Toward natural asset management in the

District of Kent

British Columbia

Summary of inventory results and recommendations
August 2021

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Municipal Natural Assets Initiative

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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 District of Kent 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?

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.

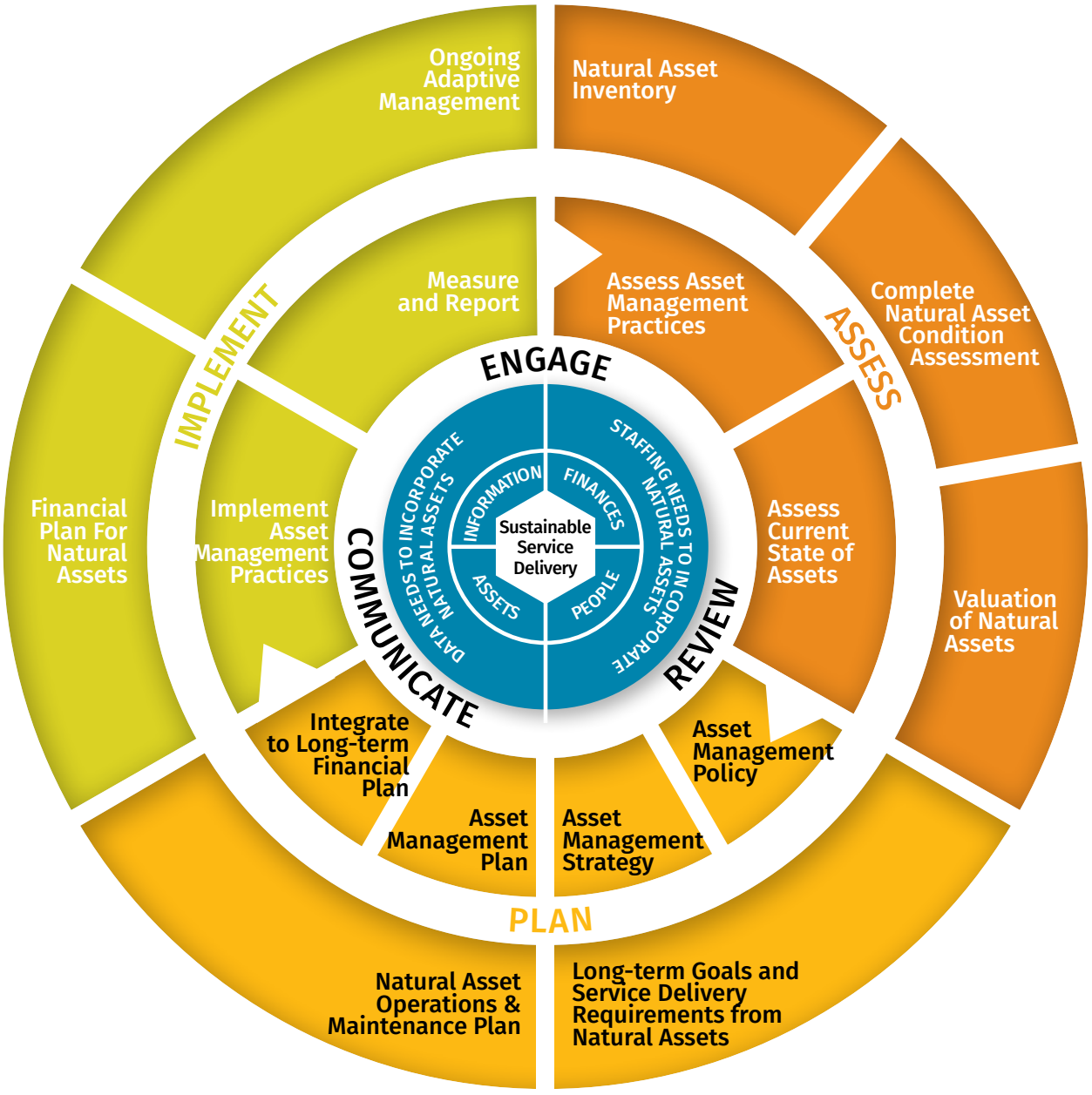

***Figure 1**: The Asset Management Process. MNAI has adapted this for use with natural assets.*

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

3 Local government context

3.1. General

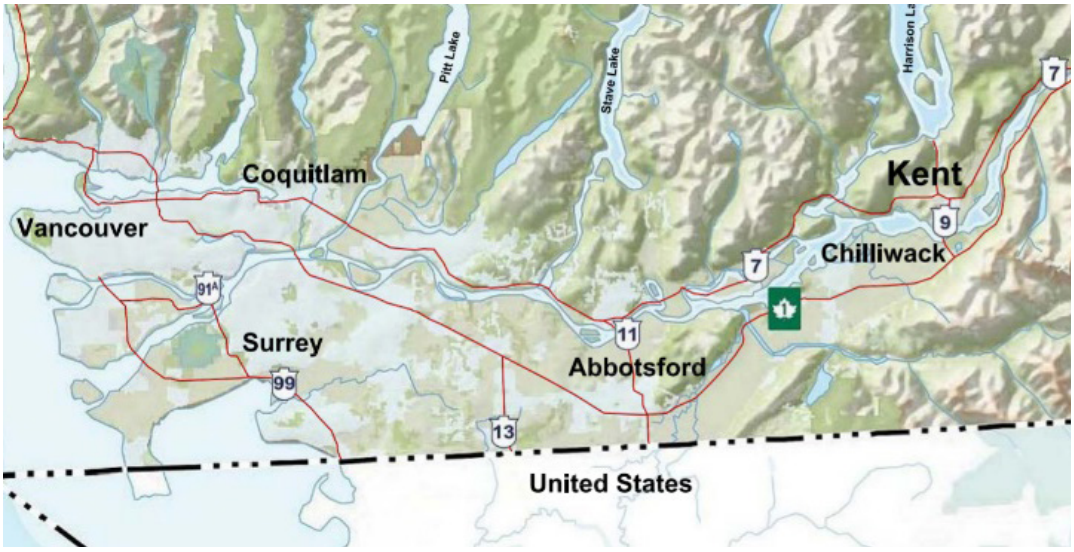

Figure 2: District of Kent[3].

The District of Kent (population ~6,000) is a district municipality located north of Chilliwack and south of Harrison Hot Springs in British Columbia. It is the fifth most populated municipality in the Fraser Valley Regional District. Most of Kent's population lives in its largest community, Agassiz[4].

Agassiz sits atop a productive aquifer that provides drinking water and irrigation through wells and a municipal water system. Agriculture is a main economic activity in the District of Kent and 50 to 60 per cent of its lands are designated as Agricultural Land Reserve. The District of Kent maintains a system of constructed ditches, channelized streams, and natural waterways that provide important drainage functions for local farms and habitat for fish and wildlife. The District of Kent considers waterways to be a top priority natural asset and is developing a bylaw to manage them.

Concerns related to waterways include flooding, invasive species, poor agricultural nutrient management regimes, climate change, sedimentation and erosion from storm events.

The District of Kent has three main interests in natural asset management. First, it wants to better understand its waterways system through the natural asset inventory and use this information to support and inform management strategies.

Second, it wants to link natural asset management to the guiding principles of the District of Kent's Official Community Plan and support its implementation. These linkages include protecting the environment and properly managing land, air, and water resources; supporting farming as an economic activity and lifestyle

3 *Wikipedia. Retrieved from en.wikipedia.org/wiki/Kelowna*

4 *Official Community Plan. District of Kent. Retrieved April 2021 from www.kentbc.ca/en/business-and-development/ocp-and-zoning.aspx#OCP-Documents*

choice; and providing infrastructure that delivers appropriate levels of service to meet the needs of existing and future residents and businesses. The District of Kent has also drafted an asset management policy that would link budgeting to the lifecycle and condition assessment of assets, including natural ones.

