Toward natural asset management in the

Town of Florenceville-Bristol

New Brunswick

Summary of inventory results and implications
April 2021

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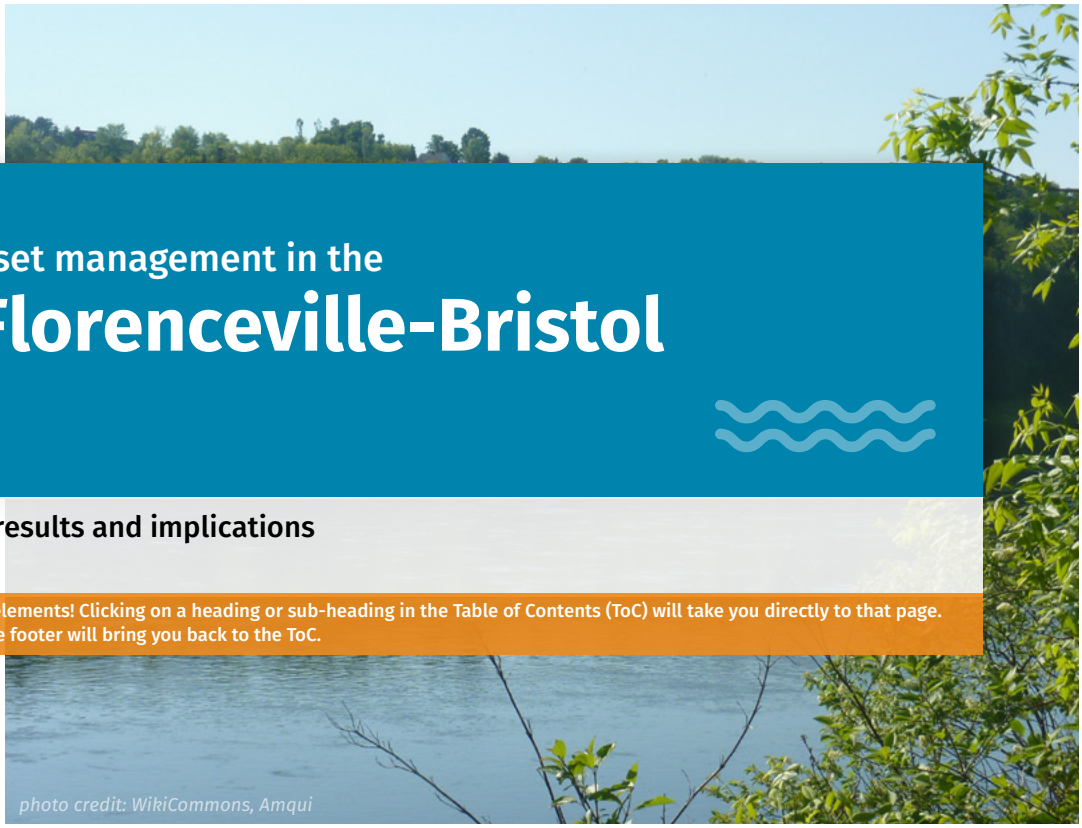

Municipal Natural Assets Initiative

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Making Nature Count

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.

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Table of Contents

1 Purpose

This document summarizes the results of a project to develop a natural asset inventory in the Town of Florenceville-Bristol, 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 ones. Doing so can enable local governments to 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.

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

What is a natural asset inventory

Inventories provide details on the type 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.

