Town of
Stratford
PRINCE EDWARD ISLAND

Toward natural asset management in the
Town of Stratford
Prince Edward Island

Summary of inventory results and recommendations
January 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

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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.

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Table of Contents

1 Purpose

This document summarizes the results of a project to develop a natural asset inventory for the Town of Stratford, P.E.I., 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.
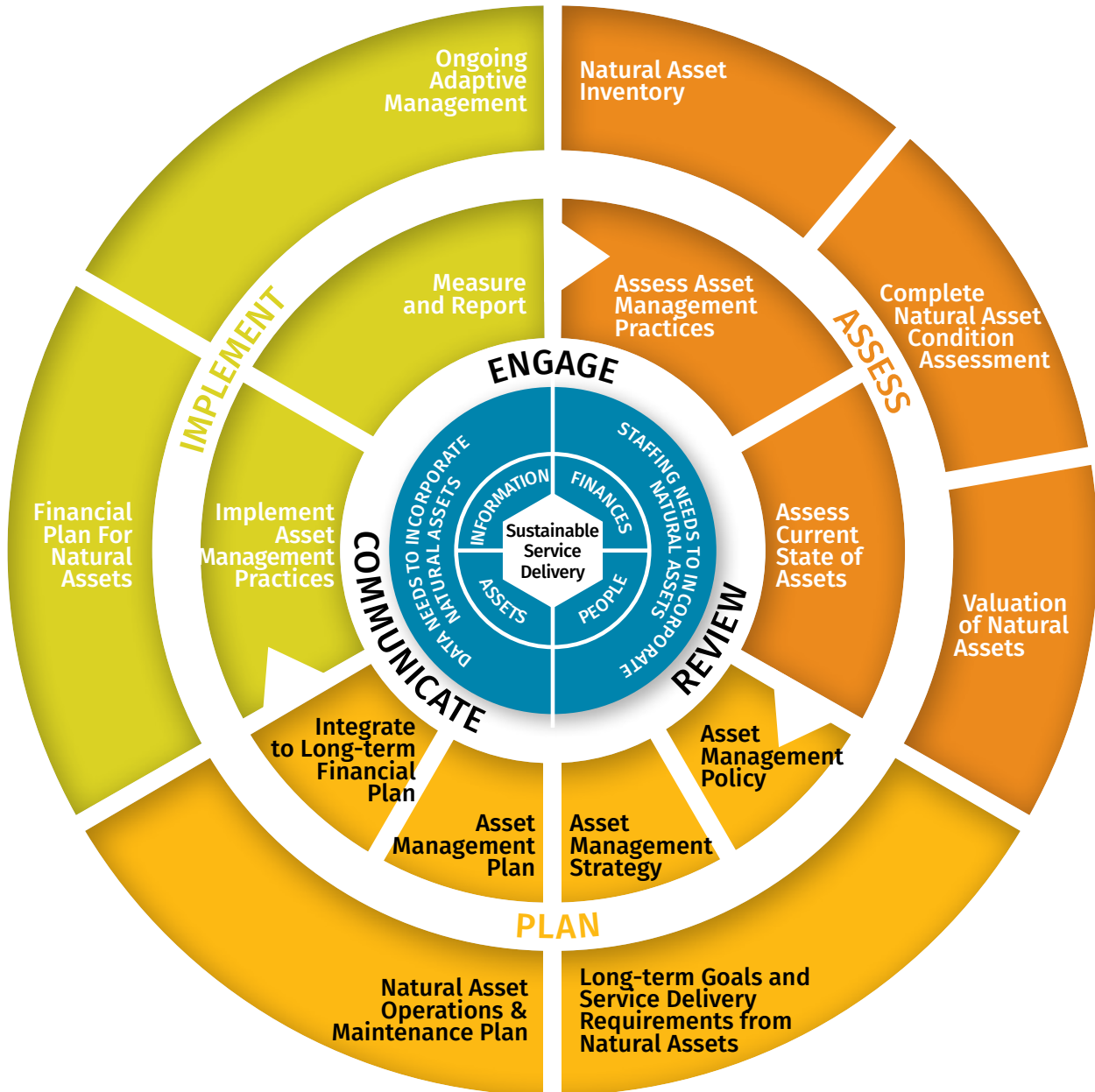
Figure 1: *The Asset Management Process. MNAI has adapted this for use with natural assets.*

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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:
Town of Stratford[3].

The Town of Stratford (population ~9,700) is located in Queens County, Prince Edward Island. It is southeast of the City of Charlottetown and is the third-largest municipality in the province.

The Town of Stratford's interest in natural asset management is two-fold. First, it wants to better understand the natural assets upon which it relies for services. This includes gaining knowledge on their condition, the threats they face, and the services they provide. This understanding will help better protect and enhance these natural assets.

Second, the Town of Stratford aims to incorporate natural asset management into its existing asset management plans. This inventory will serve as a starting point to identify resources that may be required for natural asset management[4].

The Town of Stratford identifies development pressure as a key risk facing natural assets. Urban forests and corridors, local pond systems, an aquifer, and natural soil currently constitute priority natural assets. Stormwater management, flood and source water protection are its priority services.

