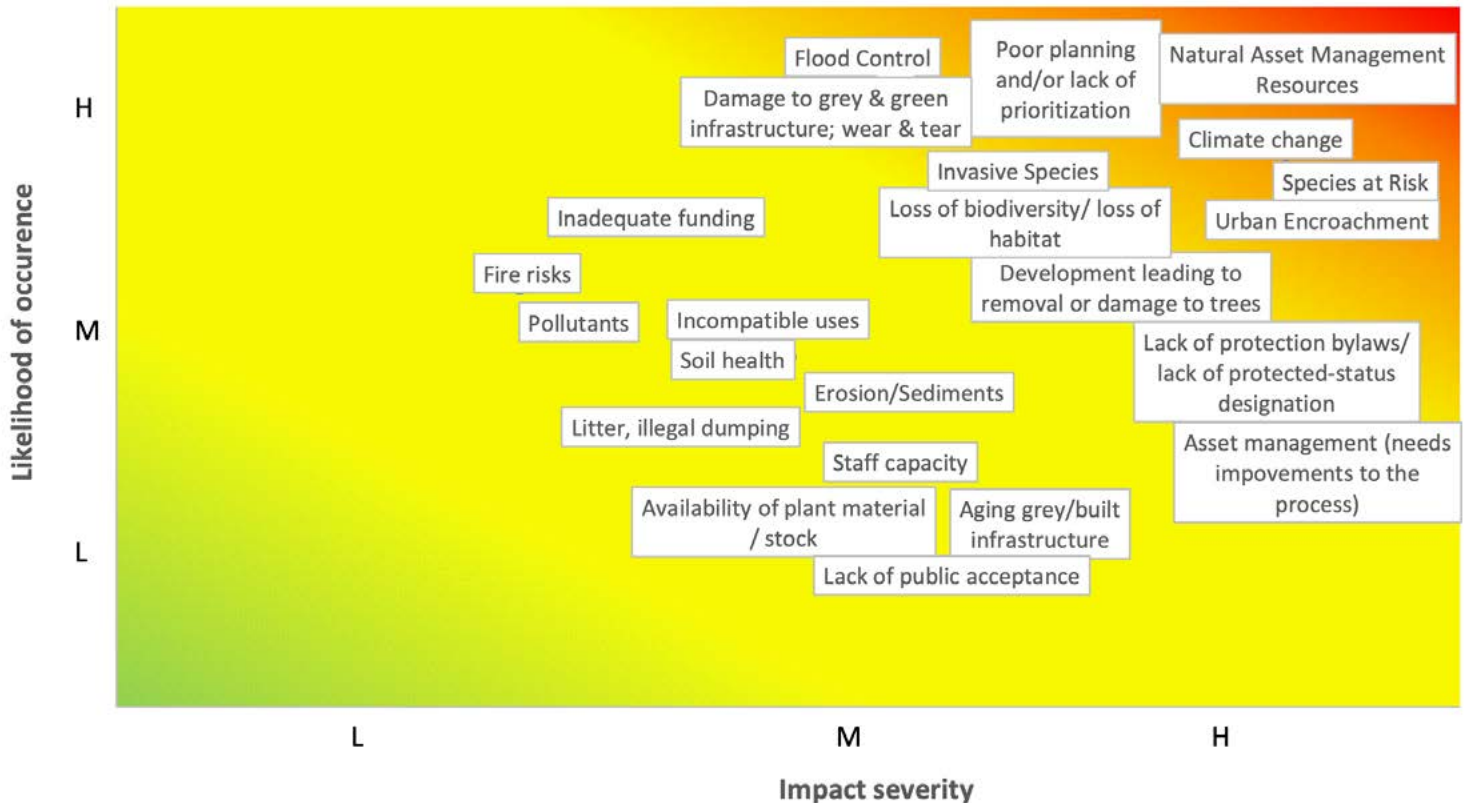## 5.3. Results of the risk identification process

The risk identification process revealed:

- 5 high-level risks (climate change, poor planning and/or lack of prioritization, species at risk, urban encroachment, and lack of resources and staffing for natural asset management)

- 7 medium-high level risks (development, loss of biodiversity, invasive species, lack of protection bylaws/ lack of protected-status designation, flood control, water quality, and damage to grey & green infrastructure)

- 11 low-level risks (incompatible uses, erosion/sedimentation, litter and illegal dumping, staff capacity, pollutants, soil health, fire risks, availability of plant material/stock, aging grey/built infrastructure, inadequate funding, and lack of public acceptance)

In terms of scope, the identified risks affect natural assets across the City of Saskatoon, with numerous risks potentially affecting watercourses (e.g., South Saskatchewan River and wetlands), city parks, the urban forest and grasslands. The identified risks also have potential to negatively impact engineered assets, municipal budgets, property, and personal health and safety.

## Risk Matrix



LEGEND  Minor  Moderate  Major  Severe

*Figure 7: Results of risk identification process.*

## 5.4. Potential priorities for the local government

The outcomes of the risk identification process highlight potential priorities on which the City of Saskatoon could focus their natural asset management efforts. Where possible, these are also informed by the condition assessment. These are:

- **Climate change:** Climate change was identified as a high-level risk to natural assets due to impacts related to drought, extreme heat, high winds and intense storms, flooding, freezing rain, and temperature swings. Specific threats include reductions to water supply from less snow and glaciers in the Rockies, increased stress on wildlife and plants, release of stored GHG from wetland and grassland loss, property damage and increased maintenance and clean-up costs following

extreme weather events. The role of the South Saskatchewan River in buffering droughts and floods is recognized. In fact, all intact natural assets play an important buffering role in reducing the severity of climate change impacts on society and as such should be a component of any climate resilience or adaptation strategy.

- **Poor planning and/or lack of prioritization:** Coordinated and collaborative planning is necessary for effective natural assets management. By contrast, poor planning was identified as a high-level risk in formal green spaces such as parks and the urban forest. Planning that lacks coordination or a prioritization process results in no or little tree protection, or identified places to plant trees, or connected green spaces; it may also result in risks to wetlands. Stakeholders and groups to consult in strategy and planning documents (e.g., neighborhood plans and concept documents) include municipal departments (e.g., engineering, finance, utilities), residents, local conservation groups, industry, and First Nations and Métis.

- **Species at risk:** The loss of wetland and grassland habitat was identified as a high-level risk to species at risk. Lack of resources and staffing for these land types is contributing to the risk. There is a well-defined connection between biodiversity and service delivery from natural assets. As such, overlaying locations of importance to species at risk with highly valued natural asset locations for service delivery would assist in identifying priority sites for actions that benefit both species at risk and local government service outcomes.

- **Urban encroachment:** Urban encroachment leading to habitat fragmentation was identified as a high-level risk. Drivers of encroachment include development pressures associated with a growing population, policy and process barriers, and planning and coordination challenges. Prioritizing compact, low-impact development, creating multifunctional landscapes, and protecting sensitive areas should guide development and limit fragmentation.

- **Lack of resources and staffing for natural asset management:** The lack of resources and staffing for natural asset management is recognized as a high-level risk, particularly to the urban forest. Without increased resources dedicated to building internal capacity and knowledge, policies will fail to capture and support natural assets, municipal spending may be sub-optimal, and natural asset loss will continue. The Parks Department is moving toward a condition-based asset management model that could serve as model for other departments. This approach could be expanded in the near-to-medium term by using the urban forestry management plan to: (i) develop the business case for natural asset management and (ii) articulate the role of forests in building climate resiliency and policy support required at local and provincial levels.