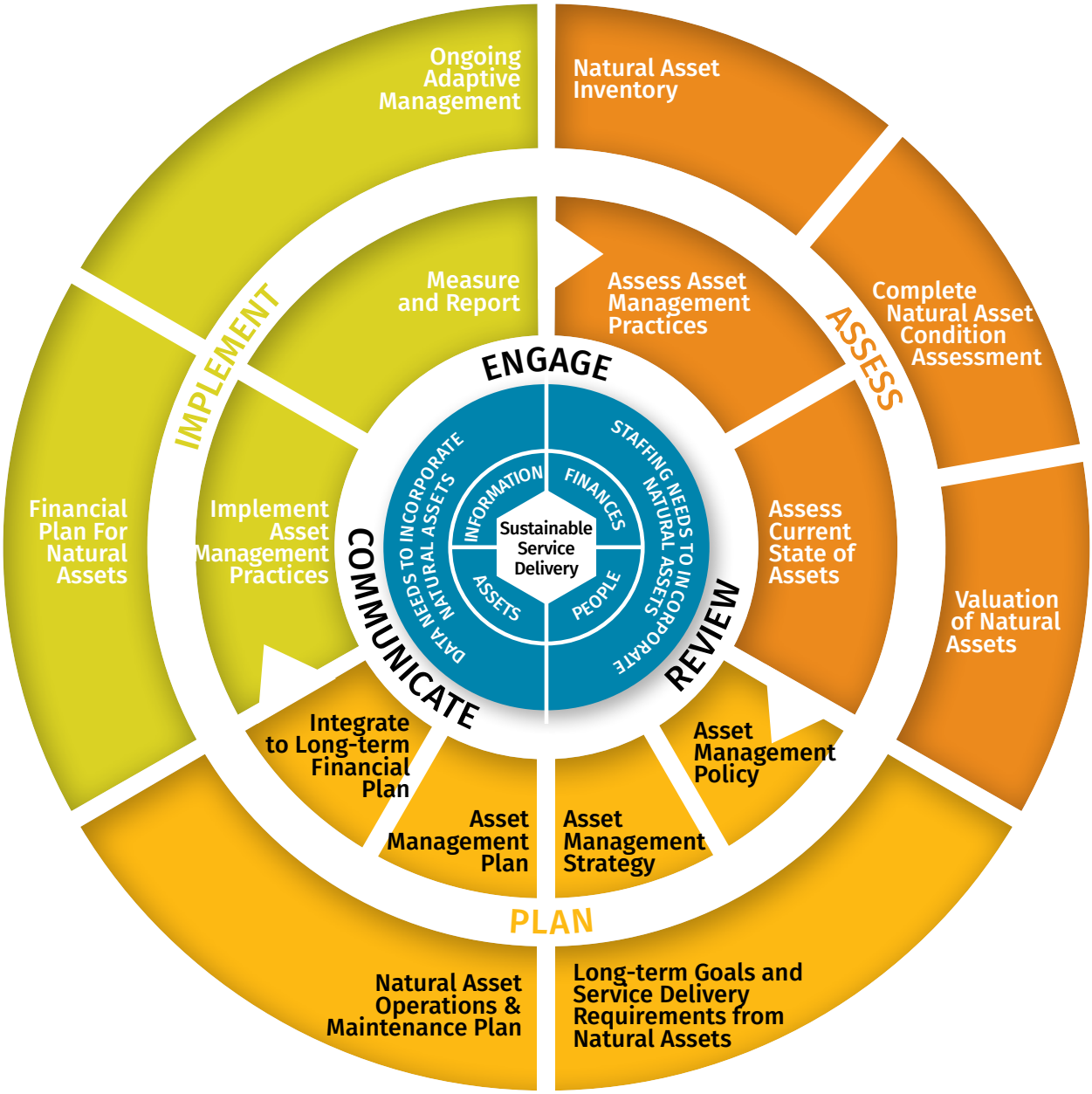

Figure 1: *The Asset Management Process. MNAI has adapted this for use with natural assets.*

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: Town of Florenceville-Bristol. Source: Wikipedia

Florenceville-Bristol (population ~1,600) is a town located on the banks of the Saint John River in the northwest part of Carleton County, New Brunswick. The "naturalness" of the community is a reason many people choose to live there and is a feature of business and residential recruitment strategies.

Florenceville-Bristol has already completed a natural asset management project with World Wildlife Fund (WWF)-Canada and MNAI in one part of the community[3]. The inventory project would build on this work and help Florenceville-Bristol better incorporate natural assets into municipal planning and existing asset management systems.

Florenceville-Bristol also wants better information to share with developers and residents on the value of natural asset services, and how they can be protected, enhanced, or restored.

A particular focus is on the aquifer as most of the community relies on private wells for water needs. The forested landscapes, trail system and recently restored wetland are also important to residents and provide valuable recreation spaces. Florenceville-Bristol also wants to enhance the service value of forested landscapes and the buffering capacity of wetlands for the municipality.

Stormwater management and dealing with flooding from the St. John river are also priorities. Climate change and adaptation resilience are strategic priorities and Florenceville-Bristol is interested in developing climate-friendly bylaws and planning processes and a Sustainable Neighbourhood Action Plan to combat climate change impacts and biodiversity loss; the inventory and any subsequent efforts could support these efforts as well.

3 *Florenceville-Bristol completed a natural asset management project on a catchment with the assistance of MNAI, WWF-Canada, and the Western Valley Regional Service Commission, which demonstrated the value of forests to reduce flooding. Details available at: mnai.ca/town-of-florenceville-bristol*

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 assessment will, in turn, help the local government prioritize actions that will increase its effectiveness in managing all assets, including natural ones.

Florenceville-Bristol is in the process of adopting asset management as a fully integrated business process. It is at the mid-level of progress for almost all outcome areas on the readiness scale, and at an early stage for incorporating natural asset management considerations in all areas. Its asset management policy is beginning to guide its actions and includes a statement about natural assets.

Florenceville-Bristol has an asset management team that is accountable for implementing its asset management program, and senior management has recognized the role of natural assets in service delivery as part of its commitment to its formal asset management program. Florenceville-Bristol's cross-functional team includes a staff person responsible for incorporating natural asset management-related needs into its asset management system. Florenceville-Bristol has a roadmap and has established performance measures for engineered assets.

4 Natural asset inventory

4.1. Inventory overview

MNAI's natural asset inventories have two main components, or ways, 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 Florenceville-Bristol 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 used the most recently available annual crop inventory data produced by Agriculture and Agri-Food Canada (AAFC) as

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

baseline for land use / land cover.[5] MNAI then combined this spatial data with data the municipality provided on wetlands and water bodies to establish a comprehensive depiction of natural assets. Table 1 describes the data sources used to develop the inventory and condition assessment.