> The Town of Stratford acknowledges that the land upon which they gather is unceded Mi'kmaq territory. Epekwitk (Prince Edward Island) is covered by the historic Treaties of Peace and Friendship. The Town of Stratford pays its respects to the Indigenous Mi'kmaq People who have occupied the Island for over 12,000 years; past, present and future.

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3   *Wikipedia. Retrieved August 2021 from en.wikipedia.org/wiki/Stratford,_Prince_Edward_Island.*

4   *2014 Imagine Stratford – Town of Stratford Official Plan (working copy). Retrieved August 2021 from stratford.civicweb.net/document/103833/9a-1%20-%20Revised%20OP%20BTY%20working%20copy.pdf?handle=5B2868971399407F869DBA5C5F39E06E*

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[5] 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 Town of Stratford is at an early stage of adopting organization-wide asset management. It has an Asset Management Policy that applies to all physical assets it owns or is responsible for managing; the policy does not specifically exclude natural assets. The Chief Administrative Officer and Environmental Sustainability Coordinator recognize the importance of natural assets to deliver services; however, to-date, there is little awareness of the role natural assets play in service delivery among other senior staff or council members. The Town of Stratford's Environmental Sustainability Coordinator is beginning to identify and work on short-term actions to support natural asset management.

The Town of Stratford does not yet have an asset management strategy or roadmap in place for all service areas, but it does have a high-level roadmap for water and sewer engineered assets. Specific objectives for natural asset management have not yet been defined. Data has not yet been collected to measure progress on the implementation of asset management.

Competency 2: People & Leadership

The Town of Stratford has a formal, permanent, cross-functional asset management team that includes senior representation from all departments. Team members have designated roles and responsibilities but no one on the team has responsibility yet for natural asset management considerations.

Council has demonstrated political buy-in and support for asset management and has funded priority improvements, but does not yet champion asset management in the same sense that staff does. Council is not yet fully aware of what commitments and resourcing might be required to make progress on natural asset management.

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

Competency 3: Data & Information

The Town of Stratford is currently building its asset management data and information foundation. It has basic inventory data for most major assets, including information on general asset properties such as size, material, location, and installation date. It is beginning to centralize its data and information for the asset management team to use, has defined critical assets, and has some condition information for them. Data and information is more robust for some engineered assets than others, such as water and sewer assets. The Town of Stratford has captured capital and operating expenditure data for some assets and has developed a strategy to link its asset management data with financial information about the assets.

The Town of Stratford has a basic inventory of natural assets from this project, as well as information on the condition and performance of its aquifers and natural assets that deliver stormwater services such as wetlands. It does not yet have any financial data associated with natural assets.

Competency 4: Planning & Decision-making

The Town of Stratford's departments all follow a similar approach to asset investment planning. The approach is still evolving and evaluates investment needs and priorities based on a mix of structured and ad hoc practices and criteria. As yet, there is no documented approach to managing or protecting natural assets that support municipal service delivery, but the strategic plan does have a goal related to natural asset management.

Because it is still in an early stage of adopting asset management, asset investment plans are typically reactive and focus on addressing basic needs (e.g., growth, regulations and known problems). That said, its water and sewer utility is further advanced on asset management and has done forecasting of financial needs based on estimated data.

Technically, the Town of Stratford has a five-year capital plan; however, capital planning is informal and budgeting is based on trends in spending and requirements for one to two year periods.

With respect to natural asset management, the Town of Stratford has made some commitments to conserve and protect critical natural assets/areas but has not yet translated these commitments into developing formal natural asset management plans. The Town of Stratford sets aside $7,000 annually for Kelly's Pond restoration.

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 Town of Stratford 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 Town of Stratford and the Province of Prince Edward Island (open data). 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
municipal_boundaries	Municipal Boundaries	Prince Edward Island Government	Used to delineate the study area boundary for the Town of Stratford.
1990_ForestInventory	Forest Inventory	Town of Stratford	Used as the main source of landcover for the natural asset inventory. Data quality performed with satellite imagery and dataset adjusted where possible.
Wetlands2000_Modified	Wetlands	Prince Edward Island Government	Used to add in wetlands not captured in the 1990 forest inventory to the inventory of natural assets.
ParkOpenSpaces	Parks and Open Spaces	Town of Stratford	Used as the main source for green spaces in the natural asset inventory. Merged green space polygons with the forest inventory to capture semi-natural assets not captured in the forest inventory. Also added the park name to inventory.
SportsFields	Sport Fields	Town of Stratford	Used to capture green spaces not accounted for in forest inventory or the parks and open spaces dataset. Sport field name also added to inventory.

