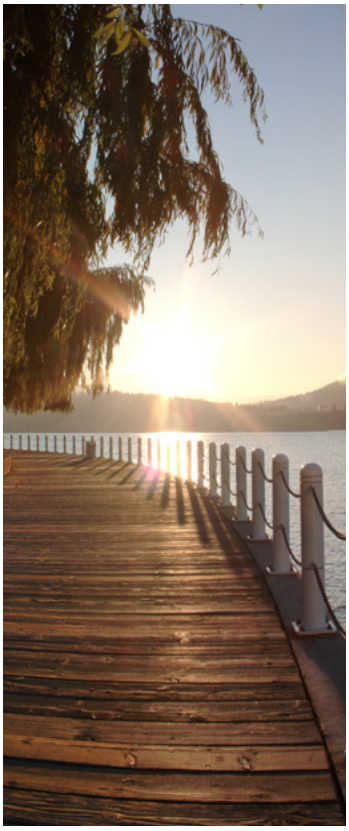
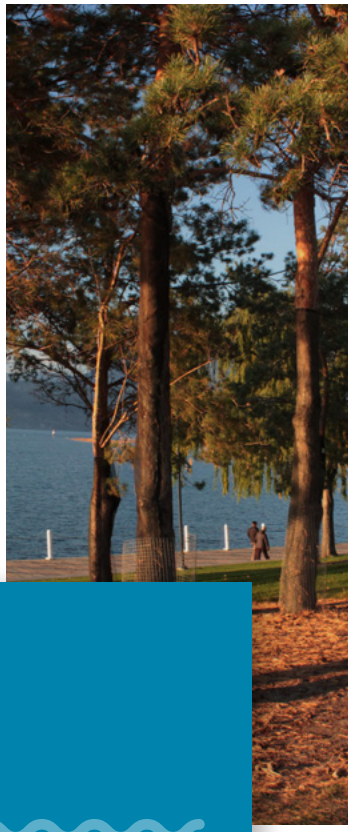


Regional District of Central Okanagan

photo credit: Accuruss



Toward natural asset management in the

Regional District of Central Okanagan

British Columbia

Summary of inventory results and recommendations
April 2023

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

MNAI.CA
Making Nature Count

Land Acknowledgment from the Regional District of Central Okanagan

The RDCO acknowledges our presence on the traditional, ancestral, and unceded tm̓xʷúlaʔxʷ (land) of the syilx / Okanagan people who have resided here since time immemorial. We recognize, honour, and respect the syilx / Okanagan lands upon which we live, work, and play.

Making Nature Count

Invest in Nature

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

Disclaimer

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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 Regional District of Central Okanagan 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.

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.

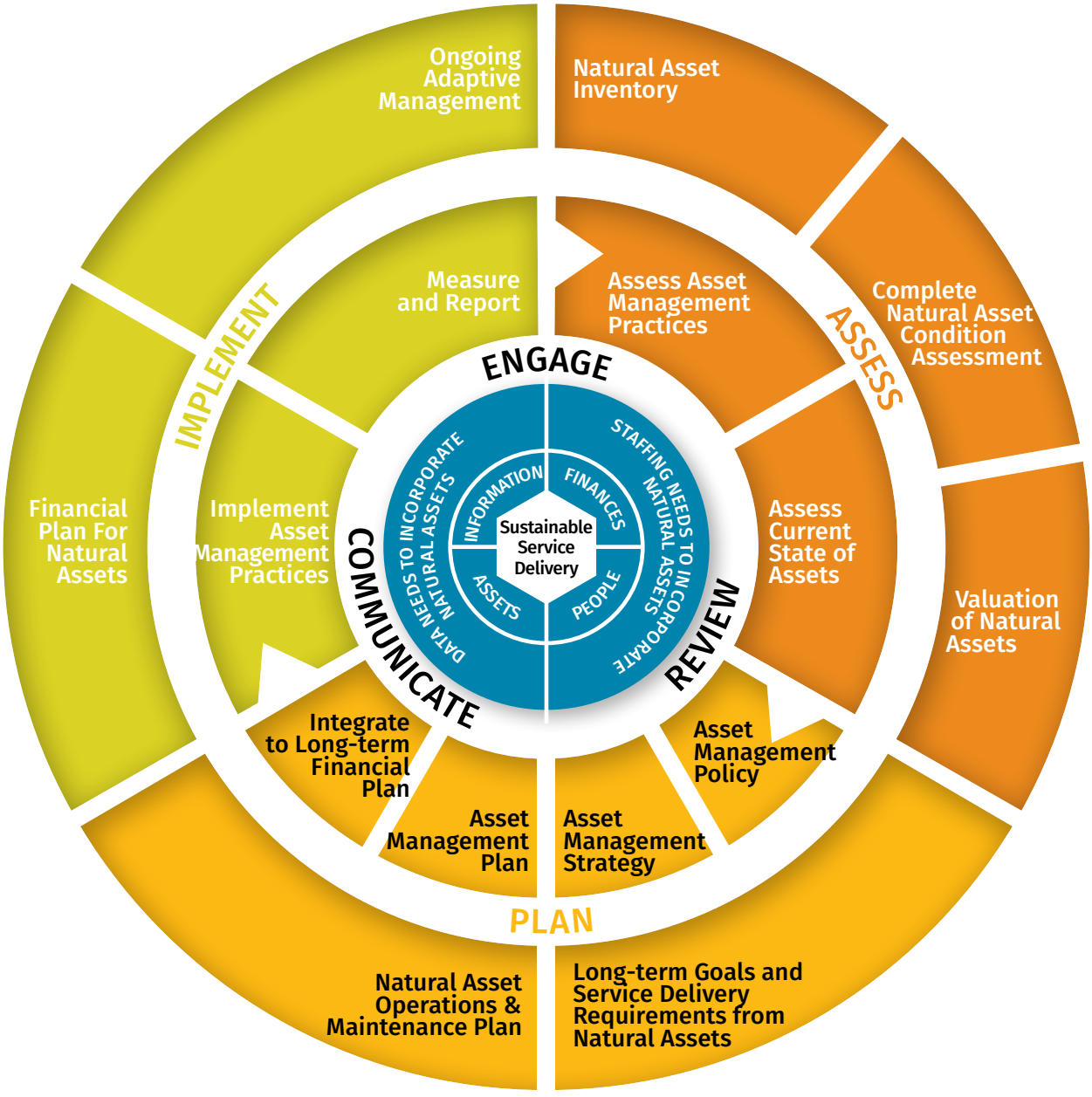

***Figure 1**: The Asset Management Process. MNAI has adapted this for use with natural assets.*

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

3 Local government context

3.1. General

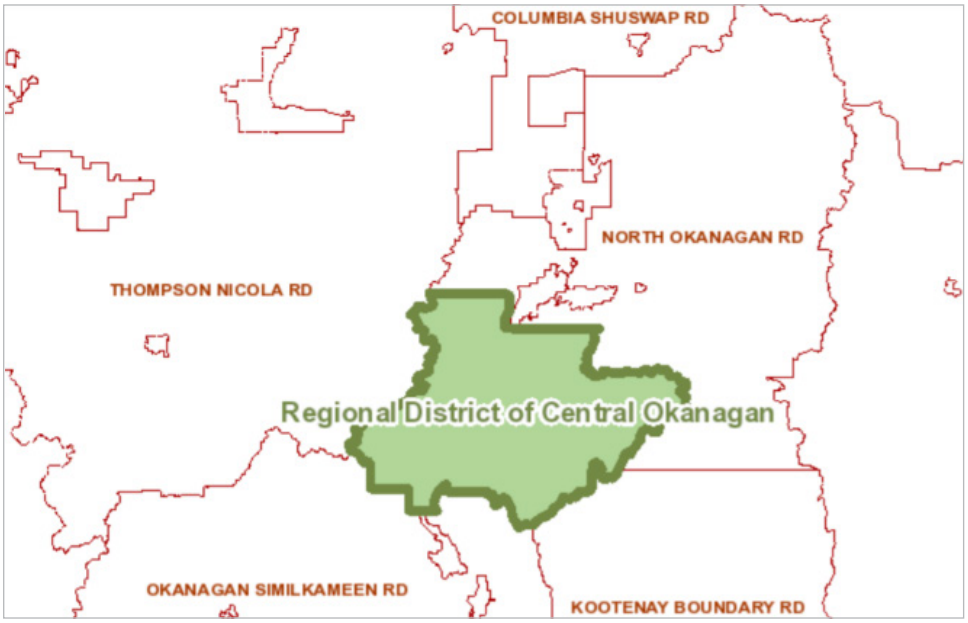

Figure 2: Regional District of Central Okanagan[3].