TABLE 1: DATA SOURCES SUMMARY

DATA	SOURCE	PURPOSE
Municipal Boundary	Florenceville-Bristol	Used to determine study area and link datasets
Non-Forest	GeoNB	Used to create the base natural asset inventory
Forest	GeoNB	Used to create the base natural asset inventory
FB_WETLANDS2019	Florenceville-Bristol	Used to create the base natural asset inventory
FB_LC_ROUGHNESS	Florenceville-Bristol	Used to assign area of subclass descriptions to assets. For example, how much of an asset is light underbrush versus dense underbrush. Majority and minority subclasses of assets also added
FB_NBHB_WC	Florenceville-Bristol	Used to determine length of watercourse running through natural assets
Forest Soils	GeoNB	Used to assign majority soil drainage class and type to natural assets
Ecological Land Classification - EcoSection	GeoNB	Assets assigned to corresponding ecoregion, ecodistrict, and ecosection
Lidar Digital Elevation Model (1m DEM)	GeoNB	Used to assign a mean elevation in metres to each asset
High Resolution Digital Elevation Model (HRDEM) - CanElevation Series - 1m DSM	Natural Resources Canada	Used to create a 1m Canopy Height Model (CHM) by subtracting the DEM from the DSM. The mean elevation within forested areas was then assigned to the forest assets.
Wildlife Management Zones	GeoNB	Assets were assigned to relative WMZ
Pump_Stations	Florenceville-Bristol	Spatially joined to the full asset dataset because these points reside in areas classified as unnatural such as urban assets
Catchbasins	Florenceville-Bristol	Spatially joined to the full asset dataset because these points reside in areas classified as unnatural such as urban assets
Sanitary_MHs	Florenceville-Bristol	Spatially joined to the natural asset inventory
Inlets_Outfalls	Florenceville-Bristol	Spatially joined to the natural asset inventory
Sanitary_Pipes	Florenceville-Bristol	Summarized length within associated natural assets added to inventory

5 *[1] For more information on AAFC annual crop inventory, see: Annual Crop Inventory - Open Government Portal (canada.ca)*

TABLE 1: DATA SOURCES SUMMARY

DATA	SOURCE	PURPOSE
Storm_Pipes	Florenceville-Bristol	Summarized length within associated natural assets added to inventory
Subcatchment_FB	Florenceville-Bristol	Natural assets were assigned to associated subcatchment and relevant attributes of the subcatchment added to the natural asset inventory. Natural assets also summarized by subcatchment within dashboard

The inventory project defined a total of 4,958 individual assets, covering 980 hectares (ha) of the municipal area, as noted in Table 2. The majority of this area was forest cover, followed by agriculture.

TABLE 2: SUMMARY OF NATURAL ASSETS BY TYPE

NATURAL ASSET TYPE	NUMBER OF ASSETS	TOTAL AREA (HA)	AVERAGE ASSET AREA (HA)
Agriculture	111	442	3.99
Forest	240	548	2.28
Urban Greenspace	7	16.47	2.35
Wetland	14	8.50	0.61
Total	**372**	**1,015**	**2.73**

4.3. Asset registry

Each asset within the inventory has a unique identification number that allows individual assets to be selected, analyzed, and the corresponding data manipulated 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 Florenceville-Bristol's registry showing natural asset characteristics and details.

TABLE 3: EXCERPT FROM THE REGISTRY

Florenceville-Bristol Natural Asset Inventory | Summary | Asset Registry | Condition | Decomposition

Natural Asset Registry

Asset ID	Asset_Type	Asset Area (ha)	Sub Asset Area (ha)	Subcatchment Name	Eco Section	Main Tree Species	Sub Class	Majority Soil Drainage	Soil Type	Specific Landuse	Watercourse Length (km)	Inlets Outfalls Count	Length of Sanitary Pipes (km)	Length of Storm Pipes (km)	Sanitary MH Count	Adjacent Land Use Score	Permeability Score	Road Density Score	Relative Size Score	Total Score
PER8	Urban Greenspace	2.15	2.15	S51_2	3		Grass, Dense	3	Caribou	Treed Parkland	0.15	0	0.00	0.00	0	7	1	5	5	18
PER12	Urban Greenspace	2.08	2.08	S55_1	4		Grass, Dense	2	Muniac	Leisure Area	0.00	1	0.00	0.11	0	5	1	1	5	12
PER14	Urban Greenspace	4.11	0.72	S38_2	3		Fallow soils (no residue)	2	Muniac	Leisure Area	0.00	0	0.00	0.00	0	5	1	1	10	17
PER14	Urban Greenspace	4.11	3.39	S50_1	3		Fallow soils (no residue)	2	Muniac	Leisure Area	0.00	0	0.00	0.02	1	5	1	1	10	17
PER7	Urban Greenspace	3.72	0.09	S50_1	4		Grass, Dense	2	Carleton	Leisure Area	0.00	0	0.00	0.00	0	6	1	5	10	22
PER7	Urban Greenspace	3.72	3.62	S53_1	4		Grass, Dense	2	Carleton	Leisure Area	0.00	0	0.00	0.00	0	6	1	5	10	22
PER9	Urban Greenspace	4.42	4.42	S55_1	4		Grass, Dense	2	Muniac	Leisure Area	0.00	0	0.00	0.00	0	4	1	1		6
AGR100	Agriculture	4.44	1.21	S55_1	4		Grass, Dense	2	Muniac	Fallow Pasture	0.00	0	0.00	0.00	0	5	5	1	1	12
AGR100	Agriculture	4.44	3.24	S65_1	4		Grass, Dense	2	Muniac	Fallow Pasture	0.00	0	0.00	0.00	0	5	5	1	1	12
AGR101	Agriculture	1.94	1.94	S50_1	4		Woods, Light Underbrush	2	Carleton	Fallow Pasture	0.00	0	0.00	0.00	0	9	5	5	1	20
AGR103	Agriculture	2.36	0.04	S47_4	3		Ordinary Concrete lining	3	Caribou	Fallow Pasture	0.06	0	0.00	0.00	0	6	5	1	1	13
AGR103	Agriculture	2.36	2.31	S55_3	3		Ordinary Concrete lining	3	Caribou	Fallow Pasture	0.06	0	0.00	0.00	0	6	5	1	1	13
AGR108	Agriculture	1.38	1.38	S51_2	3		Grass, Dense	3	Caribou	Fallow Pasture	0.00	0	0.00	0.00	0	6	5	5	1	17
AGR11	Agriculture	0.77	0.77	S50_1	4		Grass, Dense	2	Carleton	Fallow Pasture	0.00	0	0.00	0.00	0	6	5	5	1	17
AGR110	Agriculture	0.14	0.14	S53_1	4		Grass, Dense	2	Carleton	Fallow Pasture	0.00	0	0.00	0.00	0	7	5	5	1	18
AGR13	Agriculture	0.05	0.05	S50_1	4		Grass, Dense	2	Carleton	Fallow	0.00	0	0.04	0.00	0	5	5	5	1	16