TABLE 1: SUMMARY OF DATA SOURCES

DATASET NAME	DESCRIPTIVE NAME	SOURCE	PURPOSE
NRN_PE_17_0_ROADSEG	PEI Roads Dataset	Prince Edward Island Government	Used to insert road polygons from 8-metre buffers surrounding road lines. Also used to perform road density condition assessment.
LandUseMap	Stratford Landuse	Town of Stratford	Used to assign relevant land use category to natural assets based on largest area of overlap.
PEI LiDAR Watershed Boundaries 2008	PEI Watersheds	Prince Edward Island Government	Used to split assets in the natural asset inventory by watershed and to summarize natural assets by watershed in the dashboard.
2021Electoral_Ward_ Boundaries	2021 Stratford Wards	Town of Stratford	Used to assign natural assets to relevant ward for filtering the inventory by ward.
PEI_Hydronetwork	PEI Hydronetwork	Town of Stratford	Used to summarize length of watercourses within natural assets.
GovProperties	Provincial and Federal Gov Properties	Town of Stratford	Used to summarize area of natural assets that are federally or provincially managed.
TownProperties	Town of Stratford Properties	Town of Stratford	Used to summarize area of natural assets the Town of Stratford manages.
Trails	Stratford Trails	Town of Stratford	Used to summarize length of trails within natural assets.
LandZoningMap	Land Zoning	Town of Stratford	Used to assign zoning category to natural asset based on largest area of overlap between the zoning parcel and natural asset.
Soils	Soil Survey	Prince Edward Island Government	Used to assign soil drainage type to natural assets based on largest area of overlap.
SurficialGeology	Surficial Geology	Prince Edward Island Government	Used to assign surficial geology description to natural assets based on largest area of overlap.

The inventory project defined a total of 920 individual assets, covering 1,348 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 the Town of Stratford was forests, 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	50	444	8.87
Built-up Pervious*	93	185	1.99
Cleared Land	59	175	2.97
Forest	591	477	0.81
Water	9	0.61	0.07
Wetland	118	66	0.56
Total	**920**	**1,348**	**1.47**

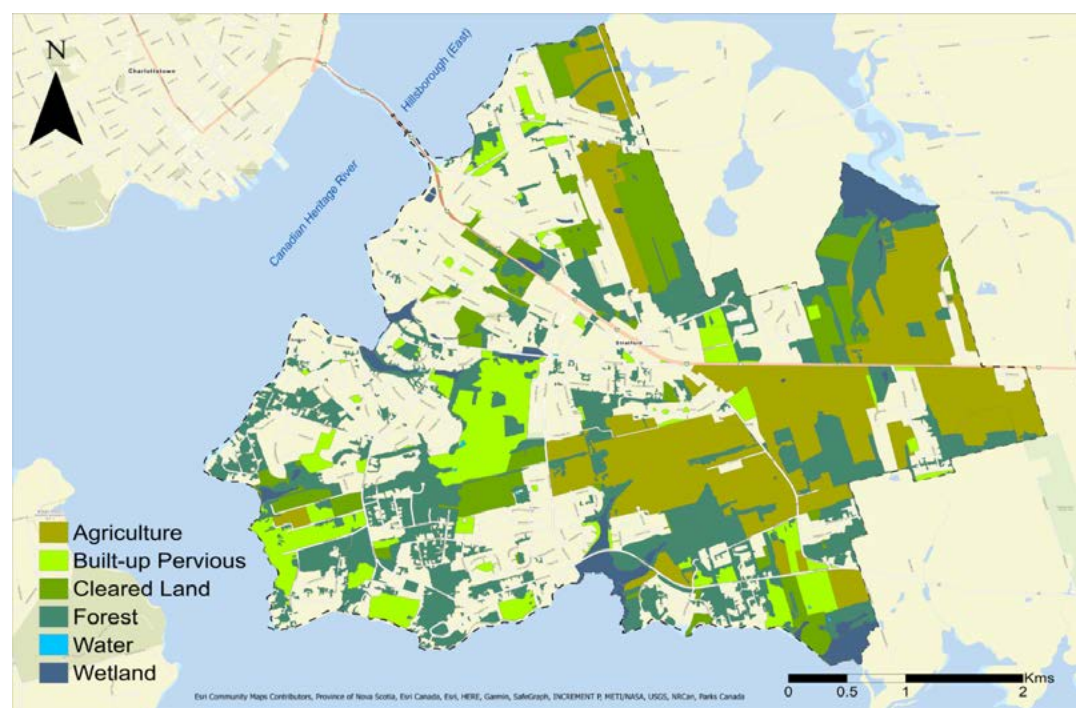Figure 3 shows the spatial distribution of the natural assets.

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 Town of Stratford's online registry showing natural asset characteristics and details. Additional detail is provided in the online dashboard.