The Regional District of Central Okanagan (population ~222,162) includes the two unincorporated Electoral Areas of Central Okanagan East and Central Okanagan West, along with the member municipalities of the City of Kelowna, the District of Lake Country, the District of Peachland and City of West Kelowna.[4]

The RDCO is located on the unceded territory of the sylix Okanagan people and encompasses Westbank First Nation IR#8, #9,#10, #11 & #12, as well as Okanagan Indian Band IR#7. Citizens across the region are engaged in governance and invested in efforts taken to strengthen the broader community. The Syilx/ Okanagan people are true partners, helping to interpret the past, shape the present and define a shared future.

The Regional District of Central Okanagan's interest in natural asset management relates to achieving a deeper understanding of the type, number, condition, and importance of the natural assets within its boundaries. The Regional District of Central Okanagan recognizes the need for an inventory and corresponding efforts to determine the service value of natural assets to limit their loss, and associated risks. The inventory will also link to environmental priorities in the Regional District of Central Okanagan's Strategic Priorities Plan[5] and Regional Growth Strategy[6].

3 *Edmonton City Plan: One Million More. Retrieved, Green and Blue Network. August 2021 from www.edmonton.ca/sites/default/files/public-files/assets/PDF/City_Plan_FINAL.pdf*

4 *Geographic Information System, Regional District of Central Okanagan. Retrieved August 2021 from www.rdcogis.com/GIS_App_public/index.html*

5 *Regional District of Central Okanagan - Regional Board Strategic Priorities 2019-2022. Retrieved August 2021 from www.rdco.com/en/your-government/resources/Documents/2020-Board-Strategic-Priorities-Plan-Update.pdf*

6 *Regional District of Central Okanagan - Regional growth strategy: Priority projects plan. (2017, July 31). Retrieved August 2021 from www.rdco.com/en/business-and-land-use/resources/Documents/Regional-Growth-Strategy-Priority-Projects-Plan.pdf*

Watershed, lake, forest, floodplain and foreshore areas are priority natural assets for the Regional District of Central Okanagan. They consider the delivery of clean potable water, stormwater management, flood protection, soil stability and removal of pollutants to be high priority services from natural assets.

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[7] to help local governments measure their progress on both asset management and natural asset management in four competency areas, each of which describes outcomes based on five levels of progress or maturity.

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

Competency 1: Policy & Governance

In the Regional District of Central Okanagan's 2020 update to its Strategic Priorities plan, the environment is identified as a top priority. This has supported efforts to strengthen natural asset management. Staff has drafted an Asset Management Policy and a Strategic Asset Management Plan that include natural assets in its scope. The development of this inventory will aid the RDCO in identifying the benefits it would like natural assets to deliver in support of organizational objectives.

With respect to measuring and monitoring progress on asset management, the Regional District of Central Okanagan has begun to establish performance measures to monitor progress related to asset management, but has not yet developed performance measures for progress on natural asset management.

Competency 2: People & Leadership

The Regional District of Central Okanagan is at an early stage of asset management in relation to people and leadership. It does not yet have a formal cross-functional asset management team. That said, the RDCO does prioritize asset management-related communication and there is a small natural asset team that has been tasked with guiding and supporting the integration of natural asset management in its asset management system and drafting the Strategic Asset Management Plan (SAMP). The SAMP is a guiding document that informs roles and responsibilities, synergies, and implementation related to asset management.

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

In terms of Regional Board leadership and governance, the Board has demonstrated buy-in and support for asset management and has approved funding for priority improvements. This inventory project will provide the first step towards awareness of the resources and funds needed for natural asset management. In terms of Regional Board leadership and governance, the Board has demonstrated buy-in and support for asset management and has approved funding for priority improvements, though it is not yet aware of the resources and funds needed to for natural asset management. The Board has approved funding to continue asset management roadmap activities (i.e. Asset Management Investment Plans, condition assessments, and life-cycle activities).

Two current asset management projects of note, are the Westside Regional Wastewater Treatment Plant Asset Management Plan, and the Species at Risk and Critical Habitat Project, a natural asset-related partnership project with MNAI and the City of Kelowna to determine natural asset management options that benefit both species at risk and local government service delivery.

Competency 3: Data & Information

TThe Regional District of Central Okanagan is at an early stage of asset management with respect to data. 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 making progress in moving asset data to a centralized location for use by the asset management team, and is defining critical assets and collecting condition information for them.

Regarding natural assets, the RDCO has completed the final phase of the Regional Flood Management Plan and is working on the Okanagan Lake Protection Strategy in partnership with the Okanagan Nation Alliance, the Okanagan Collaborative Conservation Program, and the South Okanagan Similkameen Conservation Program. Further natural asset-related projects[1][8] include:

- A resource for Okanagan lakeshore living (a best management practices guide has been developed to offer practical solutions for Central Okanagan property owners along the shoreline of Okanagan Lake)
- Okanagan Lake Foreshore inventory and mapping (FIM)
- Planning for ecosystem connectivity in the Central Okanagan
- Sensitive ecosystem inventory (the RDCO Sensitive Ecosystem Inventory will be updated in 2023-2024)
- Sensitive habitat inventory and mapping

8 *See www.rdco.com/en/business-and-land-use/projects-and-initiatives.aspx#:~:text=Environmental%20planning for details on each project*

With respect to financial data, the Regional District of Central Okanagan has captured capital and operating expenditure data for all engineered assets in Asset Management Investment Plans (AMIPs) and is currently developing asset management plans for major assets and asset groupings. It has not yet identified service values for natural assets.

Competency 4: Planning & Decision-making

The Regional District of Central Okanagan is at an intermediate stage of asset management with respect to planning and decision-making. The RDCO has a 5-year capital and operating plan that is updated annually. By 2023, the RDCO will have, at minimum, a ten-year capital plan for all of its engineered assets. It is working on developing a structured asset investment planning approach, but still evaluates investment needs and priorities based on a mix of structured and ad hoc practises and criteria. It does not yet have a formal approach to investment planning for natural assets, primarily because it does not yet have enough knowledge about the services natural assets provide to the community.