4.4. Online dashboard

Inventories may provide more insights when characterised visually in a dashboard, which enables users to explore different aspects of the data. For instance, natural asset information can be quickly summarized by watershed area, 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 3 and Figure 4 are screen shots from the dashboard that MNAI provided to Florenceville-Bristol. The full version can be accessed at *go.greenanalytics.ca/FlorencevilleBristol*.

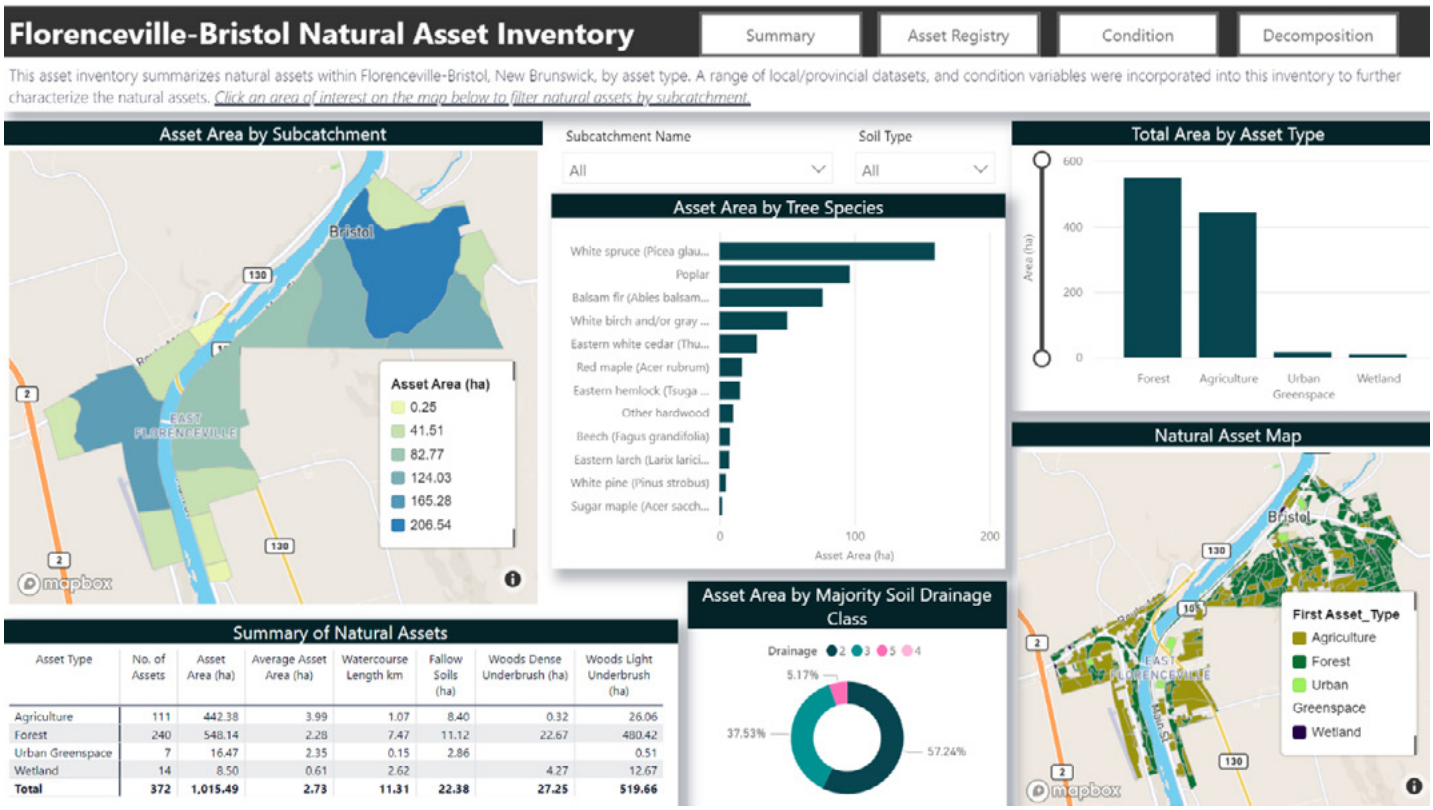

Figure 3: Screenshot of main inventory summary

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 Florenceville-Bristol. Table 4 summarizes the condition assessment steps and indicators.

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 square km), medium density (assets with between 1km and 2km of roads per square km), and low density (assets with less than 1km of roads per square km).	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. Urban areas, roads and industrial areas are ranked as nil. Assets within impervious surfaces are assigned as low permeability. Agriculture and shrublands are ranked as medium. 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*
Adjacent land use ('nearest neighbours')	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.	Natural asset inventory plus spatial representation of land use as well as intensity rankings of land uses.