Table 6 lists and provides brief descriptions of risk mitigation strategies. Future stages of the MNAI process can address these.

| TABLE 6: RISK MITIGATION STRATEGIES | |
|---:|:---|
| Accept | Risk may be acceptable if probability and consequences are small |
| Minimize | Risk under local government's control that warrants exposure reduction |
| Share | Partners in a project permit the sharing of larger risks to reduce it for each |
| Transfer | Insurance, fixed price contracts, and other risk transfer tools |

# 6  Recommendations

This section provides insights that can be gained from considering both the inventory - including the condition and risk assessments - and the asset management readiness assessment. It is divided into (6.1) opportunities to strengthen natural asset management at an organization-wide level (6.2) possible actions for the further development of the inventory, and (6.3) steps the City of Saskatoon can consider to advance to a full natural asset management initiative.

## 6.1.  Opportunities to strengthen natural asset management at an organization-wide level

The City of Saskatoon identified a short-term opportunity to integrate natural asset management into its asset management framework and processes. At the time of writing, the City of Saskatoon was undertaking a maturity assessment of its asset management practices in all service areas and had noted that the integration of natural asset management was at an early stage. For example, where ecosystem management is being implemented, it is not yet explicitly tied to asset management planning and decision-making. A key action to ensure integration of natural asset management into the City of Saskatoon's asset management processes would be to include objectives related to natural asset management in its roadmap. Staff also noted the need for continuous improvement of the data and information contained in its natural asset inventory.

With respect to people and leadership, staff noted the need to establish a formal, permanent asset management team or committee that includes staff responsible for integrating natural asset management considerations. Terms of reference have been drafted; responsibilities for integrating natural asset management should be included in these. The formal asset management team should also include a staff person explicitly responsible for integrating natural asset management considerations into the City of Saskatoon's asset management system. This would support integrated approaches to natural asset

management in all relevant service areas. Currently, natural asset management is relatively siloed because management decisions reside in specific departments.

With respect to data and information, the City of Saskatoon is working on strengthening data and information for all assets and services. There is an opportunity to strengthen natural asset data as well. Overall, natural asset data is not yet comprehensive and additional information is needed on, for example, the range of natural assets and their condition, risk, and levels of service. The City of Saskatoon has an approved budget to proceed with natural asset management plans in 2022-2023. Resources from this project would be available to support these efforts.

## 6.2. Possible actions for the further development of the inventory

Based on the inventory, the City of Saskatoon could consider the following, regardless of whether or not it pursues a full natural asset management process. These are mostly incremental measures.

### ALIGN INVENTORY WITH RELATED CITY INITIATIVES

- Identify other work groups at the City of Saskatoon that maintain inventories and assess if and how the natural asset inventory can be linked to these. Examples may include results from Natural Area Screenings, Parks inventories for trees and green spaces, and the City's wetland inventory.

- Identify how the natural asset inventory could be integrated with concurrent City of Saskatoon projects such as Natural Area Management Plans and the Natural Capital Asset Valuation pilot project. For example, the City of Saskatoon could use the natural asset inventory as part of its prioritization process for Natural Area Management Plans.

### REFINE THE CONDITION AND RISK ASSESSMENTS

- Further develop the condition assessment (e.g., with field verification) and risk assessment for the South Saskatchewan River, wetlands, grasslands and Parks using local climate projections, land use modelling, and other data already at the City's disposal. To the extent possible, refinements to the condition assessment should follow the framework used in the Urban Forestry Management Plan.

- Include additional metrics related to condition (e.g., relative biodiversity, riparian and wetland health/function, soil condition, connectivity, and others) and possibly include site visits to confirm and verify the condition ratings.

- Building on the risk assessment results, confirm priority natural assets and services to focus on.

- Initiate or enhance monitoring - for example, using gauges, water level sensors, and loggers to improve understanding of trends, feed into condition ratings of assets, and gather information for modelling.
- Expand the risk identification process to include field verification of results.

### BEGIN TO LINK THE INVENTORY TO NATURAL ASSET SERVICE LEVELS

- Identify linkages between services and assets and assess the condition of, and risks to, the assets from the perspective of their ability to deliver services. For example, watercourses, grasslands, wetlands and forested areas in the watersheds will be important to consider in the context of water supply, climate resilience, and stormwater management.