Third, it wants to extend the inventory to a full natural asset initiative, including the valuation of services from natural assets on which they rely. This, in turn, could support them in grant applications and resource budgeting to prevent the degradation of their waterways.

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.

Based on the results of the readiness assessment, the District of Kent is at a relatively early stage of adopting asset management for both its engineered and natural assets. It has an asset management policy that was endorsed by senior leadership and Council and has begun to track baseline information about its asset management practices. It is currently reviewing its policy and is also developing a data governance policy that will be aligned with its asset management policy. The District of Kent undertook a gap analysis of its asset management practices that has led to a strategy and roadmap of actions that will be implemented in the next several years.

The District of Kent has a cross-functional asset management team that includes staff working in engineering, finance, GIS, and information technology, and a team member has also been identified that will be responsible for natural asset management. The team is accountable to senior management and Council, but asset management responsibilities have not yet been included formally in job descriptions. Council is supportive of asset management and may be willing to allocate resources to make progress, but based on the readiness assessment, would not yet be considered fully engaged asset management champions.

The District of Kent has a basic inventory of engineered assets, condition information about most of its critical assets, and some information about asset performance. Capital financial information conforms to the Public Sector Accounting Board PSAB 3150 reporting requirements. The District of Kent does not yet have a structured approach to asset investment planning across the

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

whole organization, but departments follow a similar approach informally. It uses a combination of formal and ad hoc criteria to determine investment needs. Budgeting is still done annually based on a mix of historical values and new priorities and there are no asset management plans in place yet.

The inventory project is the District of Kent's first major step to understand how natural assets are contributing to service delivery. It has identified that its drainage ditches support water conveyance and while agricultural drainage is actively protected and maintained, the assets associated with it were not tracked formally in an inventory prior to this project.