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 rated as either 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 scorse between 10 to 19
- **Very Poor -** assets with a score lower than 10

Figure 4 is a summary of the condition assessment results for Florenceville-Bristol as presented in the online dashboard.

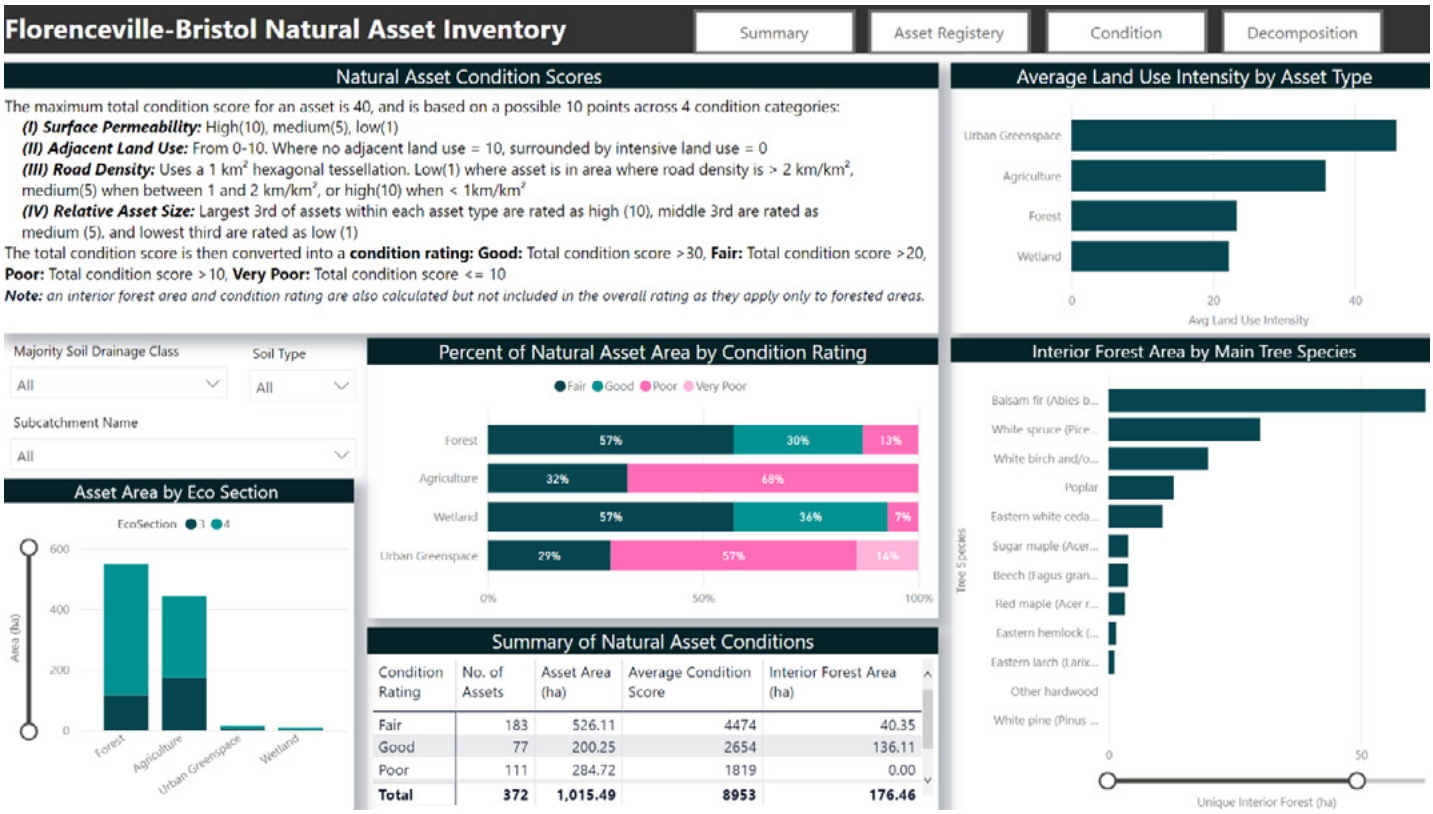

Figure 4: Screenshot of condition assessment results

Overall, about 200 ha (or 20 per cent) of natural assets were assessed in good condition and 526 ha (or 52 per cent) were assessed in fair condition.

Forests and wetlands were generally assessed in good and fair condition. Those that rated poor were due to a combination of these assets being relatively small, and in close proximity to dense roads.

Table 5 summarizes condition ratings and Figure 5 summarizes condition by natural asset type.

TABLE 5: SUMMARY OF NATURAL ASSET CONDITION RATINGS			
Condition Rating	**Number of Assets**	**Total Area (ha)**	**Average Total Score**
Good	77	200	34.47
Fair	183	526	24.45
Poor	111	285	16.39
Very Poor	1	4	6.00
Total	**372**	**1,015**	**24.07**