TABLE 3: EXCERPT FROM THE REGISTRY

Natural Asset Registry

Asset ID	Asset Type	Asset Area (ha)	Asset Area in Watershed (ha)	Watershed Name	Ward Name	Landcover	Flagged for Future Development	Future Development Area (ha)	Stratford Owned (ha)	Provincial Owned (ha)	Flood Extent 2100 Area (ha)	Flood Extent 2020 Area (ha)	Stream Length (km)	Trail Length (km)	Vegetated 15m Buffer Area (ha)	Permeability Score	Relative Size Score	Adjacent Land Use Score	Road Density Score	Total Score
AGR10	Agriculture	1.84	1.84		Ward 3 (Tea Hill)	Agriculture	No	0.00	0.00		0.79	0.51	0.00	0.00	0.38	5	1	8	1	15
CLR19	Cleared Land	2.66	2.67		Ward 2 (Stewart Cove)	Cleared Land not in Ag Use	No	0.00	0.00		0.26	0.05	0.00	0.00	0.25	5	1	8	5	19
CLR22	Cleared Land	12.11	12.11		Ward 3 (Tea Hill)	Cleared Land not in Ag Use	No	0.00	1.16		5.32	2.29	0.00	0.00	1.19	5	5	9	10	29
CLR49	Cleared Land	0.00	0.01			Cleared Land not in Ag Use	No	0.00	0.00		0.01	0.01	0.00	0.00	0.01	5	1	7	1	14
CLR49	Cleared Land	0.00	1.84		Ward 3 (Tea Hill)	Cleared Land not in Ag Use	No	0.00	0.00		0.04	0.02	0.00	0.00	0.49	5	1	7	1	14
CLR7	Cleared Land	0.51	0.51		Ward 2 (Stewart Cove)	Cleared Land not in Ag Use	No	0.00	0.00		0.11	0.07	0.03	0.00	0.33	5	1	10	10	26
FOR169	Forest	6.83	6.83		Ward 2 (Stewart Cove)	>75% Softwood Species	No	0.00	0.34		0.67	0.49	0.28	0.00	1.93	10	5	8	1	24
FOR300	Forest	0.06	0.06		Ward 2 (Stewart Cove)	Unknown Forest	No	0.00	0.05		0.00		0.00	0.00	0.04	10	1	7	1	19
FOR497	Forest	2.79	0.57		Ward 1 (Kellys Cove)	50-75% Hardwood Species	No	0.00	0.00		0.01	0.01	0.00	0.00	0.12	10	5	5	1	21
FOR497	Forest	2.79	2.23		Ward 2 (Stewart Cove)	50-75% Hardwood Species	No	0.00	0.00		0.00	0.00	0.00	0.00	0.04	10	5	5	1	21
FOR503	Forest	0.61	0.61		Ward 2 (Stewart Cove)	50-75% Hardwood Species	No	0.00	0.32		0.48	0.41	0.12	0.06	0.44	10	1	8	1	20
Total			1348.03					104.62	214.43	4.23	64.79	50.83	10.19	17.39	46.51					

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 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 4 is a screenshot from the dashboard that MNAI provided to the Town of Stratford. The full version can be accessed at *go.greenanalytics.ca/Stratford*.
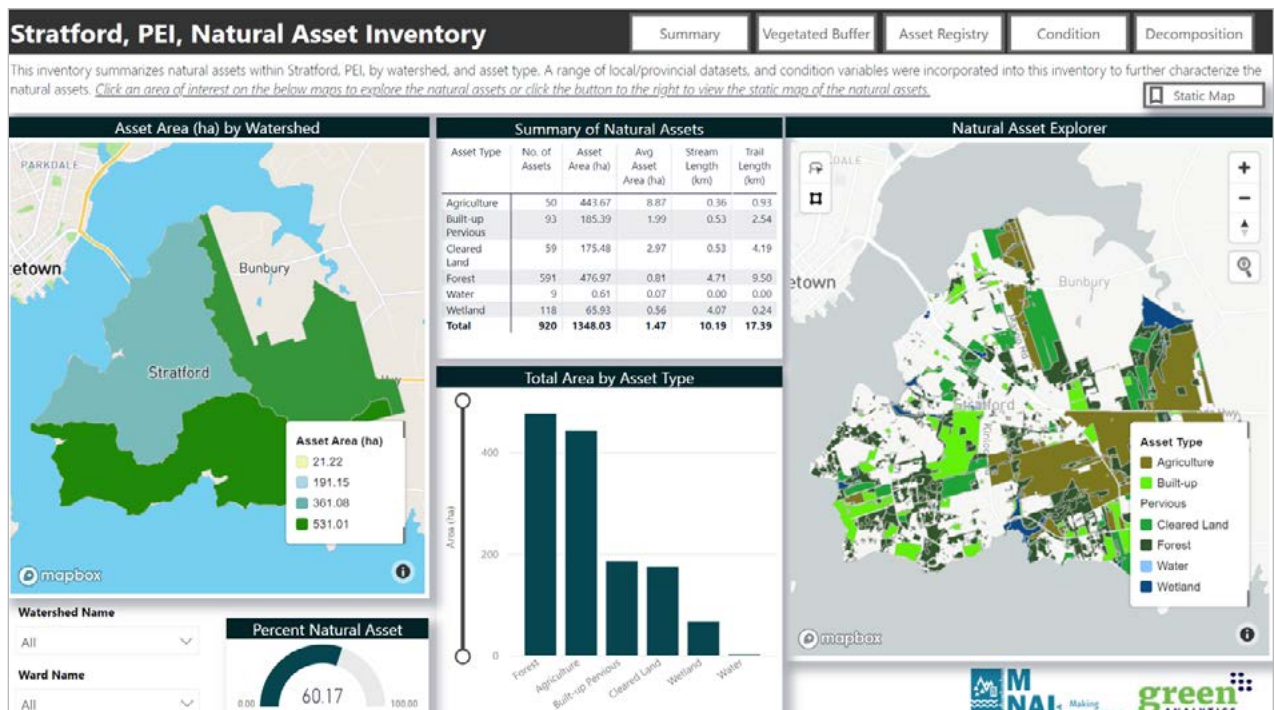
Stratford, PEI, Natural Asset Inventory

| Summary | Vegetated Buffer | Asset Registry | Condition | Decomposition |

This inventory summarizes natural assets within Stratford, PEI, by watershed, and asset type. A range of local/provincial datasets, and condition variables were incorporated into this inventory to further characterize the natural assets. *Click an area of interest on the below maps to explore the natural assets or click the button to the right to view the static map of the natural assets.*