### COMMUNICATE RESULTS

- Communicate results of the inventory with City of Saskatoon work groups and decision-makers to maintain interest and momentum in natural asset management.
- Share the inventory with adjacent local governments, conservation groups, residents, and industry to stimulate collaboration within the watershed.
- Share the inventory with City of Saskatoon decision-makers, including council.
- Initiate or enhance monitoring - for example, using gauges, water level sensors, and loggers to improve understanding of trends, feed into condition ratings of assets, and gather information for modelling.
- Schedule regular updates (e.g., every 3-5 years) of the inventory, condition assessment and risk identification to understand trends.
- Identify if and how the natural asset inventory can be linked to existing inventories such as results from Natural Area Screenings and the urban forestry tree inventory or incorporated into concurrent projects such as Natural Area Management Plans.
- Communicate key results of the inventory on public platforms such as the City's Environmental Dashboard.

### MAINTAIN AND UPDATE THE INVENTORY AS NEEDED

- Schedule regular updates (e.g., every 3-5 years) of the inventory, condition assessment and risk identification to understand trends.

## 6.3. Steps to a full natural asset management project

A full natural assessment management project allows local governments to move through all phases of the cycle depicted in Figure 1. This, in turn, helps them understand the capacity of the natural assets they own and/or the ones they rely upon for services, understand changes in services as a result of different interventions (e.g., restoration, acquisition), determine the current services from natural assets, their value, and how these services and values may change with interventions, and develop strategies and actions to protect and manage natural assets for the long-term.

Following is an illustrative list of steps that the City of Saskatoon could undertake with MNAI, should it wish to proceed with a full natural asset management project. These steps can be phased, and/or adapted to local context. MNAI is available to discuss specifics in detail.

1/ **Confirm scope, roles and responsibilities**. Undertake a meeting or workshop to confirm (a) assumptions related to priorities and objectives (b) roles, responsibilities, and capacities (c) community capacity to undertake larger projects.

2/ **Fill essential knowledge gaps**. If discussions on scope and certainty and related data needs for modelling indicate the need for additional data, these could be filled.

3/ **Modelling**. Modelling the levels of service that natural assets currently provide and the levels of service under different potential management, local climate change projections, and rehabilitation or restoration scenarios, is central to natural asset management as it gives communities the ability to explore how different actions will affect the health and corresponding performance of natural assets. MNAI can undertake the modelling on behalf of local governments.

4/ **Economic assessment**. The economic assessment component provides a market-based indication of (a) the current value of the services from natural assets if they had to be provided by an engineered means, and (b) the costs and values of different interventions in terms of service delivery.

5/ **Planning**. This step allows local governments to explore different scenarios such as "what happens to the services provided by the wetland if there is significant building upstream?" or "what happens to the services if the forest is restored?" Using modelling, changes in service levels can be understood and quantified. Corresponding values can also be determined through continued economic assessment. Based on the foregoing, local governments can begin to consider and prioritize actions ranging from status quo to planning, regulatory, financial operations, maintenance, acquisition, and monitoring interventions.

6/ **Implementation**. MNAI can provide ongoing advice/guidance on policy pieces and integration of the above information for 12-18 months. After that, the local government, together with local partners and service providers, would ideally have the capacity to continue efforts on their own.

7/ **Ongoing monitoring**. It is essential to continue monitoring the project to learn whether interventions are working and to share lessons and learnings from other communities undertaking natural asset management. MNAI would typically stay involved with the community for three years through a monitoring arrangement to be established with the communities.

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# Annex: Results of the City of Saskatoon's risk identification process

This Annex contains the results of the City of Saskatoon's use of MNAI's risk identification tool, which they self-administered with guidance from MNAI. Table 7 was the main product that personnel developed from the exercise.