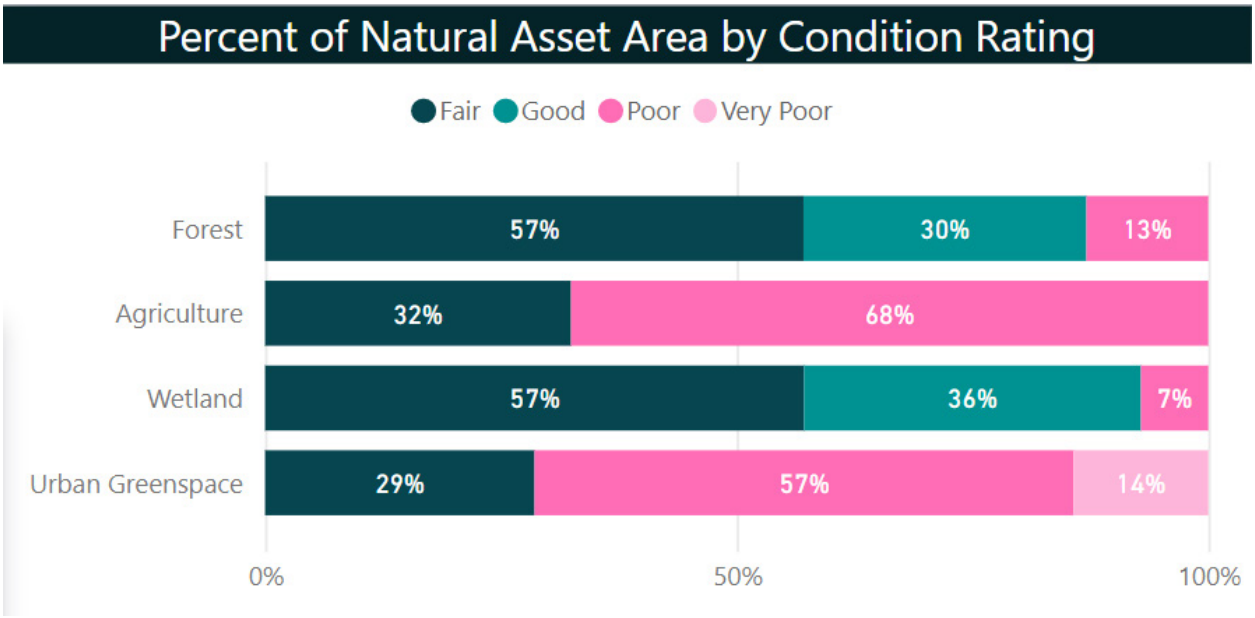

***Figure 5**: Summary of condition rating by natural asset type*

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. However, 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 at 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 through the identification of top risks to natural assets and their associated services, and 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 Florenceville-Bristol 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, Florenceville-Bristol considered possible risks that the loss of natural asset functions could pose to built infrastructure, personal health and safety, and private property, including:

- 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

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, Florenceville-Bristol considered four questions:

1/ what impact is likely to happen?
2/ what is the consequence of that impact happening?
3/ what can be done to mitigate the impact probability and/or consequence?
4/ what cues will signal the need for mitigation?

5.3. Results of the risk identification process

The risk identification process revealed:

- 6 high-level risks (flooding, development pressure, pollutant loading, erosion, ice jams, and political policy change)
- 5 medium-level risks (overuse of trails/dumping, forest fire, invasive species, drought, and construction activity)
- 4 low-level risks (storm surge, lack of flood hazard mapping, lack of land management plans, and lack of monitoring reports)

The identified risks affect natural assets across the entire area within Florenceville-Bristol boundaries, particularly those in the vicinity of the St. John River where floods, blizzards, ice and wind storms have caused economic, environmental, and social impacts.