The Regional District of Central Okanagan is currently working on developing asset management plans for engineered assets and has not yet begun the process for natural assets. This project provides the data foundation for natural assets to move to a planning stage for natural asset management. Currently, the Regional District of Central Okanagan prepares annual capital and operating budgets based on annual assessments of current needs and long-term financial plans (AMIPs). Activities for managing natural assets are budgeted for only where they exist alongside grey infrastructure or if identified as a stand-alone 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 Regional District of Central Okanagan 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 Regional District of Central Okanagan, the Province of British Columbia, the Okanagan Basin Water Board, and the Government of Canada. 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

FILE NAME	DESCRIPTIVE NAME	SOURCE	PURPOSE
RDCO_Lakes	RDCO Lakes	RDCO Open Data Portal	Used as a supplementary source of landcover for lake assets not present in the VRI.
Veg_Comp_Poly	Vegetation Resource Inventory - 2020 - Forest Vegetation Composite Polygons	BC Open Data Catalogue	The British Columbia Land Cover Classification Scheme Level 1 was used as the primary source of landcover for natural areas.
BC_COVsurvey	2014 RDCO Agricultural Land Use Inventory (ALUI)	Okanagan Basin Water Board	Used as source of landcover for Agricultural asset types. The "cover" and "covertype1" fields were used to define the landcover of parcels. Landcover which was crop related was assigned the same landcover type, and boundaries of the ALUI parcels were then dissolved by landcover to avoid showing the full parcel breakdown in maps.

TABLE 1: SUMMARY OF DATA SOURCES

FILE NAME	DESCRIPTIVE NAME	SOURCE	PURPOSE
SEI_Primary_Decile	Sensitive Ecosystem Inventory	RDCO Open Data Portal	The primary decile category was used as a source of landcover for wetlands and forested areas not captured in the Vegetation Resource Inventory.
NRN_BC_14_0_ROADSEG	British Columbia Road Network	Government of Canada	Buffered roads were inserted into base landcover dataset as their own landcover category. This was done to account for breaks within natural assets. Road lines were also used to perform road density condition assessment.
Area_Boundary	RDCO Study Boundary with Municipal Areas	RDCO Open Data Portal	Used to determine study area boundary, and also used to split natural assets by their respective administrative boundaries to summarize natural areas by these various boundaries.
PMBC_Parcel_Polygon	Land Title's Parcel Map BC	RDCO Data Share	Used to summarize natural assets by various ownership types.
RDCO_Regional_Parks	RDCO Regional Parks	RDCO Open Data Portal	Used to summarize area of natural assets within RDCO parks and assign name(s) of parks to assets within them.
RDCO_Streams	RDCO Streams	RDCO Open Data Portal	Used to summarize the length of streams running through natural assets.
Regional_Parks_ Designated_Trails	RDCO Trails	RDCO Open Data Portal	Used to summarize the length of trails running through natural assets.
RDCO_Water_Points	RDCO Water Points	RDCO Open Data Portal	Used to indicate which natural assets contain water points and the number of water points within a natural asset.
RDCO_DPA_-_Sensitive _Aquatic	Sensitive Aquatic Areas	RDCO Open Data Portal	Used to summarize area of natural assets within the various Development Permit Areas.
RDCO_DPA_-_Sensitive_ Terrestrial	Sensitive Terrestrial Areas	RDCO Open Data Portal	Used to summarize area of natural assets within the various Development Permit Areas.
RDCO_DPA_-_Slope	Sloped Areas	RDCO Open Data Portal	Used to summarize area of natural assets within the various Development Permit Areas.
BCS_Relative_Biodiversity	Biodiversity Conservation Strategy Relative Biodiversity	RDCO Open Data Portal	Used to assign a biodiversity ranking to each natural asset based on their greatest area of overlap with rankings in this dataset.

TABLE 1: SUMMARY OF DATA SOURCES

FILE NAME	DESCRIPTIVE NAME	SOURCE	PURPOSE
BCS_Management_Class	Biodiversity Conservation Strategy Management Class	RDCO Open Data Portal	Used to assign a management class to each natural asset based on their greatest area of overlap with rankings in this dataset.
BCS_Conservation_ Ranking_Class_Values	Biodiversity Conservation Strategy Management Class	RDCO Open Data Portal	Used to assign a management class to each natural asset based on their greatest area of overlap with rankings in this dataset.
BCS_Conservation_ Ranking_Class_Values	Biodiversity Conservation Strategy Conservation Ranking	RDCO Open Data Portal	Used to assign a conservation ranking to each natural asset based on their greatest area of overlap with rankings in this dataset.
BCS_Habitat_Connectivity	Biodiversity Conservation Strategy Habitat Connectivity	RDCO Open Data Portal	Used to assign a habitat connectivity category to each natural asset based on their greatest area of overlap with categories in this dataset.
ALR_Polygons	Agricultural Land Reserve in British Columbia	Provincial Agricultural Land Commission	Used to summarize area of natural assets within the ALR.
WHSE_TANTALIS_TA_ PARK_ECORES_PA_SVW	BC Parks, Ecological Reserves, and Protected Areas	BC Open Data Catalogue	Used to summarize area of natural assets within parks and protected areas. Name of the significant area and its designation (ecological reserve, protected area, etc.) also assigned to natural assets within these features.
WHSE_BASEMAPPING_ FWA_ASSESSMENT_ WATERSHEDS_POLY	Freshwater Atlas Assessment Watersheds	BC Open Data Catalogue	Used to map watersheds in dashboard and summarize natural assets within watershed boundaries.

The inventory project defined a total of 37,059 individual assets, covering 298,940 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 bisected by a road would constitute two assets. The majority of the asset area in the Regional District of Central Okanagan was forest, followed by aquatic, shrubland and grassland.

TABLE 2: SUMMARY OF NATURAL AND ENHANCED ASSETS

NATURAL ASSET TYPE	NUMBER OF ASSETS	ASSET AREA (HA)
Agriculture*	2,582	7,312
Anthropogenic Waterbody**	26	118
Aquatic	311	24,166
Build-up Pervious***	2,545	1,758
Forest	24,665	229,910
Grassland	3,654	16,356
Moss/Lichen	7	83
Rock/Rubble	156	864
Shrubland	1,580	16,698
Treed	979	714
Wetland	554	961
Total	**37,059**	**298,940**

** Source: 2014 RDCO Agricultural Land Use Inventory (ALUI) and the Provincial Agricultural Land Commission*

*** The RDCO Anthropogenic Waterbodies category refers to those waterbodies that are either reservoirs, in which they are heavily used and managed by humans, or are located and maintained within anthropogenic areas. It is also used to represent reservoirs and waterbodies inside the bounds of golf courses.*

**** Built-up pervious includes manicured lawns and greenspaces (e.g., sports fields)*

Figure 3 shows the spatial distribution of the natural assets.