☐ Static Map

Asset Area (ha) by Watershed

Summary of Natural Assets

Asset Type	No. of Assets	Asset Area (ha)	Avg Asset Area (ha)	Stream Length (km)	Trail Length (km)
Agriculture	50	443.67	8.87	0.36	0.93
Built-up Pervious	93	185.39	1.99	0.53	2.54
Cleared Land	59	175.48	2.97	0.53	4.19
Forest	591	476.97	0.81	4.71	9.50
Water	9	0.61	0.07	0.00	0.00
Wetland	118	65.93	0.56	4.07	0.24
Total	**920**	**1348.03**	**1.47**	**10.19**	**17.39**

Natural Asset Explorer

Asset Area (ha)
- 21.22
- 191.15
- 361.08
- 531.01

Total Area by Asset Type

Asset Type
- Agriculture
- Built-up Pervious
- Cleared Land
- Forest
- Water
- Wetland

Watershed Name
All

Percent Natural Asset
60.17

Ward Name
All

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 Town of Stratford. 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, soil condition, connectivity) and possibly employ 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. 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*

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 per the online dashboard.
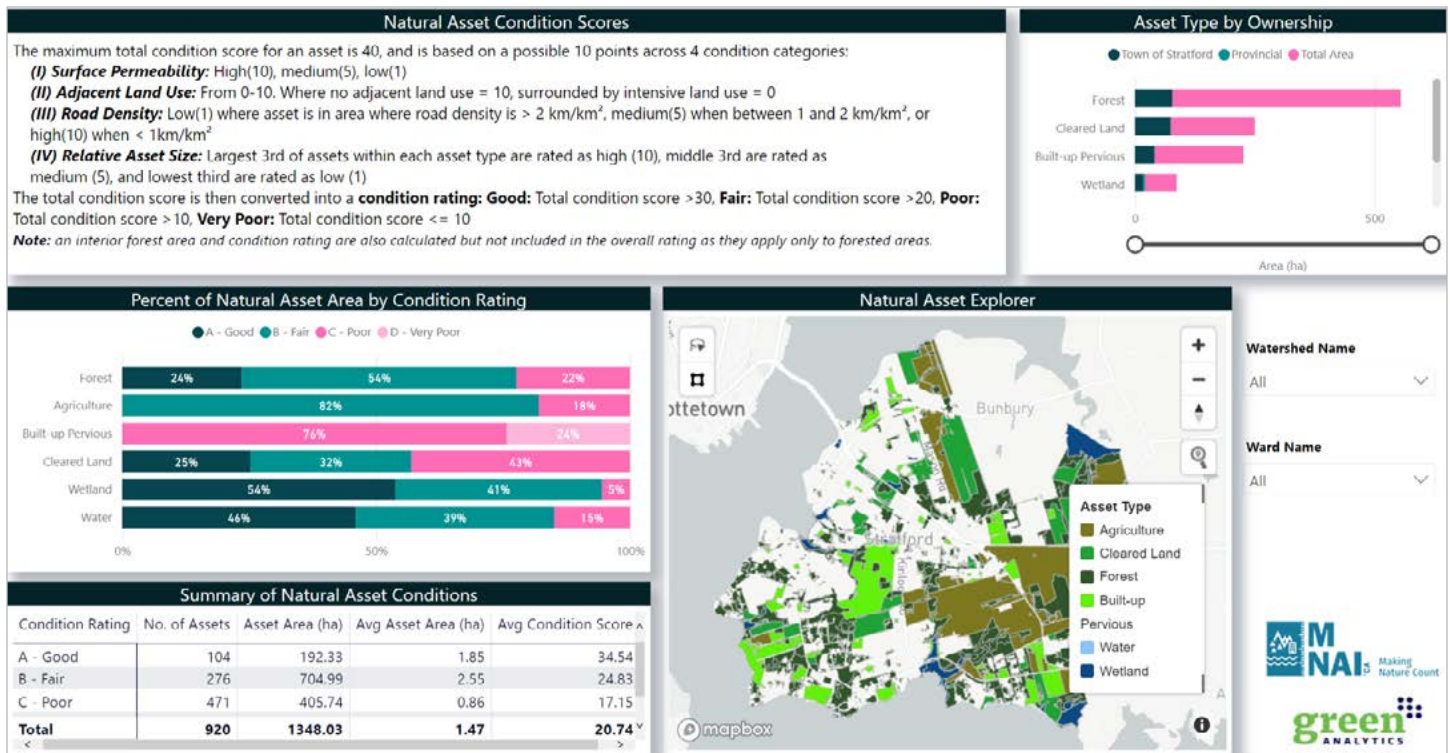

Figure 5: *Screenshot of condition assessment details.*

Overall, about 192 ha (or 14 per cent) of natural assets were assessed in good condition and 705 ha (or 52 per cent) were assessed in fair condition. Wetland and water assets largely ranked good and fair, while forest ranked a combination of good, fair and poor.