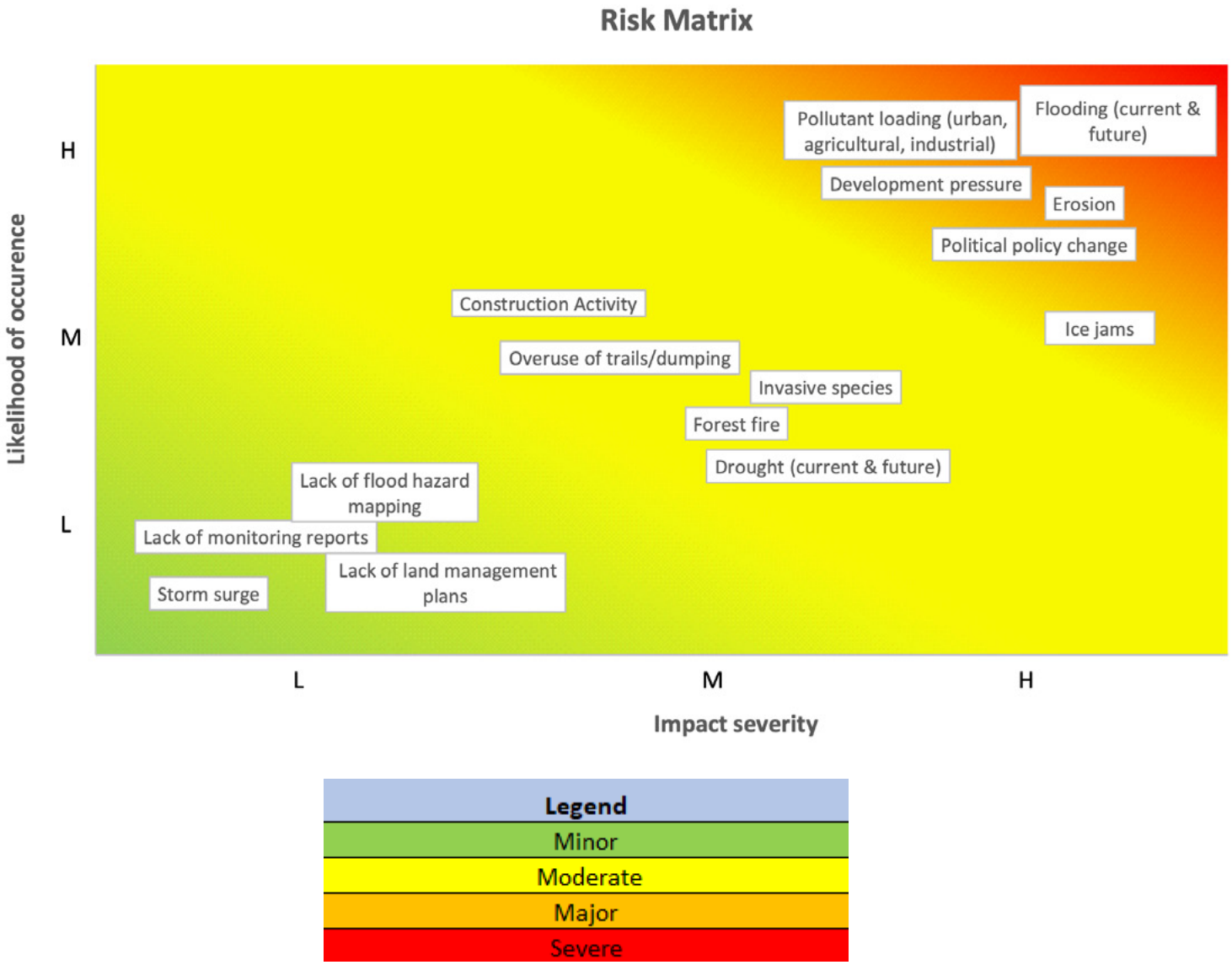

***Figure 6**: Results of risk management process*

6 Implications

This section provides insights that can be gained from considering both the inventory - including the condition assessment and risk assessment identification - and the asset management readiness assessment. It is divided into (a) potential priorities for the local government (b) possible actions for the further development of the inventory, and (c) issues the community can consider to advance to a full natural asset management initiative.

6.1. Potential priorities for the local government

Combining the results of the condition assessment with the outcomes of the risk identification highlights potential priorities on which Florenceville-Bristol could focus natural asset management efforts. These are:

- **Flooding:** Current and future flooding is a high-level risk that can have significant impacts to the community. Flooding of the St. John River can damage engineered infrastructure and businesses, alter travel routes, delay service delivery to residents, and result in damage or loss of natural assets adjacent to the River[6]. Florenceville-Bristol has completed adaptation actions to address current flooding such as greening and reinforcing riverbanks, replacement of the causeway crossing Route 105, and replacing and enlarging culverts[7]. Florenceville-Bristol has also worked with WWF-Canada, assisted by flood risk mapping completed by the University of New Brunswick's Forest Watershed Research Centre, to complete a climate change vulnerability assessment.
- **Development pressure:** Development pressure can impact natural assets across Florenceville-Bristol. Although the condition assessment reveals few instances of intensive land use, road density is of concern for forests in the S55-3 and S65_3 sub-catchments, and wetlands in S50_1 sub-catchment. Florenceville-Bristol mitigates development pressure through by-laws and policies such as the recently completed Municipal Plan that includes provisions to discourage development in environmentally sensitive areas, the implementation of riparian buffers to protect natural habitat, and the promotion of natural infrastructure.[8]
- **Pollutant loading:** Pollutant loading was identified as a high-level risk to natural assets, particularly to agricultural lands, green space and rivers/streams. Industrial pollution / accidents and fertilizer from agricultural fields were noted as leading contributors. The Municipal Plan controls or restricts any development or land use that would pollute sensitive environmental areas, protects water quality in water courses, and

6 *World Wildlife Fund, 2017.*

7 *Ibid.*

8 *Town of Florenceville-Bristol, 2020.*

strives to work with farmers, environmental and recreational groups to preserve natural areas[9].

- **Erosion:** Erosion resulting from flooding, ice jamming, and increased frequent and intense storms is recognized as a high-level risk to natural assets across Florenceville-Bristol. In particular, areas along the river are at risk of erosion, land loss, sedimentation, degraded habitat for aquatic life, and increased flooding. Various eroded areas have been repaired, but future impacts are of concern owing to projections for more frequent and intense precipitation. As part of the aforementioned climate change vulnerability assessment, Florenceville-Bristol has mapped areas of concern, shown below in Figure 7. Since that time, additional areas of concern have emerged, specifically along the boardwalk adjacent to the river in the downtown core. Additional measures may be required in erosion-prone areas.

Figure 7: *Florenceville-Bristol map indicating impact areas 2008 - present*

- **Ice jams:** Ice jam flooding in the St. John River is responsible for a significant portion of flood damage to communities and infrastructure in the province[10]. Local climate change projections indicate more widespread and frequent mid-winter thaws and ice break-ups, which

9 *Ibid.*

10 *Humes and Dublin, 1998.*

may result in ice jam floods. Should those jams re-consolidate, spring ice break-up may lead to severe impacts[11]. The Community Climate Change Vulnerability Assessment highlighted the need to develop forecasting capacity and analysis of ice jam flooding.

- **Political policy change:** Change in political leadership at municipal, provincial and federal levels can have unintended consequences on natural assets across Florenceville-Bristol; these may take time to emerge. Natural asset management can provide an opportunity to amend bylaws and regulations to protect critical natural assets such as forests, riparian areas, and green spaces along the St. John River. Table 6 lists and provides brief descriptions of risk mitigation strategies.

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.

Table 6 lists and provides brief descriptions of risk mitigation strategies.