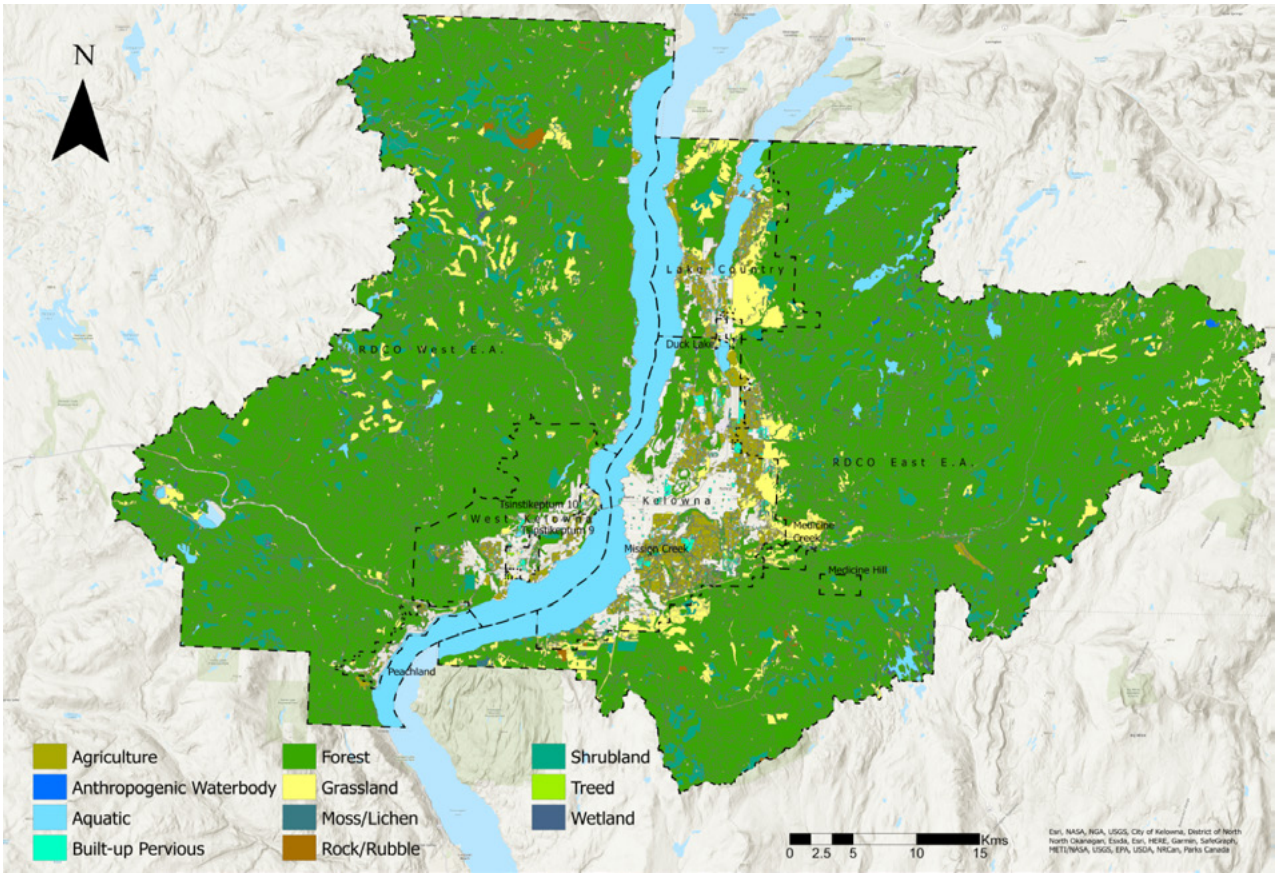

***Figure 3**: Spatial distribution of natural assets.*

4.3. Asset registry

Each asset within the inventory has a unique identification number that allows 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 Regional District of Central Okanagan'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	Sub-Asset ID	Asset Area (ha)	Asset Area (ha) in Admin Boundary	Administrative Boundary	Regional Park Trail Length (km)	Regional Designated Trail(s)	BC Parks and Protected Area (ha)	Regional Park Area (ha)	Protected Lands Name	Stream Length (km)	Water Points	Majority Management Class	Adjacent Land Use Score	Permeability Score	Relative Size Score	Road Density Score	Total Score
AGR1	Agriculture	AGR1-1	0.00	0.00	RDCO West E.A.	0.00		0.00	0.00		0.00	0	Private lands (non-agricultural/non-rural)	10	5	1	1	17
AGR10	Agriculture	AGR10-1	0.31	0.31	Kelowna	0.00		0.00	0.00		0.00	0	Private lands (non-agricultural/non-rural)	9	5	1	1	16
AGR100	Agriculture	AGR100-1	2.53	2.53	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	10	26
AGR1000	Agriculture	AGR1000-1	0.28	0.28	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	10	26
AGR1001	Agriculture	AGR1001-1	0.24	0.24	Kelowna	0.00		0.00	0.00		0.02	0	Rural, Ag. and Crown Leases	10	5	1	1	17
AGR1002	Agriculture	AGR1002-1	0.06	0.06	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	10	26
AGR1003	Agriculture	AGR1003-1	3.07	3.07	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	1	17
AGR1004	Agriculture	AGR1004-1	0.63	0.63	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	1	17
AGR1005	Agriculture	AGR1005-1	0.34	0.34	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	1	17
AGR1006	Agriculture	AGR1006-1	0.07	0.07	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	10	26
AGR1007	Agriculture	AGR1007-1	0.15	0.15	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	1	17
AGR1008	Agriculture	AGR1008-1	0.80	0.80	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	10	26
AGR1009	Agriculture	AGR1009-1	0.30	0.30	Kelowna	0.00		0.00	0.00		0.00	0	Rural, Ag. and Crown Leases	10	5	1	1	17
AGR101	Agriculture	AGR101-1	0.94	0.94	RDCO West E.A.	0.00		0.00	0.00		0.00	0	Private lands (non-	10	5	1	1	17

4.4. Online dashboard

Inventories may provide more insight 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 explore 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 Regional District of Central Okanagan. The full version can be accessed at *go.greenanalytics.ca/RDCO*.

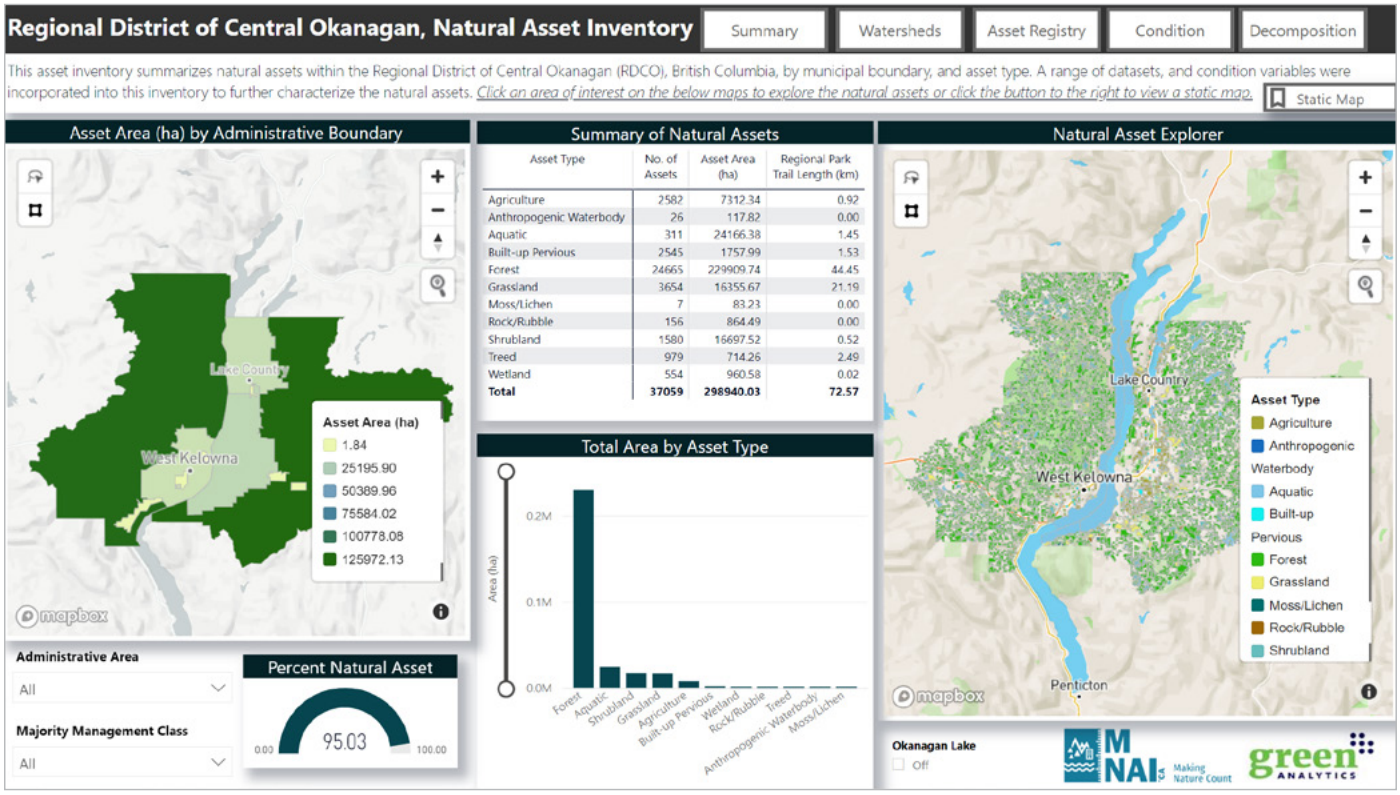

Figure 4: Screenshot of main inventory summary.