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 District of Kent 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 District of Kent and GeoBC. 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 USED

DATASET NAME	SOURCE	PURPOSE
MuniBoundaries	District of Kent	Used to determine boundary for the District of Kent
VRI - 2020 - Forest Vegetation Composite Rank 1 Layer (R1)	GeoBC	Used to create base natural asset inventory as District of Kent does not have full landcover coverage for study area
FraserRiver	District of Kent	Used to supplement VRI in creating a base landcover dataset
Lakes	District of Kent	Used to supplement VRI in creating a base landcover dataset
RoadsDistrict	District of Kent	Used to supplement VRI in creating a base landcover dataset
RoadsFVRD	District of Kent	Used to supplement VRI in creating a base landcover dataset

TABLE 1: SUMMARY OF DATA USED

DATASET NAME	SOURCE	PURPOSE
Freshwater Atlas Wetlands	GeoBC	Used to supplement VRI in creating a base landcover dataset
Freshwater Atlas Assessment Watersheds	GeoBC	Used to split polygons by watershed and assign assets to appropriate watershed
ALR	District of Kent	Used to summarize area of natural assets/assets within the ALR
RNReserves	District of Kent	Used to determine assets within reserves and summarize asset area within reserves
TownsiteBoundary	District of Kent	Used to determine assets within the town boundary
ZoningOverlay	District of Kent	Used to assign a majority zoning type to assets using the zone type covering the greatest area of the asset
CulvertMtSlough_BU	District of Kent	Used to indicate assets containing culverts. Name of culvert assigned to relevant assets
CulvertMiamiRiver_BU	District of Kent	Used to indicate assets containing culverts. Name of culvert assigned to relevant assets
CulvertHarrisonMills_BU	District of Kent	Used to indicate assets containing culverts. Name of culvert assigned to relevant assets
CulvertEastAgassiz_BU	District of Kent	Used to indicate assets containing culverts. Name of culvert assigned to relevant assets
Mountains	District of Kent	Used to assign name of mountain to relevant asset
Parks	District of Kent	Used to assign area of assets within parks
Trails	District of Kent	Used to summarize length of trails within assets
DevPermArea	District of Kent	Used to assign type of development permit for which the majority of the asset falls within
FloodLevel	District of Kent	Used to assign average FCL value within an asset
OCPLanduse	District of Kent	Used to assign the land use description to assets for which the majority of the asset area falls within
UrbanGrowth	District of Kent	Used to indicate which assets fall within urban growth areas
DitchSalvage	District of Kent	Used to indicate which assets contain ditch salvages and total length of ditch salvage within asset
DrainageAreas	District of Kent	Used to determine asset area within drainage areas
HarrisonMillsWaterShed	District of Kent	Used to assign asset area within watershed boundary
MiamiRiverStream Drainage	District of Kent	Used to assign asset area overlapping with boundary
MtSloughStreamDrainage	District of Kent	Used to assign asset area overlapping with boundary

TABLE 1: SUMMARY OF DATA USED

DATASET NAME	SOURCE	PURPOSE
OregonForestSnail	District of Kent	Indicate which assets are intersecting with the species location
OregonSpottedFrog	District of Kent	Indicate which assets are intersecting with the species location
SalishSucker	District of Kent	Indicate which assets are intersecting with the species location
SoilSurvey	District of Kent	Used to add majority drainage type and soil name to each asset
Streams	District of Kent	Used to summarize total length of streams within an asset
GeotechHazardOverview	District of Kent	Used to assign relevant geohazard description to assets
Floodplain2007	District of Kent	Used to determine which assets fall into floodplain
ParcelMap BC Parcel Fabric	GeoBC	Used to assign ownership details to assets by summarizing area of asset by owner type
Digital Road Atlas (DRA) - Demographic Partially-Attributed Roads	GeoBC	Used to perform the road density condition assessment

The inventory project defined a total of 1,852 individual assets, covering 21,357 hectares (ha), as noted in Table 2. The majority of this area was forest, followed by agriculture and water.

TABLE 2: SUMMARY OF NATURAL ASSETS BY TYPE

NATURAL ASSET TYPE	NUMBER OF ASSETS	TOTAL AREA (HA)
Agriculture	73	5,072
Forests	1,483	11,939
Water	100	3,547
Successional Forest	134	585
Shrubland	16	49
Built-up Pervious	15	93
Wetland	5	4
Beach/Bluff	7	26
Grassland	12	31
Bryoid	2	2
Total	**1,852**	**21,357**

Figure 3 demonstrates the spatial distribution of the natural assets within the District of Kent.