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

Florenceville-Bristol is already adopting asset management and integrating it as a business process across the organization. It has achieved Level 3 in the competency area for data and information for engineered assets, which means it has a consolidated, basic inventory of all assets. It has defined life-cycle investment requirements for critical assets and has also standardized condition rating systems defined for most asset groups with asset condition information on all critical engineered assets. An important next step will be to build on the information on natural assets in its inventory to include an improved understanding of the condition of and risks to critical natural assets assumed to support municipal service delivery and the level of service they are providing to the community.

In its readiness assessment, Florenceville-Bristol identified a couple of immediate next steps as (1) to capture capital and operating expenditure data for at least one critical natural asset to support the desired level of service, and (2) to complete an economic valuation of at least one critical natural asset based on the replacement cost of grey infrastructure alternatives that could provide equivalent services.

11 *World Wildlife Fund, 2017.*

The above actions would support Florenceville-Bristol in its goals of being able to incorporate investment plans for natural assets in its asset investment planning and setting priorities that ensure the conservation and protection of natural assets, and to begin factoring in capital and operating costs for natural assets in its annual budgeting process for some key natural assets.

In terms of policy, staff also noted the need to strengthen the statement about natural assets in its asset management policy to explicitly reference the ecologic services that natural assets provide to support municipal service delivery. They would also like to incorporate objectives related to natural asset management into their asset management strategy and roadmap to show how it will be integrated into core infrastructure management processes over the next one-to-three years, and to inform Council of and have them approve the funding required to incorporate natural assets into core asset management business practices.

Even though a member of the asset management team is responsible for incorporating natural asset management into overall asset management practices, a helpful next step may be to complete a staff competency review to identify required skillsets for natural asset management and to fill gaps.

6.2. Possible actions for the further development of the inventory

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

- Expand the risk identification to include to field verification of results.
- Determine acceptable levels of risk to inform Florenceville-Bristol's risk mitigation strategies (see Table 6).
- 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. From a flooding and stormwater management perspective, the wetlands and forested areas in the watersheds will be key.
- Develop forecasting capacity and analysis of ice jam flooding.
- Share the inventory with adjacent local governments to stimulate collaboration.
- Add more condition ratings - for example, canopy cover, which also links to stormwater management services.
- Examine how urban development, forest fire, pollutant loading, and political pressures could increase risk to assets.
- 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.
- Maintain interest and momentum in natural asset management to move towards a full natural asset management project.

6.3. Steps to a full natural asset management project

If Florenceville-Bristol wishes to proceed with a full natural asset management project for additional areas[12], including implementation, they could consider the following steps:

1/ **Confirm scope, roles and responsibilities**. Undertake a meeting or workshop to confirm (a) assumptions [for example, that the aquifer, forested landscapes and trails are of particular concern] (b) roles, responsibilities and capacities (c) community capacity to undertake a larger project.

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. It gives communities the ability to explore how different actions will affect the health and corresponding performance of natural assets.

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, for example, “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**. The natural asset implementation phase is an adaptive management cycle, not a finite journey. It is during this time that actions identified based on the previous steps can begin to be implemented. MNAI can provide ongoing advice / guidance on policy

12 *I.e. beyond the specific area explored in its earlier MNAI project that is noted at mnai.ca/town-of-florenceville-bristol/*

pieces and integration of the above information for 12-18 months. After this point, the local government, together with local partners and service providers, would ideally have the capacity to continue these efforts on their own.

7/ **Ongoing monitoring**. Project monitoring is essential 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 a period of three years through a monitoring arrangement to be established with the communities.

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Annex: Results of risk identification

This Annex contains the results of the use of MNAI's risk identification tool, which they self-administered with guidance from MNAI. Table 1 was the main product, developed by Florenceville-Bristol personnel, that resulted 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 1: SIMPLIFIED RISK IDENTIFICATION SURVEY

Risk	Ranking (L/M/H)	Assets Affected	Location	Notes
1/ Overuse of trails/ dumping	M	Forests, streams, river	Shiktehawk, NB Trail, streams, rivers	Municipal issue. Mitigate through by-laws, policies and monitored by Town staff.
2/ Flooding (current and future)	H	All	River adjacent	Impact significant and affect all aspects of the community. Provincial/Federal/Municipal responsibility.
3/ Forest fire	M	Forests	Forested areas	Dealt with by Province and Fire Department
4/ Invasive species	M	All	All	Lack of information and capacity issue
5/ Development pressure	H	All	All	Mitigate through by-laws, polices, etc.
6/ Pollutant loading from urban, agricultural, or industrial sources (e.g., overuse of salt on roads)	H	All but primarily agriculture, green space, rivers/streams	All	Fertilizer from agricultural lands
7/ Drought (current and future)	M	Streams, rivers, forests, wetlands and agriculture	All	Increasing risk
8/ Erosion	H	All	All	Impacted by flooding, ice jamming, increased frequency, and intensity of storms
9/ Ice jams	H	All	All	Impacted by flooding, ice jamming, increased frequency and intensity of storms
10/ Storm surge	L	Riparian areas	Riparian areas	
11/ Lack of flood hazard mapping	L	All	All	
12/ Lack of land management plans	L	All	All	

TABLE 1: SIMPLIFIED RISK IDENTIFICATION SURVEY				
13/ Lack of monitoring reports	L	All	All	Built infrastructure asset management plan, natural asset management plan, groundwater study, water availability study, staff and community monitoring
14/ Construction activity	M	All	All	Working on it – partially there with by-laws and policies but need more examples to make some headway
15/ Political policy change	H	All	All	Change in political leadership at municipal, provincial and federal levels

Municipal Natural Assets Initiative