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 can, in turn: support the effective management of natural assets, be reflected in the registry and the dashboard, and be updated over time.

MNAI completed a desktop condition assessment and built it into the inventory to provide an initial understanding of the status of the natural assets for the Regional District of Central Okanagan. As part of a comprehensive natural asset management project, this assessment can be expanded to include additional metrics (e.g., relative biodiversity, riparian and wetland health, soil condition, connectivity). Site visits could be conducted to confirm and verify condition ratings.

Table 5 summarizes condition assessment steps and indicators. Indicators were chosen 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 broader condition considerations. For example, larger asset size implies more connectivity of natural areas and more permeability implies greater ability to store water, which can mean 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 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 alters pre-existing drainage and infiltration pathways, which can cause an area to receive much more or much less drainage than prior to being in an urban context. Urban runoff also typically carries 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 each asset class. The maximum possible score for an asset was 40, based on a possible 10 points for each of 4 categories:

- Road density rated 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

It is worth noting that the condition ranking is a snapshot of existing natural assets, and does not account for features that would have been entirely lost as the result of land cover actions such as development prior to this assessment.

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

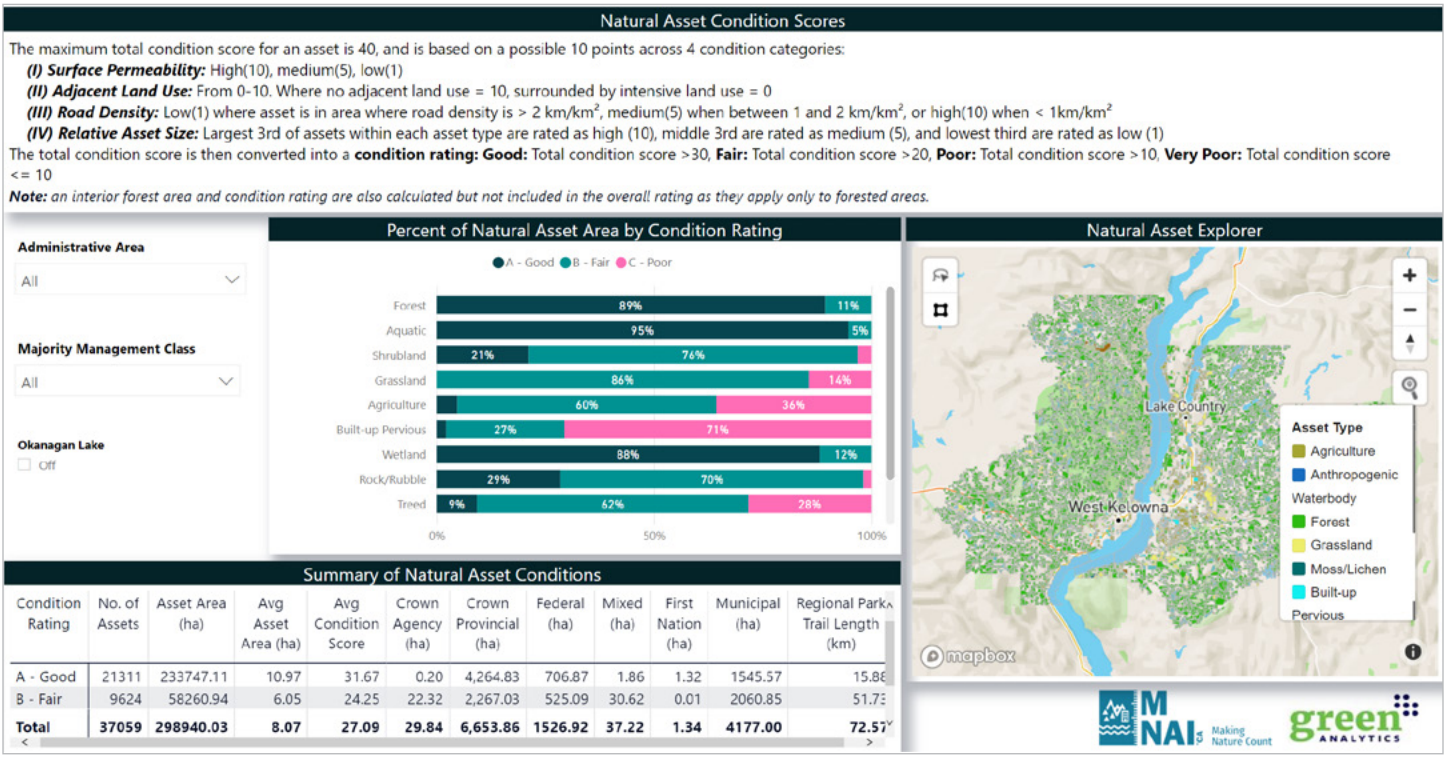

Figure 5: Screenshot of condition assessment results.

Overall, about 233,747 ha (or 78 percent) of natural assets were assessed in good condition and 58,260 ha (or 19 percent) were assessed in fair condition. Forest, aquatic, shrubland, grassland and wetland assets largely ranked good and fair.

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	21,311	233,747	31.67
Fair	9,624	58,261	24.25
Poor	6,124	6,931	15.63
Very poor	0	0	n/a
Total	**37,059**	**298,940**	**27.09**