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	104	192	34.54
Fair	276	705	24.83
Poor	471	406	17.15
Very Poor	69	45	8.13
Total	920	1,348	20.74

Percent of Natural Asset Area by Condition Rating

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

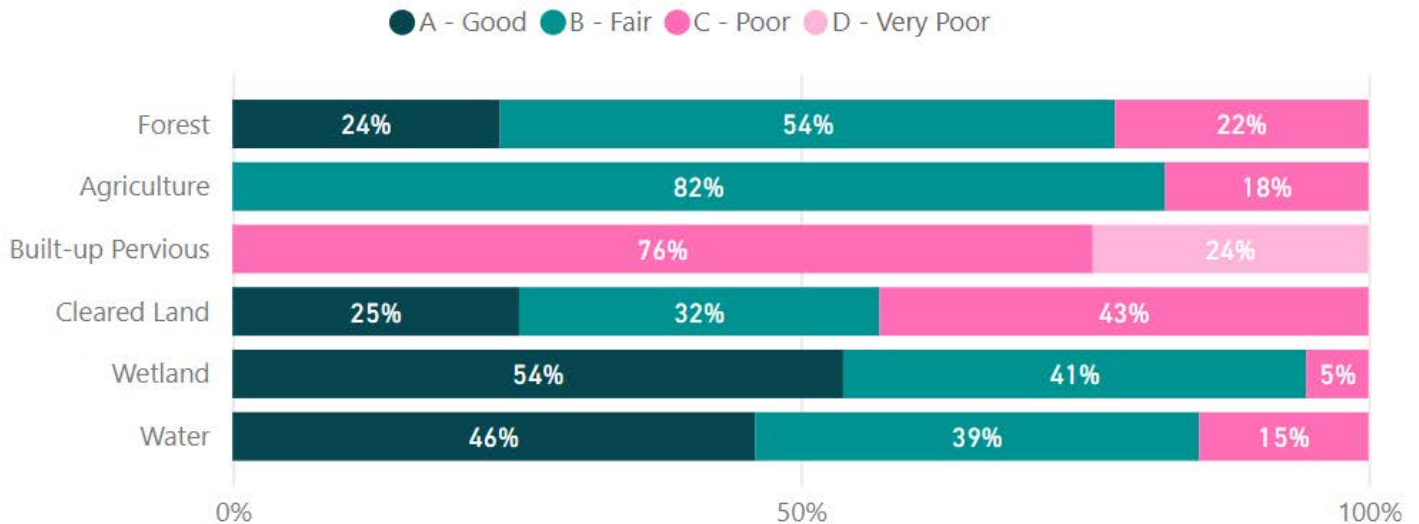| Asset Type	A - Good	B - Fair	C - Poor	D - Very Poor
Forest	24%	54%	22%	
Agriculture		82%	18%	
Built-up Pervious			76%	24%
Cleared Land	25%	32%	43%	
Wetland	54%	41%	5%	
Water	46%	39%	15%	

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 Town of Stratford 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 Town of Stratford 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 / illegal dumping
- Flooding
- Forest fire
- Invasive species
- Development pressure
- Pollutant loading
- Drought
- Erosion
- Lack of land management plans
- Policy change
- Hurricanes
- Transportation of dangerous goods

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 Town of Stratford considered four questions:

i/ what impact is likely to happen?

ii/ what is the consequence of that impact happening?

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

**iv/** what cues will signal the need for mitigation?

5.3. Results of the risk identification process

The risk identification process revealed:

- 3 high-level risks (development pressure, coastal erosion, and lack of land management plans)

- 5 medium-level risks (invasive species, pollutant loading in urban and industrial areas, drought, inland erosion, and hurricanes)

- 1 low-medium level risk (inland flooding)

- 6 low-level risks (overuse of trails / illegal dumping, coastal flooding, forest fires, pollutant loading in non-urban areas, policy change, and transportation of dangerous goods)

The identified risks affect natural assets across the Town of Stratford, with numerous risks in urban and suburban areas as well as coastal areas. The identified risks also have the potential to negatively impact engineered assets (both Town-owned and non-Town-owned), property, and personal health and safety.