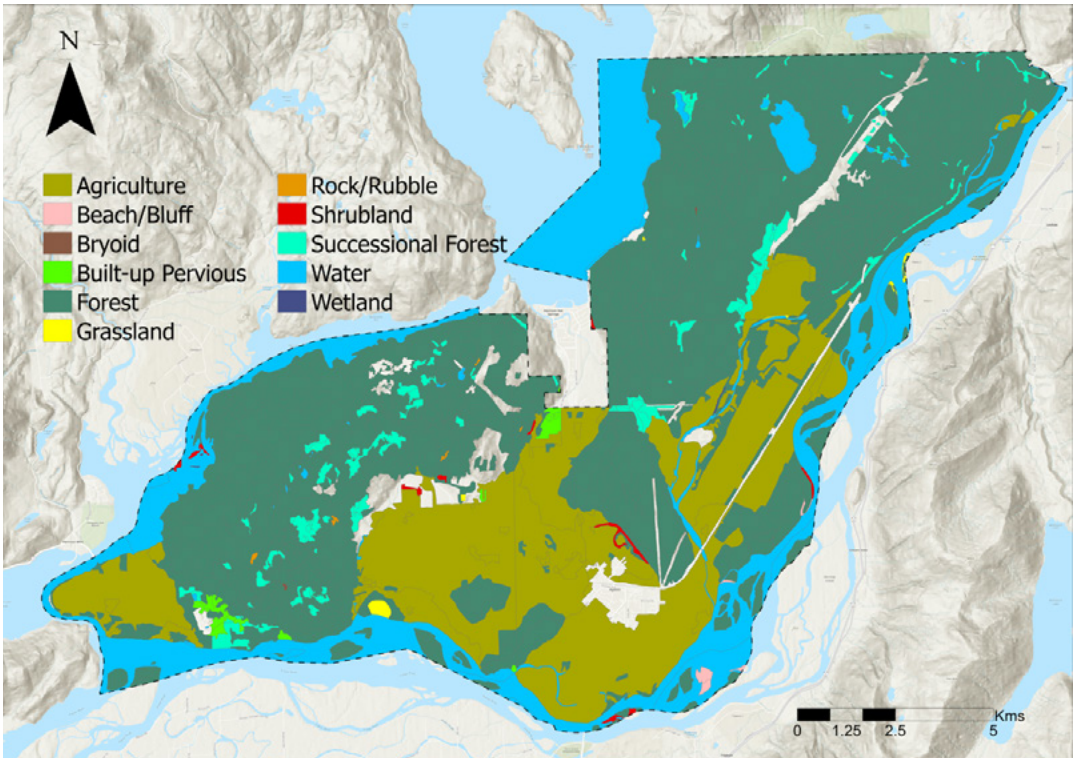

Figure 3: *Spatial distribution of natural assets.*

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 the District of Kent's registry showing natural asset characteristics and details.

TABLE 3: EXCERPT FROM THE REGISTRY

Natural Asset Registry

Asset ID	Asset Type	Asset Area (ha)	Asset Area in Watershed (ha)	Watershed	Area in ALR (ha)	Reserve Name	Reserve Area (ha)	Majority Zoning Type	Majority Geohazard Description	Park Area (ha)	Park Name	Stream Length (km)	Culvert	Interior Forest %	Adjacent Land Use Score	Permeability Score	Relative Size Score	Road Density Score	Total Score
AGR12	Agriculture	12.16	12.15	Agassiz Townsite/Seabird Island	12.16	Seabird Island	12.16			0		0.00		0	9	5	1	10	
AGR13	Agriculture	5.80	5.80	Agassiz Townsite/Seabird Island	3.11		0.00	Agriculture	Moderate probability of hazard occurrence. Will require geotechnical hazard assessment for building sites and subdivision.	0		0.00		0	8	5	1	10	
AGR14	Agriculture	11.83	11.83	Agassiz Townsite/Seabird Island	10.34		0.00	Agriculture	Geotechnical assessment generally not required. However, most areas do require floodproofing.	0		0.01		0	9	5	1	1	1
AGR15	Agriculture	5.77	5.76	Agassiz Townsite/Seabird Island	5.77	Seabird Island	5.05	Agriculture		0		0.00		0	9	5	1	1	1
AGR16	Agriculture	171.57	171.47	Agassiz Townsite/Seabird Island	170.54		0.00	Agriculture	Geotechnical assessment generally not required. However, most areas do require floodproofing.	0		1.19		0	8	5	5	5	
AGR17	Agriculture	19.46	19.44	Agassiz Townsite/Seabird Island	19.46		0.00	Agriculture	Steep slope / debris flow and other site specific geotechnical problems. Will require geotechnical hazard assessment for building sites and subdivision.	0		1.43	East Agassiz	0	8	5	1	5	1

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 District of Kent. The full version can be accessed at *go.greenanalytics.ca/Kent*.