## Step 1: Identification of risks

Common Risks to Natural Assets:

- Overuse of trails/dumping
- Flooding (current and future)
- Forest fire
- Invasive species
- Development pressure
- Pollutant loading from urban, agricultural, or industrial sources (e.g., overuse of salt on roads)
- Drought (current and future)
- Erosion
- Ice jams
- Storm surge
- Lack of flood hazard mapping
- Lack of land management plans
- Lack of monitoring reports
- Construction activity
- Political policy change

# Step 2: Complete survey

## TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

| Major Risks | Score | Impacted Assets | Tolerance for the Risk | Notes |
|---|---|---|---|---|
| **Climate change** | H | Aquatic (river), formal green space, grassland, wetland | Intolerable in some cases, depends in other cases | Climate change - includes drought, extreme heat, high winds & intense storms, flooding, freezing rain, swings in temperatures. River helps to buffer against drought and flooding. Water Supply for Saskatoon may be impacted by climate change (less snow and melting glaciers in Rockies may mean less water in river). Also risks related to the corresponding maintenance/clean-up required after these events. Stress to wildlife and plants. Release of GHG related to loss of natural assets. Lack of resources. |
| **Poor planning and/or lack of prioritization** | H | Formal green space, urban forest | Intolerable in urban forest; dependent in formal green space | Poor planning, uncoordinated approach, and/or lack of prioritization (e.g., can lead to lack of tree protection, no place to plant trees, lack of green space or connectivity of green space)/berms, neighbourhood planning, concept plans, etc. |
| **Species at Risk** | H | Grasslands, wetlands | Intolerable in wetlands; dependent in grasslands | Loss of grasslands & wetlands, especially native habitat will lead to a decline in SAR. Lack of resources or staffing for wetlands and grassland areas. |
| **Urban encroachment leading to habitat fragmentation of natural assets** | H | All natural assets | Depends | Partly a result of planning & coordination issues, but there are also other factors like policy and process barriers, pressures of land development, and a growing population. |

## TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

| Major Risks | Score | Impacted Assets | Tolerance for the Risk | Notes |
|---|---|---|---|---|
| **Resources and staffing for asset management of natural areas.** | H | Urban forest | Depends | Trees and green space are not valued to the same degree as built/grey infrastructure. As a result, they're occasionally removed without much consideration/needs improvements. 2017 Asset Management Plan has been useful in identifying future upgrades & priorities, however, many of the factors are based on age alone. In 2020-22, Parks will move towards a true condition-based asset management model, which will allow for investments to closely align with citizen expectations. Parks will participate in the Civic Operations Long Term project to ensure aging physical assets are replaced in a timely manner / Some policies in place such as the Wetland Policy but it has not been followed and we need to develop some internal capacity and knowledge in this area. Developers have impacted a number of wetlands with virtually no consequences in the past, as there is also no provincial policy that the government will uphold. We Need a more integrated development process to help developers know where natural areas are on the landscape and build an ecological network where the development builds around and incorporates the natural assets. |
| **Development** | M-H | Aquatic (river), cropland, wetland, urban forest | Intolerable in wetlands and urban forest; tolerable in aquatic and cropland | Wildlife habitat along the river bank lost to development or other factors / Riverbank is usually protected through OCP but only to 92 m. Conversion of arable land to urban development due to development in green field areas / Much of the current arable land in the city is within sector plans with development proposed. Development (e.g. removing or damaging trees during construction; utilities conflicting with potential tree planting locations; new neighbourhoods = poor planning) / **Note: tree removal can also lead to erosion and bank de-stabilization |

## TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

| Major Risks | Score | Impacted Assets | Tolerance for the Risk | Notes |
|---|---|---|---|---|
| **Loss of biodiversity** | M-H | Aquatic (river), grassland, wetland, urban forest | Intolerable in wetlands, dependent otherwise | Loss of biodiversity - loss of habitat = reduced biodiversity. Pollinators, migratory birds of concern. Loss of connectivity highly impacts biodiversity, but listed as moderately tolerable because the city has few policies or processes in place to conserve connectivity |
| **Invasive Species** | M-H | Aquatic (river), formal green space, grasslands, wetlands, urban forest | Depends | Invasive species can compete with local species and make maintenance challenging. Species e.g. goldfish. Insects (e.g. emerald ash borer, cottony ash psyllid). Disease (e.g., Dutch elm disease) |
| **Lack of protection bylaws, lack of protected-status designation** | M-H | Urban forest | Depends | Loss of, damage to, and/or no compensation for trees due to a lack of tree protection bylaw(s) (or no knowledge of the existing policy). Decline of and/or inadequate maintenance for trees in key areas due to a lack of urban forest management plans / service levels. |
| **Flood Control** | M-H | Aquatic (river), formal green space, wetland | Intolerable | Flooding of river leading to habitat or property damage. Flood Control - wetlands help buffer flooding. |
| **Water Quality** | M-H | Aquatic (river), wetland | Depends for aquatic, intolerable for wetlands | As development encroaches on the river then there will be less filtering of water into the river. Wetlands filter our water and sequester pollutants / Wetlands and the riparian areas around them filter water and improve quality. |
| **Damage to grey & green infrastructure; wear & tear** | M-H | Formal green space, urban forest | Depends | COVID leading to increased use of these areas and therefore more litter, dog waste, and wear-and-tear. Damage both intentional and unintentional. Also includes resident interference. |
| **Incompatible uses** | M | Formal green space, outdoor recreation, wetland | Depends | Incompatible uses such as conflicts between active recreation like disc golf and a naturalized area. Outdoor rec spaces often have difficult growing conditions (compaction, low biomass) that can reduce ecosystem services. |

## TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

| Major Risks | Score | Impacted Assets | Tolerance for the Risk | Notes |
|---|---|---|---|---|
| **Erosion/ Sediments** | M | Aquatic (river), naturally non-vegetated, wetland | Depends | Erosion/Sediments impacting lacustrine processes, causing bank destablization. More erosion if natural areas not left in place. |
| **Aesthetics** | M | Wetland | Tolerable | Keeping wetlands intact improves the aesthetics of the city and enjoyment by citizens. |
| **Litter, illegal dumping** | M | Forest and shrubland, formal green space | Depends | On-going challenge. COVID: There is increased use of these areas, and therefore more litter and dog waste. |
| **Homelessness** | M | Forest and shrubland, formal green space | Intolerable | Homelessness is increasing as some community members are unable to access safe, affordable, accessible housing options. This can lead to encampments, litter, and fire risks. |
| **Staff capacity** | M | Formal green space, urban forest | Depends | Staff capacity/insufficient resourcing for the Parks Department. |
| **Pollutants -** | M | Aquatic (river), grasslands, wetland, urban forest | Depends | Pollutants/Heavy Metals/Plastics/ Light & Noise pollution impacting environmental quality. Includes road salt, debris, sand & vehicle contaminants. Impacts: trees on medians and boulevards, outfalls from drainage and snow dump meltwater go into the river taking pollutants. Wetlands & natural areas filter out pollutants. |
| **Soil health** | M | Cropland, informal green space | Depends | Soil impacts can reduce food production or impact crop research. Arable land in the city is usually for crop research. Receive many public complaints about the state of rights-of-way. The public often wants to garden in these spaces but sites require enhancements. |
| **Fire risks** | M | Grassland | Intolerable | Concerns: If intentional burns get out of control, or due to other environmental or human causes, damage to property. |

## TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

| Major Risks | Score | Impacted Assets | Tolerance for the Risk | Notes |
|---|---|---|---|---|
| **Availability of plant material / stock** | M | Urban forest | Tolerable | Availability of plant material / stock can sometimes be a challenge (in terms of quantity, quality, and species type). The right trees, the right amount of trees at the right time. |
| **Aging grey/built infrastructure** | M | Formal green space | Tolerable | |
| **Inadequate funding** | M | Formal green space, urban forest | Depends | Inadequate operational funding to (a) maintain assets (e.g., in terms of frequency, type, responsiveness, upgrade schedules) and (b) keep up with park service requests (e.g., site inspections, enforcement, response). |
| **Lack of public acceptance** | M | Urban forest | Intolerable | Lack of public acceptance (e.g., some residents do not want trees near their property, or naturalized plantings neighbouring their homes). |