Risk Matrix
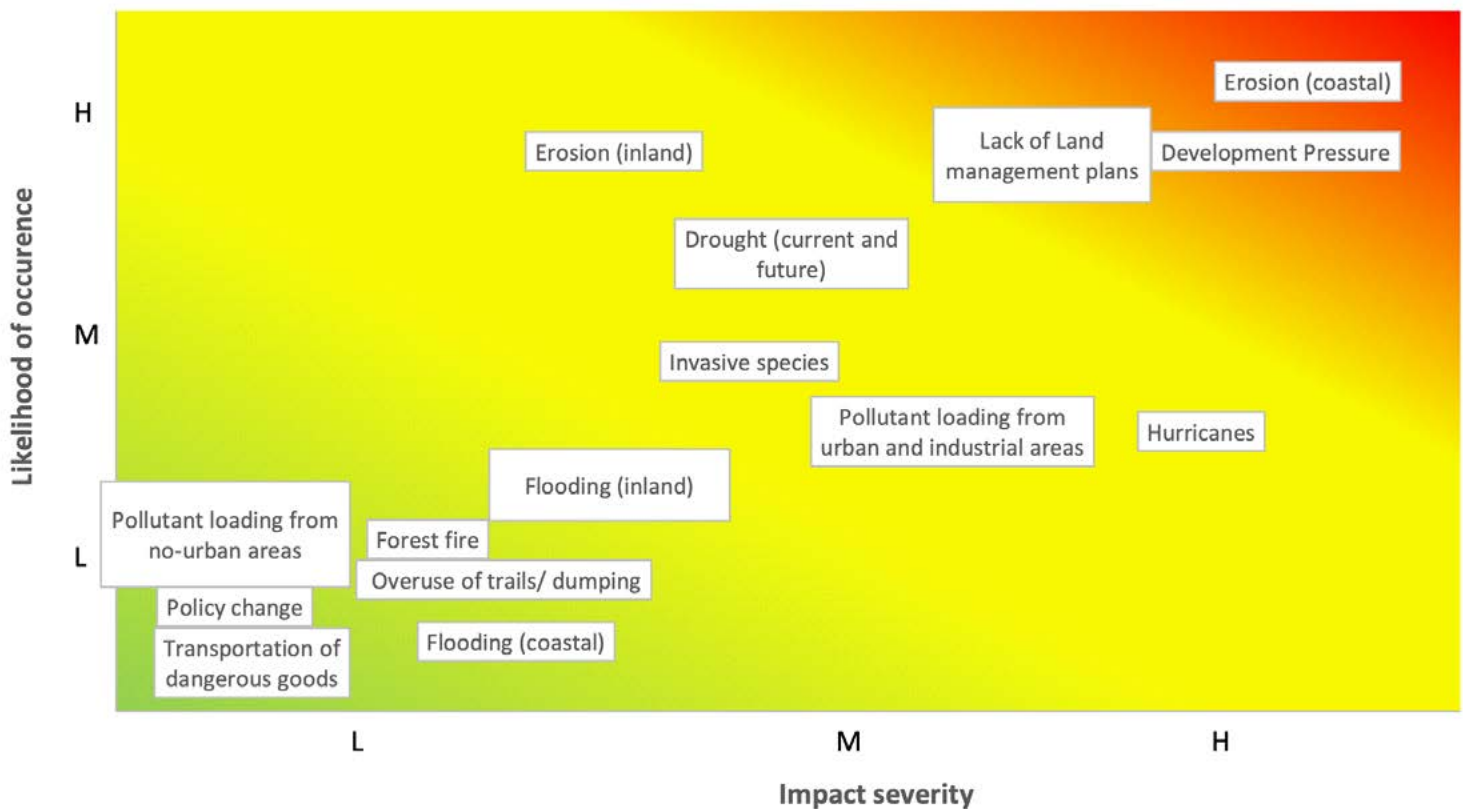
Figure 7: Results of risk identification process.

5.4. Potential priorities for the local government

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

- **Development pressure:** The Town of Stratford is one of the fastest-growing municipalities in Atlantic Canada. Staff have identified development pressure as a high-level risk to natural assets near urban and suburban areas, particularly agricultural land, cleared land, and forested areas. This is reflected in the condition assessment results that reveal road density to be driving poor condition rankings. There is protection for natural assets located in protected areas such as the Recreational and Open Space Zone (O1), the Environmental Reserve Zone (O2) of the local zoning bylaw[6], and in buffer zones under protection from provincial legislation. However, the majority of natural assets outside these areas remain at risk. The degradation or loss of natural assets resulting from development may put additional pressure on engineered assets.

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6   *Town of Stratford, 2019.*

- **Coastal erosion:** Coastal erosion was identified as an increasing high-level risk to natural assets in coastal areas. The sandstone coastline and lack of buffer vegetation, coupled with climate change impacts becoming more frequent and intense, threatens all coastal assets, the health and safety of residents, and may negatively impact the local economy. The Town of Stratford completed erosion monitoring and shoreline classification in 2010.[7] Assessing the relative role of coastal natural assets in mitigating erosion and storm surge is a next step to determine a risk mitigation strategy.

- **Lack of land management plans:** The Town of Stratford identified the lack of land management plans as a high-level risk to all natural asset areas. While they do practice land use planning and have a wellfield protection plan, a natural asset management plan could provide information including the state of natural assets, desired levels of service, risks to delivering services, a life-cycle management strategy, and a financial strategy to meet organizational objectives.

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 Town of Stratford can consider to advance to a full natural asset management initiative.

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7   *Natural Resources Canada, 2010.*

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

The Town of Stratford is at a relatively early stage in its asset management journey. This presents opportunities to ensure that natural asset management considerations are integrated into asset management practices. From a governance perspective, the asset management policy does not exclude natural assets, so it should be assumed that the policy applies to natural assets and engineered infrastructure. It could be helpful to make this inclusion explicit in a future version of the policy.

If the Town of Stratford develops an asset management strategy or roadmap for all service areas (currently there is only a high-level roadmap for water and sewer assets), it should include objectives for natural asset management based on this inventory project. This could take the form of prioritizing assessing condition and risk and/or defining levels of service for natural assets.

While the Town of Stratford's new Sustainability Coordinator has responsibilities for natural asset management, the Coordinator does not currently sit on the Town of Stratford's cross-functional asset management team. Therefore, someone on that team should be assigned responsibilities for integrating natural asset management where appropriate.