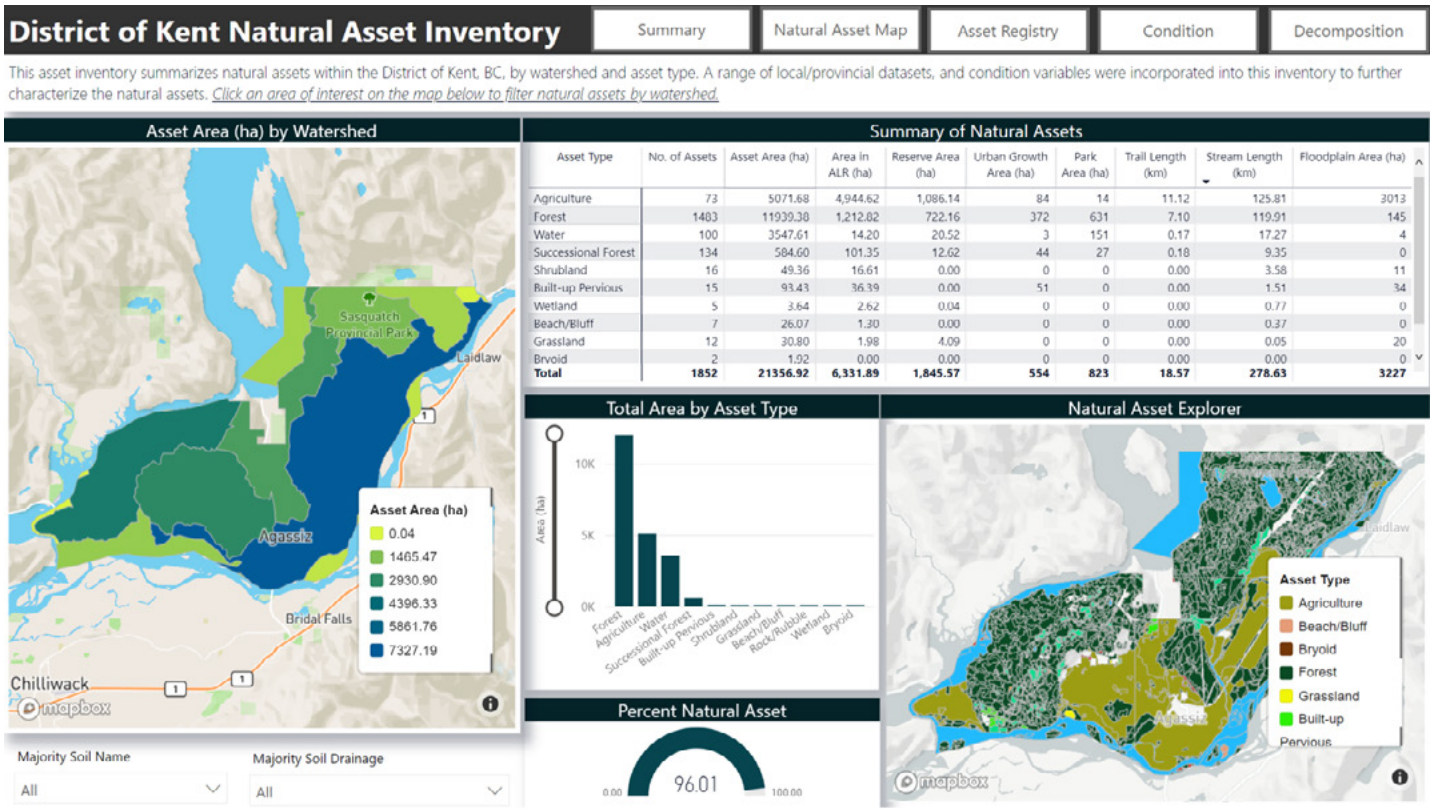

Figure 4: Screenshot of main inventory summary

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 District of Kent. Table 5 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 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*
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.

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
- **Moderate -** 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
- **No Rating**