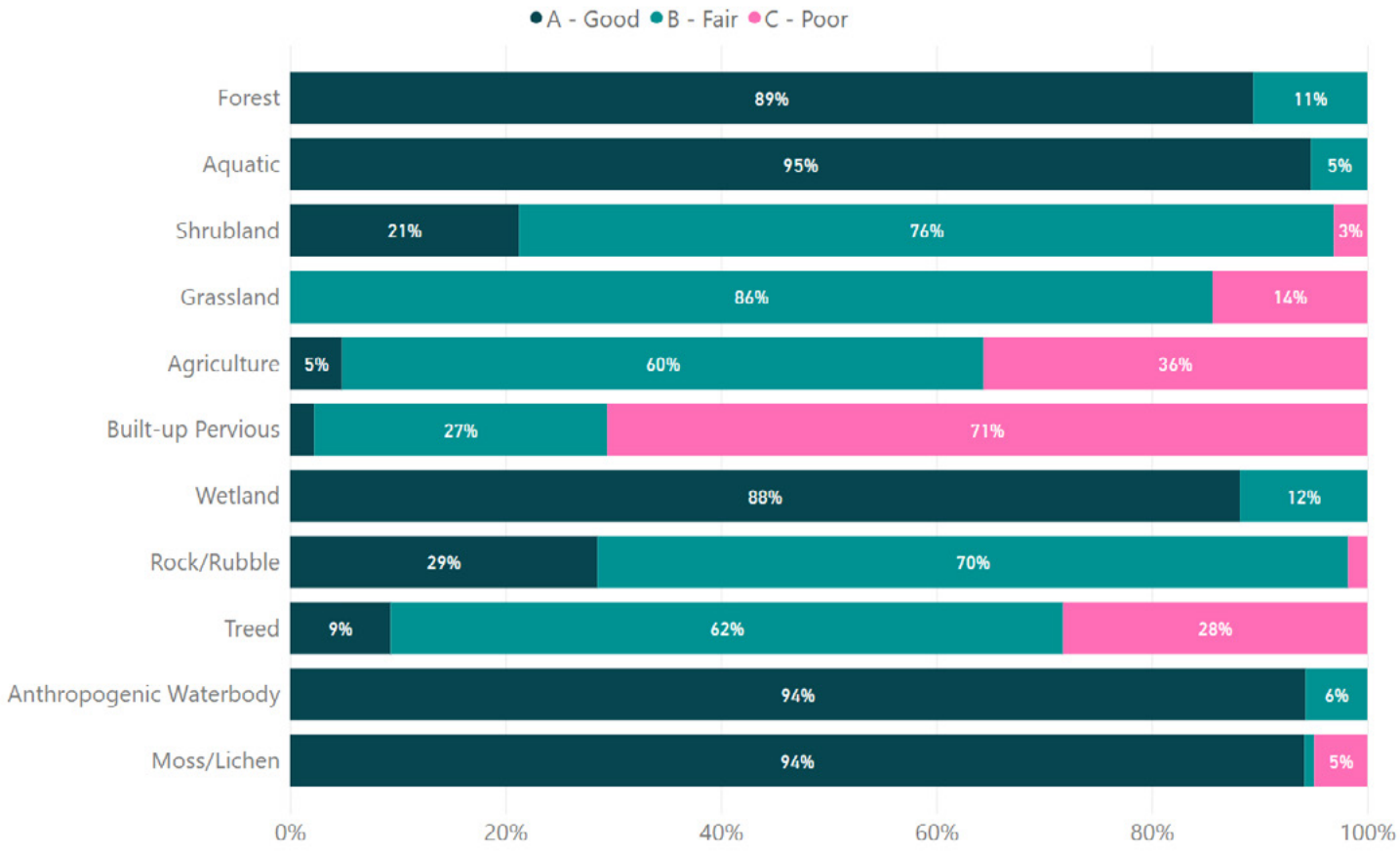

Figure 6: Summary of condition rating by natural asset type.

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 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. Full results from this process are in the *Annex*.

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 the asset.
- **Financial risk:** risks related to the financial capacity of the Regional District of Central Okanagan 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, a survey was administered to the Regional District of Central Okanagan that 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 (agricultural, industrial, etc.)
- Drought
- Erosion
- Ice jams
- Storm surge
- Lack of Flood Hazard Mapping
- Lack of Monitoring Reports
- Construction Activities
- 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, the Regional District of Central Okanagan considered four questions:

i/ what impact is likely to happen?
ii/ what is the consequence of that impact happening?
iii/ what is the driver of risk?
iv/ what cues will signal the need for mitigation?

5.3. Results of the risk identification process

Five local governments completed the risk survey and/or the risk tool, including the Regional District of Central Okanagan, the Westbank First Nation, the District of Lake Country, the City of Kelowna, and the City of West Kelowna. Although the results of the Risk Identification were different for each (individual risk matrices are provided in the Appendix), individual scores were combined and averaged

The risk identification process is summarized below and detailed in the Appendix:

- 0 high-level risks
- 3 medium-high level risks (flooding, forest fire, and development pressures)

- 7 medium-level risks (overuse of trails/dumping, invasive species, pollutant loading, drought, erosion, lack of flood hazard mapping, lack of land management plans, and construction activities)
- 3 medium-low level risks (storm surge, lack of monitoring reports, and political policy change)
- 1 low-level risks (ice jams)

In terms of scope, the identified risks affect natural assets across the Regional District of Central Okanagan, with numerous risks potentially affecting watercourses, wetlands, city parks, and the surface water reservoir. The identified risks also have the potential to negatively impact engineered assets (both city-owned and non-city-owned), property, and personal health and safety.

Figure 7 below provides a snapshot of the combined risk rankings. Risk matrix maps for each land class considered can be found in the *Annex*.

Figure 7: Combined Risk Results: RDCO

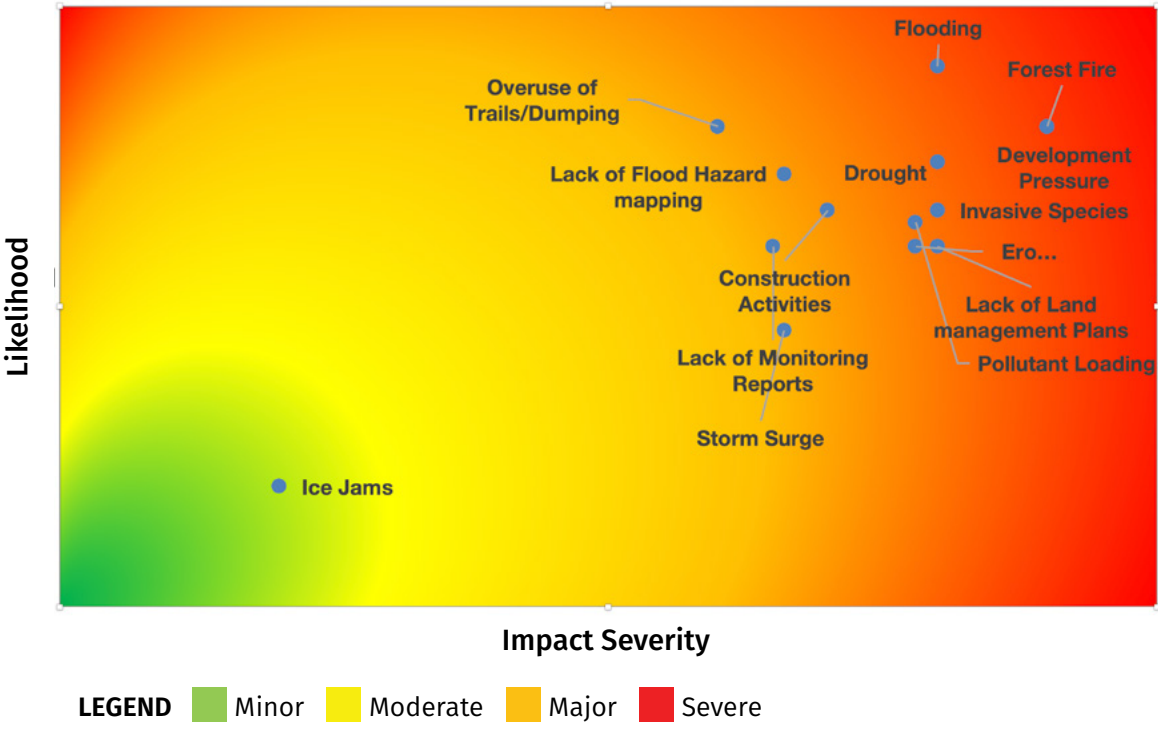

Figure 7: Combined Risk Rating.