It is also recommended that the results of the natural asset inventory project are presented to Council and senior staff to raise awareness of the progress made in accounting for natural asset's role in service delivery.

Finally, as the Town of Stratford develops asset management plans and/or documents such as a new Official Plan and strategic plans, it should reflect the role of natural assets in delivering services. This will build support for their protection and ensure that lifecycle management activities are included in budgets and long-term financial plans.

6.2. Possible actions for the further development of the inventory

Based on the inventory, the Town of Stratford 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 process to include field verification of results.
- Determine acceptable levels of risk to the Town of Stratford's risk mitigation strategies (see Table 6).
- Further develop the condition assessment and risk assessment for urban forests and corridors, ponds, the aquifer, and natural soil (the identified priority assets) using local climate projections, land use modelling, and other data already at their disposal.

- 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.
- Share the inventory with adjacent local governments to stimulate collaboration within the watershed.
- Initiate or enhance monitoring - for example, using gauges, water level sensors, and loggers to improve understanding of trends, inform condition ratings of assets, and gather information for the development of natural asset management plans.
- 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 the Town of Stratford wishes to proceed with a full natural asset management project, including implementation, it will need to consider the following steps:

1/ **Confirm scope, roles and responsibilities**. Undertake a meeting or workshop to confirm (a) assumptions [for example, that water management and development pressure are the primary services of 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 as 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 "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.

Sources

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Annex: Results of the Town of Stratford's risk identification process

This Annex contains the results of the Town of Stratford'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	**Ranking (L/M/H)**	**Assets Affected**	**Location**	**Notes**
1. Overuse of trails/dumping	L	All trails		• This might include both overuse of existing trails and over-creation of trails. Natural areas could become fragmented and have too much human encroachment on wildlife if trails are excessively created. • Trails are not currently overused and capacity is there for a lot more use. • Occasionally dumping occurs but is always reported and cleaned up right away. PEI's excellent Waste Watch system means that dumping is not a high risk.
2. Flooding	**L** Coastal **L/M** Inland	Roads, utility infrastructure/lift stations, parks, ponds, culverts, shoreline/bank, private homes with basements	Keppoch road at Kelly's Pond, bottom of Aptos Drive & Brandy Lane, Fullerton's Marsh and park, Stratford approach to Hillsborough Bridge, Bayside Drive	2050 and 2100 coastal flood risk map shows areas of highest risk.
3. Forest fire	L	All forested areas, grasslands		

TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

Major Risks	Ranking (L/M/H)	Assets Affected	Location	Notes
4. Invasive species	M	Forested areas, particularly those with ash trees and hemlock trees, all natural assets	Everywhere	• The arrival of Emerald Ash Borer, Hemlock Woolly Adelgid, and certain other forest pests is inevitable within the next 10 years. Our trees are not currently inoculated against any invasive pests. • Japanese Knotweed and other problematic plants are pervasive throughout the Town and only likely to increase as control of them is very difficult.
5. Development pressure	H	Natural assets closest to urban/suburban areas, particularly agricultural land, and cleared land, to a lesser extent, forested areas		• Only protected areas are exempt from risk, such as buffer zones (protected through provincial leg), land zoned O2 and O1 (Town zoning bylaw). • There will be some increased demand on wellfields/aquifers as population grows, though PEI's water supply in the next 10 years is not felt to be at risk. • Stratford is one of the fastest-growing municipalities in Atlantic Canada, so this is a big risk for our natural assets.
6. Pollutant loading from urban, agricultural, or industrial sources (e.g., overuse of salt on roads)	L non-urban areas M urban and industrial areas industrial areas	Wetlands, water bodies, coastal		• Pollutants are primarily sediment and soil runoff carrying inorganic solids, nitrogen, and phosphorous, either from development, or occasionally agriculture. • Risk in relation to timeline of development, high risk to water bodies during development, lower risk after completion.

TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

Major Risks	Ranking (L/M/H)	Assets Affected	Location	Notes
7. Drought (current and future)	M	Agricultural areas, wellfields/ aquifers, waterbodies		Climate patterns are expected to bring us more intense rainfall, but more intermittently. Drought has had impacts on Stratford in the past and will continue to be a risk for agriculture and water supply.
8. Erosion	**H** Coastal **M** Inland	All coastal areas, trails, stream banks to some extent		• Trail washout • High risk of coastal erosion (sandstone coastline, lack of buffer vegetation, etc), and increasing due to climate change • Increasing inland erosion due to development, channelized flow, heavy rain events, impervious surfaces.
9. Lack of land management plans	H	All natural areas		• No land management plans, just land use planning. • We do have wellfield protection plans.
10. Policy change	L	All natural areas		• Low risk for municipal and provincial policy change that negatively impacts natural assets. Policy on PEI is shifting more toward land protection.
11. Hurricanes	M	Forests, coastal areas, electrical infrastructure, buildings		Increasing hurricane activity in Atlantic Canada threatens forest stands (particularly old field white spruce stands) and built infrastructure.
12. Transportation of dangerous goods	L	Natural assets adjacent to major transportation routes (Trans Canada)	Adjacent to Trans Canada	• Risk of spills of dangerous goods during transportation by truck

Municipal Natural Assets Initiative

Making Nature Count