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

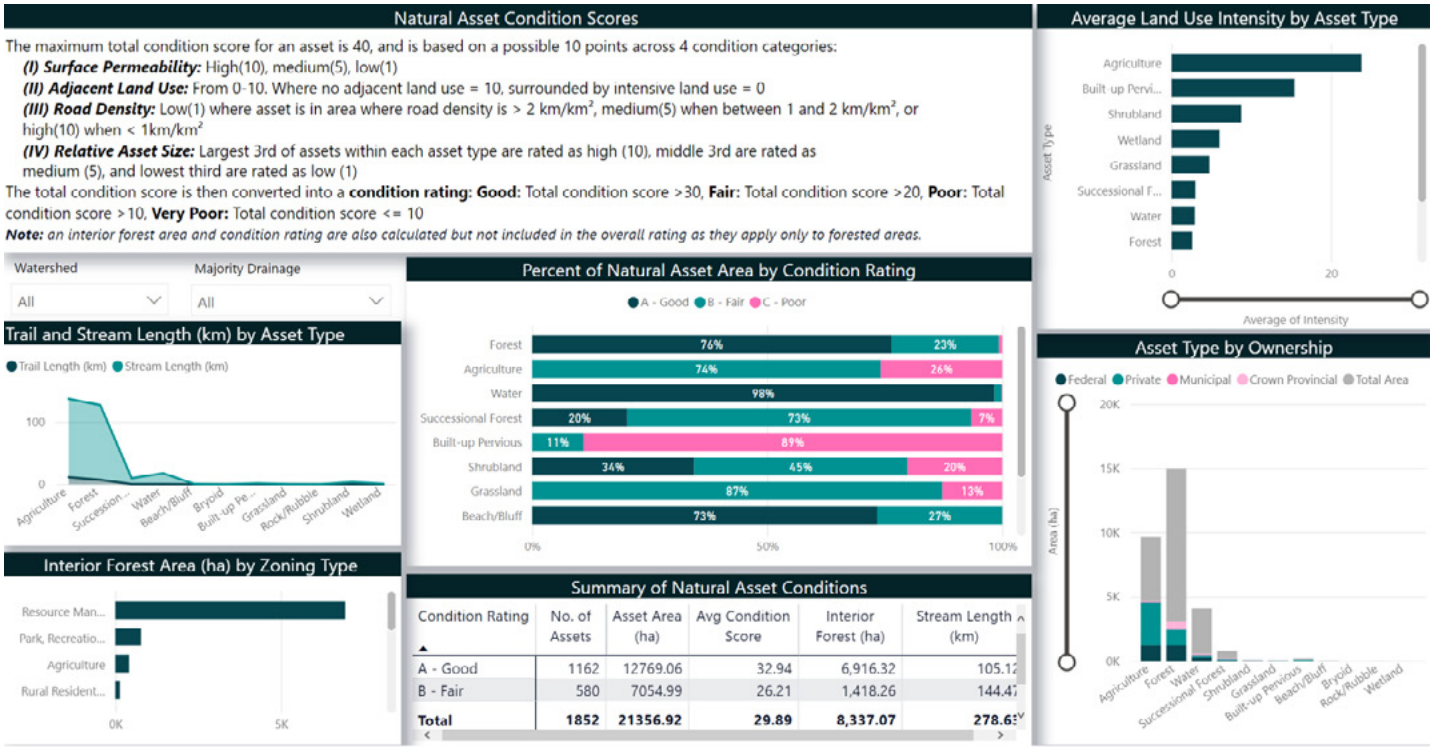

Figure 5: Screenshot of condition assessment details

Overall, about 12,769 ha (or 60 per cent) of natural asset were assessed in good condition and 7,055 ha (or 33 per cent) were assessed in fair condition. Forests, water and beach/bluff assets all largely ranked good and fair.

Table 5 summarizes condition ratings and Figure 6 summarizes condition by natural asset type.

TABLE 5: SUMMARY OF NATURAL ASSET CONDITION RATINGS
MNAI desktop approach

Condition Rating	Number of Assets	Total Area (ha)	Average Condition Score
Good	1,162	12,769	33
Fair	580	7,055	26
Poor	110	1,533	17
Total	**1,852**	**21,357**	**30**

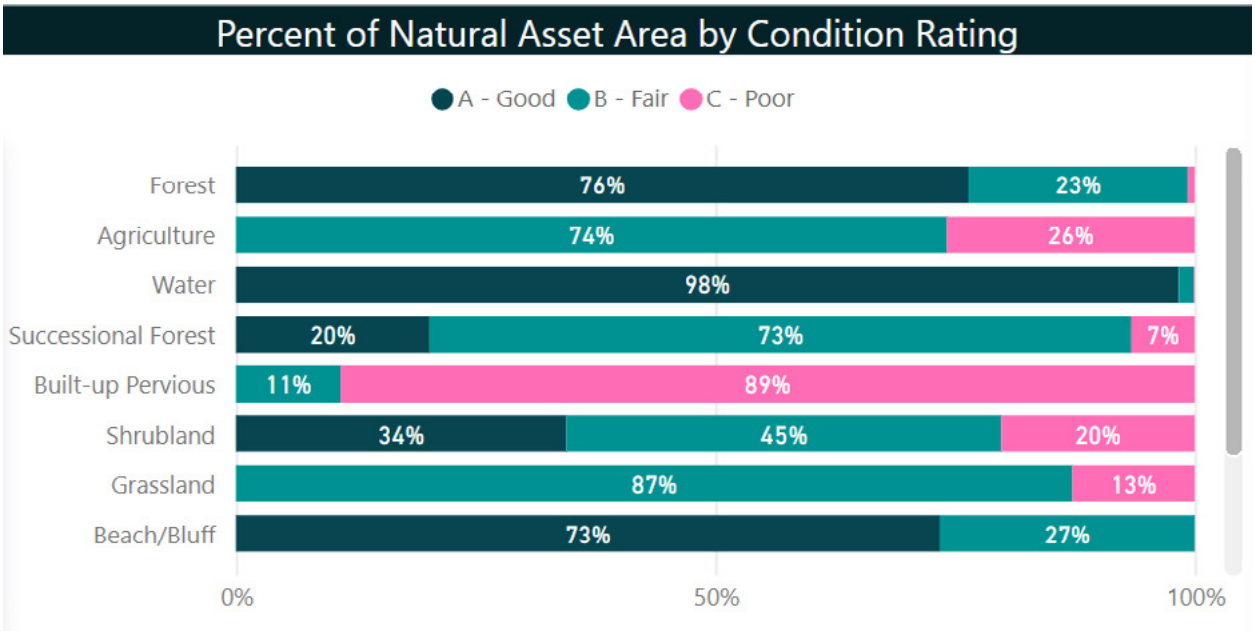

Figure 6: Summary of condition rating by natural asset type (MNAI desktop approach)

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 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 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 the District of Kent 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 District of Kent 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
- Drought (current and future)
- Erosion
- Lack of flood hazard mapping
- Lack of land management plans
- Lack of monitoring reports
- Construction activity
- Political policy change
- Earthquakes

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 District of Kent 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 probability of impact 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:

- 3 high-level risks (flooding, invasive species, and pollutant loading)
- 9 medium-level risks (overuse of trails/dumping, forest fire, development pressure, drought, erosion, lack of land management plans, lack of monitoring reports, political policy change, and earthquakes)
- 2 low-level risks (lack of flood hazard mapping and construction activity)

In terms of scope, the identified risks affect natural assets in the floodplain, agricultural areas, waterways and ditches across the District of Kent. The risks also have the potential to negatively impact engineered assets (both city-owned and non-city-owned), personal health, and safety.

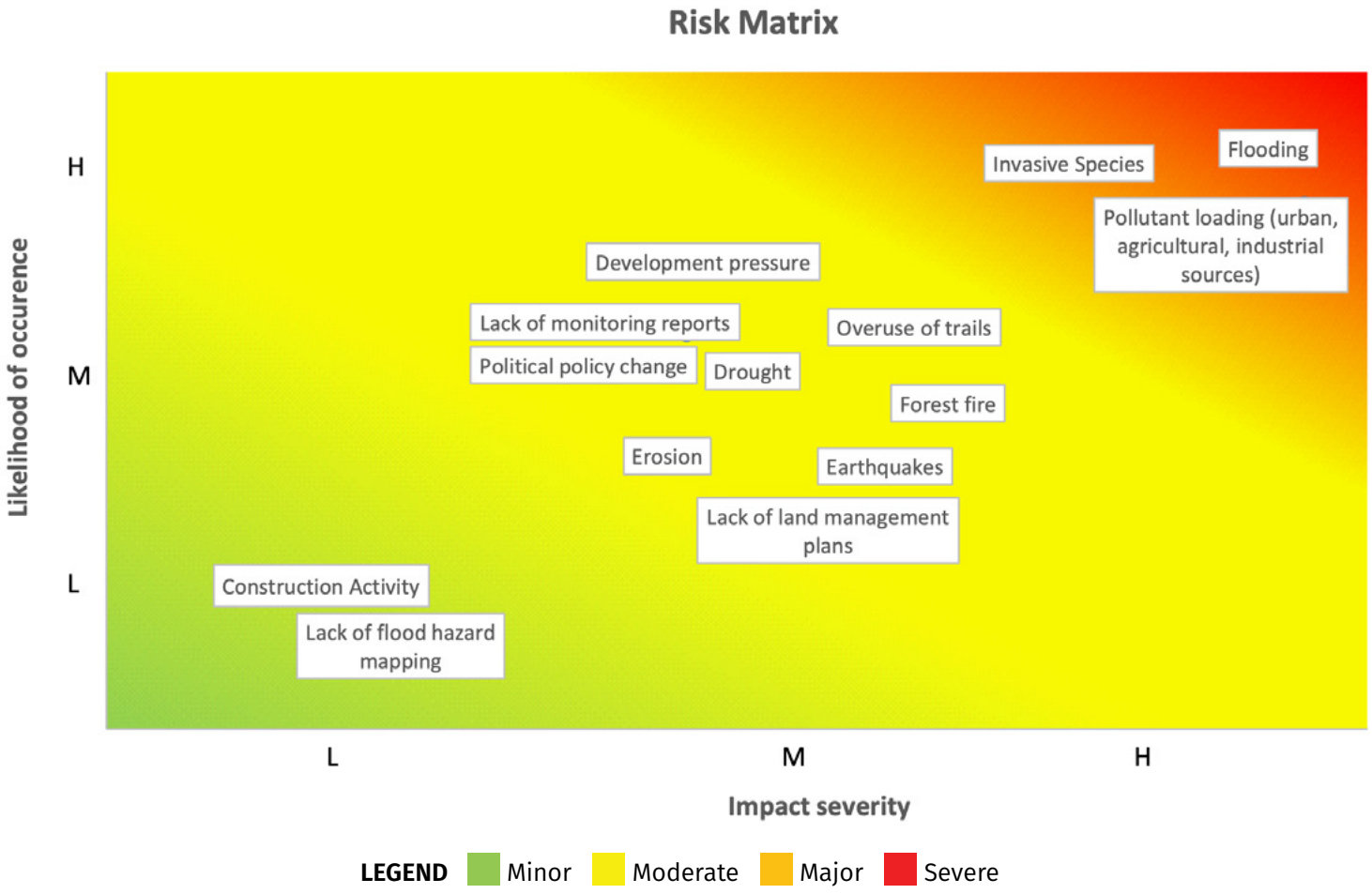

Figure 7: Results of risk management process

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 (a) potential priorities for the local government (b) possible actions for the further development of the inventory, and (c) steps the District of Kent can consider to advance to a full natural asset management initiative.

6.1. Potential priorities for the District of Kent

Combining the results of the condition assessment with the outcomes of the risk identification highlights potential priorities for the District of Kent to focus their natural asset management efforts. These are:

- **Flooding:** A large portion of the District of Kent is located on the Fraser River floodplain. Flooding events can damage natural assets in the floodplain, erode riverine shorelines, negatively impact industry profitability (particularly agriculture) and threaten the health and safety of residents. The District of Kent experienced large-scale flooding in 1894 and 1948, which prompted the construction of dykes throughout the Fraser Valley[6]. At present, 20 km of dykes and three flood pumps protect against the annual freshet and flood events along the Fraser and Harrison Rivers. The Hammersley Pump Station was upgraded in 2019 with "fish-friendly" pumps that help address flooding and drainage issues while minimizing impacts to fish and wildlife.[7] The District of Kent is moving forward with flood mitigation initiatives and should sustain work with the provincial and federal governments to fund flood protection measures. Engagement with the Fraser Basin Council on region-wide priorities could also be beneficial; the organization is mentioned several times in the District of Kent's Official Community Plan in relation to flood management activities and has a Lower Mainland Flood Management Strategy aimed at reducing flood risk and improving the flood resilience of communities the lower Fraser River and south coast.
- **Invasive species:** Invasive species can reduce resiliency, reduce land for crop growth, increase climate-related risks, negatively impact biodiversity, impair terrestrial and aquatic ecological services, lower property values, and increase costs to maintain, control and eradicate target species. They can also impact engineered assets such as roads. The District of Kent administers public education campaigns to address invasive species such as Knotweed, Giant Hogweed, Common Bugloss and Himalayan Balsam. They can also draw upon resources and support from volunteers, the Invasive Species Council of BC, and the Fraser Valley Invasive Species Society.

6 *District of Kent, 2014.*

7 *District of Kent, 2019.*

- **Pollutant loading:** Pollutant loading from urban and agricultural sources poses a high risk to natural assets, particularly agricultural areas, wetlands and waterways. Agricultural run-off resulting from poor nutrient management regimes, impacts to drinking water, and increased salt run-off from roads associated with a changing climate can impact the services being provided by natural assets in the District of Kent. Mitigation measures could include incentivizing on-farm mitigation measures, protecting natural assets such as wetlands and riparian buffers that help control run-off, and ecological restoration and retrofit activities to clean up degraded water bodies.

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

As a first priority, the District of Kent identified the need to update the senior management team on a proposed framework for natural asset management. Related to this, work on natural asset management has been done at the staff level and Council is not fully aware of resourcing required to make progress.

There is also a near-term opportunity to incorporate natural asset management into the District of Kent's asset management system because it is already improving its data system to include lifecycle and risk frameworks and condition assessment protocols. Efforts will include defining lifecycle investment requirements for critical assets that support longer-term financial planning and budgeting, and linking asset management planning-related financial information with information used for financial reporting.

Specific activities that the District of Kent could prioritize while improving data systems include integrating natural asset management into the formal terms of reference for the overall asset management system, and incorporating the proposed natural asset management framework into its asset management policy. Doing so would ensure that natural asset management is formalized and recognized as an integral part of the District of Kent's asset management system. It could also help build political support for resourcing natural asset management.

Eventually, the District of Kent would like to incorporate natural assets into its asset management plans; the preceding actions could create a foundation for doing so.

A third potential that aligns with the District of Kent's efforts to improve data systems is, as noted in its readiness assessment, conducting additional condition assessments for agricultural waterways and determining natural asset performance based on defined metrics. This may require enhancing collaboration with the agricultural community to ensure access to land and review monitoring and reporting protocols.

Finally, while a staff person has been identified as being responsible for natural asset management, the District of Kent still needs to communicate next steps around their role with the broader asset management team to help support integration of natural asset management.

6.2. Possible actions for the further development of the inventory

Based on the inventory, the District of Kent 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 field verification of results.
- Determine acceptable levels of risk to the District of Kent's risk mitigation strategies (see Table 6).
- Further develop the condition assessment and risk assessment 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. From a flooding and stormwater management perspective, the wetlands, soils and forested areas in the watersheds will be key.
- Share the inventory with adjacent local governments to stimulate collaboration as the highest-level risks (flooding, invasive species, and pollutant loading) are best addressed at a watershed-scale.
- 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 the District of Kent 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 these 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 District of Kent's risk identification

This Annex contains the results of the District of Kent's use of MNAI's risk identification tool, which they self-administered with guidance from MNAI. Table 1 was the main product that the District of Kent 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
- Drought (current and future)
- Erosion
- Lack of flood hazard mapping
- Lack of land management plans
- Lack of monitoring reports
- Construction activity
- Political policy change
- Earthquakes

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	Agriculture, Water	Off dykes, "Agassiz Grind"	
2. Flooding (current and future)	H	Agriculture, Water	Floodplain	
3. Forest fire	M	Forest, Agriculture	Forests, hillsides	
4. Invasive species	H	Agriculture, Water	Ditches	
5. Development pressure	M	Agriculture, Forest, Water	Agri-business, industrial areas, nurseries	
6. Pollutant loading from urban, agricultural, or industrial sources	H	Agriculture, Water	Ditches and waterways	
7. Drought	M	Agriculture, Forest		
8. Erosion	M	Water		
9. Lack of flood hazard mapping	L	Agriculture		
10. Lack of land management plans	M	Forest, Water		
11. Lack of monitoring reports	M	Forest, Water, Agriculture		
12. Construction activity	L			
13. Political policy change	M		Fraser, larger sloughs	
14. Earthquakes	M		Harrison Mills lacking mapping	

Municipal Natural Assets Initiative