5.4. Potential priorities for the local government

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

- **Flooding:** Beaches, riparian areas, water, forests, agricultural lands, grasslands, shrublands and wetlands were deemed to be at high-medium risk of flooding. While the impacts of overland flooding include damage to city infrastructure and private property, flooding may also damage or alter the function of natural assets. Coastal flooding may also occur due to the increased severity of storm events, rising lake levels, and wave surges.

  Areas of flood concern include along the lakes and creeks (e.g. Mission Creek, the foreshores of Indigenous Reserves 9 and 10, Smith Creek, Mill Creek, Okanagan Lake), in the floodplain (e.g. low lying areas, properties adjacent to watercourses), and areas with critical infrastructure (dams in drinking water reservoirs, landfills, airport). Signals of the need for mitigation measures include annual flood threats, impeded roadway access, and degraded shorelines, although some noted signals are already present and now is the time to partner and plan.

  Most survey respondents see flood risk as a manageable and tolerable threat, although it was noted that changing climatic conditions are likely to increase localized overland flooding. To manage this risk, survey respondents identified built or engineered options (e.g., build wave barriers, armor and build up access roads), natural options (e.g. purchase and establish riparian area in the floodplain, establish water corridors from the floodplain to existing wetlands), and hybrid options (e.g. preventative works in-stream). Planning and policy options were also highlighted, such as restrictive land uses, cumulative effects and sustainable management planning for all community watersheds. The need for collaboration across all local governments including First Nations, was recognized as essential to successful management of flooding.

- **Forest Fire:** Agricultural lands, forests, grasslands, shrubland, water, riparian areas, beaches and wetlands were deemed to be at high-medium risk of forest fire. While wildfires are a natural part of many environments, changing climatic conditions can lead to increased frequency and severity of fires and associated costs of servicing wildfire risk.

  Areas of forest fire concern include lands surrounding population centres (both urban and rural), agricultural areas adjacent to forests, undeveloped areas and communities with surface water. More specifically, IR 10, Old OK Highway, upper Peachland, Upper Glenrosa, Rose Valley watershed, Oyama community watershed, Beaver community watershed, and the neighbourhoods of Glenrosa, Goats Park/Gellatly, Shannon Lake, Bartley North, West Side Road/Bear Creek Road and Rose Valley Regional Park in West Kelowna.[9]

9 *RDCO Regional Parks has developed a Parks Community Wildfire Protection Plan located on the RDCO's website www.rdco.com/en/your-government/resources/Documents/RDCO_Parks_Community_Wildfire_Protection_Plan__CWPP__Final_Report__2020_.pdf*

Some survey respondents deemed the risk manageable, where others saw it as unmanageable, although there is agreement that it is an intolerable threat. To manage this risk, survey respondents identified a mix of protective measures (deep water intakes, underbrush clearing, tree trimming, maintaining slopes), planning (Wildfire Reduction Plans), land use regulations (Wildfire Development Permit Areas), and collaboration (work with provincial government to implement FireSmart Program, partner with the Black Mountain Irrigation District and the Glenmore Ellison Improvement District on water protection programs, education campaigns for residents).

Signals of the need for mitigation measures include reoccurring fires, wildfires near water intakes, and loss of agricultural lands. West Kelowna is developing key performance indicators for fire risk and response, which should be reviewed by all local governments within the Regional District.

- **Development Pressure:** Riparian areas, wetlands, agricultural lands, forests, grasslands, beaches, water and shrubland were deemed to be at high-medium risk of development pressures. Growing development pressures are causing stress on existing neighbourhoods, infrastructure, and the natural environment. In particular, losses to greenfield lands and the tree canopy are reducing flood attenuation and damaging flows downstream in some communities.

  Areas of concern include areas currently zoned for development and those that are deemed suitable for development but not yet zoned, areas near the agricultural land reserve, areas in the urban-rural interface, areas around lakes, wetlands, hillside developments, forest interface areas, IR 10 and IR 9.

- **Survey respondents agreed** that development pressure is a manageable risk that represents a threat but were mixed on whether it is tolerable. To manage this risk, survey respondents mainly looked to policy. Long-term planning, development permit area guidelines, and urban growth boundaries can all manage development pressures and their impacts to natural assets.

Table 6 provides brief descriptions of risk mitigation strategies; these can be addressed in future stages of the MNAI process.

TABLE 6: RISK MITIGATION STRATEGIES

Condition Rating	Number of Assets
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 (a) opportunities to strengthen natural asset management at an organization-wide level, (b) possible actions for the further development of the inventory, and (c) steps the Regional District of Central Okanagan can consider to advance to a full natural asset management initiative.

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

Being that it is at a relatively early stage of adopting asset management, the Regional District of Central Okanagan should leverage the opportunity to ensure natural asset considerations are incorporated as it progresses in asset management overall. For example, the Regional District of Central Okanagan has not yet formalized a cross-functional asset management team and if it does so, can ensure that one or more representatives of its natural asset management team are included on that team.

The Regional District of Central Okanagan will be seeking endorsement of its Asset Management Policy and Strategic Asset Management Plan at the Senior Management and Regional Board level; [in this context] the Asset Management Policy and Strategic Asset Management Plan should include requirements to assess asset management needs related to natural assets.

When the natural asset inventory is complete, it will be important to identify the most critical natural assets in terms of service delivery, and assess their condition. Staff also noted the opportunity to develop an asset management plan for natural assets, which would include identifying short-term actions that incorporate natural asset management to support flood mitigation.

It is important to build support for natural asset management among Regional Board members to ensure the plan is adequately resourced. The results of the MNAI project should be communicated to staff and the Regional Board in order to build awareness of the role of nature in service delivery.

6.2. Possible actions for the further development of the inventory

Regardless of whether or not it pursues a full natural asset management process, the Regional District of Central Okanagan should consider the following based on the inventory. These are mostly incremental measures.

- Expand the risk identification to include field verification of results.
- Determine acceptable levels of risk to the Regional District of Central Okanagan's risk mitigation strategies (see Table 6).
- Further develop the condition assessment and risk assessment for the watershed, lakes, forests, floodplains and foreshore areas (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, 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

To progress with a more comprehensive natural asset management project, including implementation, the Regional District of Central Okanagan 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 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 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

Federation of Canadian Municipalities. October 2018. Asset Management Readiness Scale: Municipal Asset Management Program. *fcm.ca/sites/default/files/documents/resources/tool/asset-management-readiness-scale-mamp.pdf*

MNAI. *Defining and Scoping Municipal Natural Assets*. June 2017. *mnai.ca/media/2019/07/SP_MNAI_Report-1-_June2019-2.pdf*

MNAI. *Results from the First National Cohort. Decision-maker summary*. 2018. *mnai.ca/media/2019/08/spmnaijuly31-summaryweb.pdf*

MNAI. *Cohort 2 National Project Overview*. February 2020. *mnai.ca/media/2020/02/MNAI-CohortSummary.pdf*

Regional District of Central Okanagan - Regional Board Strategic Priorities 2019-2022. *www.rdco.com/en/your-government/resources/Documents/2020-Board-Strategic-Priorities-Plan-Update.pdf*

Regional District of Central Okanagan - Regional growth strategy: Priority projects plan. (2017, July 31). *www.rdco.com/en/business-and-land-use/resources/Documents/Regional-Growth-Strategy-Priority-Projects-Plan.pdf*

Annex: Results of the RDCO risk identification

This Annex contains the summary results of the Regional District of Central Okanagan's risk identification survey, which they self-administered with guidance from MNAI. Table 7 was the main product that personnel developed from the exercise. Figures 8-12 show the risk results for each local government that completed the survey.

TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

Risk	Local Government	Likelihood	Severity	Risk Ranking
Overuse of Trails/Dumping	RDCO	3.6	4	14.4 (M)
	Westbank FN	5	4	20 (M-H)
	District of Lake Country	5	1	5 (L)
	Kelowna			M
	West Kelowna			M
Flooding	RDCO	4	3.3	13.2 (M)
	Westbank FN	5	2	10 (M-L)
	District of Lake Country	3	5	15 (M)
	Kelowna			H
	West Kelowna			H
Forest Fire	RDCO	3.6	3.6	12.96 (M)
	Westbank FN	3	4	12 (M)
	District of Lake Country	3	5	15 (M)
	Kelowna			H
	West Kelowna			H
Invasive Species	RDCO	4.3	4.3	18.49 (M-H)
	Westbank FN	3	4	12 (M)
	District of Lake Country	3	5	15 (M)
	Kelowna			M
	West Kelowna			n/a
Development Pressure	RDCO	3	4	12 (M)
	Westbank FN	3	4	12 (M)

TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

Risk	Local Government	Likelihood	Severity	Risk Ranking
	District of Lake Country	5	4	20 (M-H)
	Kelowna			H
	West Kelowna			H
Pollutant Loading	RDCO	4	4.5	(M-H)
	Westbank FN	3	4	12 (M)
	District of Lake Country	3	5	15 (M)
	Kelowna			M
	West Kelowna			M
Drought	RDCO	3.6	4	14.4 (M)
	Westbank FN	3	4	12 (M)
	District of Lake Country	4	4	16 (M-H)
	Kelowna			H
	West Kelowna			M
Erosion	RDCO	3	3.5	10.5 (M)
	Westbank FN	3	5	15 (M)
	District of Lake Country	3	4	12 (M)
	Kelowna			M
	West Kelowna			n/a
Ice jams	RDCO	1	1	1 (L)
	Westbank FN	n/a	n/a	n/a
	District of Lake Country	n/a	n/a	n/a
	Kelowna			L
	West Kelowna			n/a
Storm surge	RDCO	3	5	15 (M)
	Westbank FN	3	5	15 (M)
	District of Lake Country	n/a	n/a	n/a
	Kelowna			L
	West Kelowna			M-L
Lack of Flood Hazard Mapping	RDCO	5	4	20 (M-H)

TABLE 7: SIMPLIFIED RISK IDENTIFICATION SURVEY

Risk	Local Government	Likelihood	Severity	Risk Ranking
	Westbank FN	3	2	6 (M-L)
	District of Lake Country	3	4	12 (M)
	Kelowna			n/a
	West Kelowna			n/a
Lack of Land Management Plans	RDCO	3	4	12 (M)
	Westbank FN	3	4	12 (M)
	District of Lake Country	3	5	15 (M)
	Kelowna			M*
	West Kelowna			n/a
Lack of Monitoring Reports	RDCO	3	4	12 (M)
	Westbank FN	3	2	6 (M-L)
	District of Lake Country	3	4	12 (M)
	Kelowna			M*
	West Kelowna			n/a
Construction Activities	RDCO	2.6	3.3	8.58 (M-L)
	Westbank FN	3	4	12 (M)
	District of Lake Country	5	4	20 (M-H)
	Kelowna			M
	West Kelowna			M
Political Policy Change	RDCO	3	4	12 (M)
	Westbank FN	3	4	12 (M)
	District of Lake Country	1	5	5 (L)
	Kelowna			M
	West Kelowna			n/a

Notes: *n/a = not assessed Kelowna and West Kelowna provided overall scores*

**** Kelowna assessed Policy & Procedure, which was used for lack of land management plans and lack of monitoring reports***

Figure 8: **RDOC Risk Matrix**

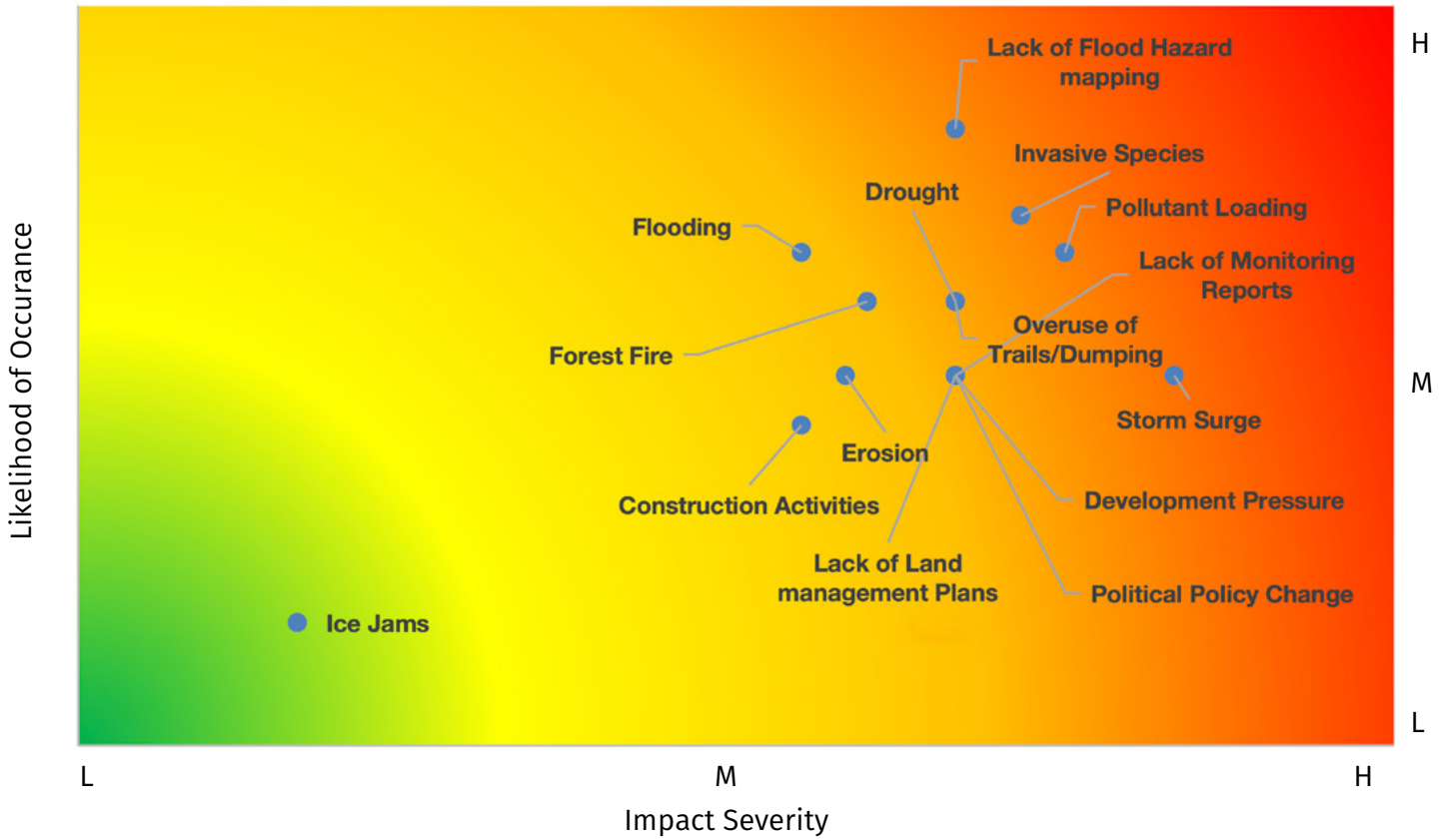

***Figure 8**: Regional District of Central Okanagan Risk Map*

Figure 9: **Westbank First Nation Risk Matrix**

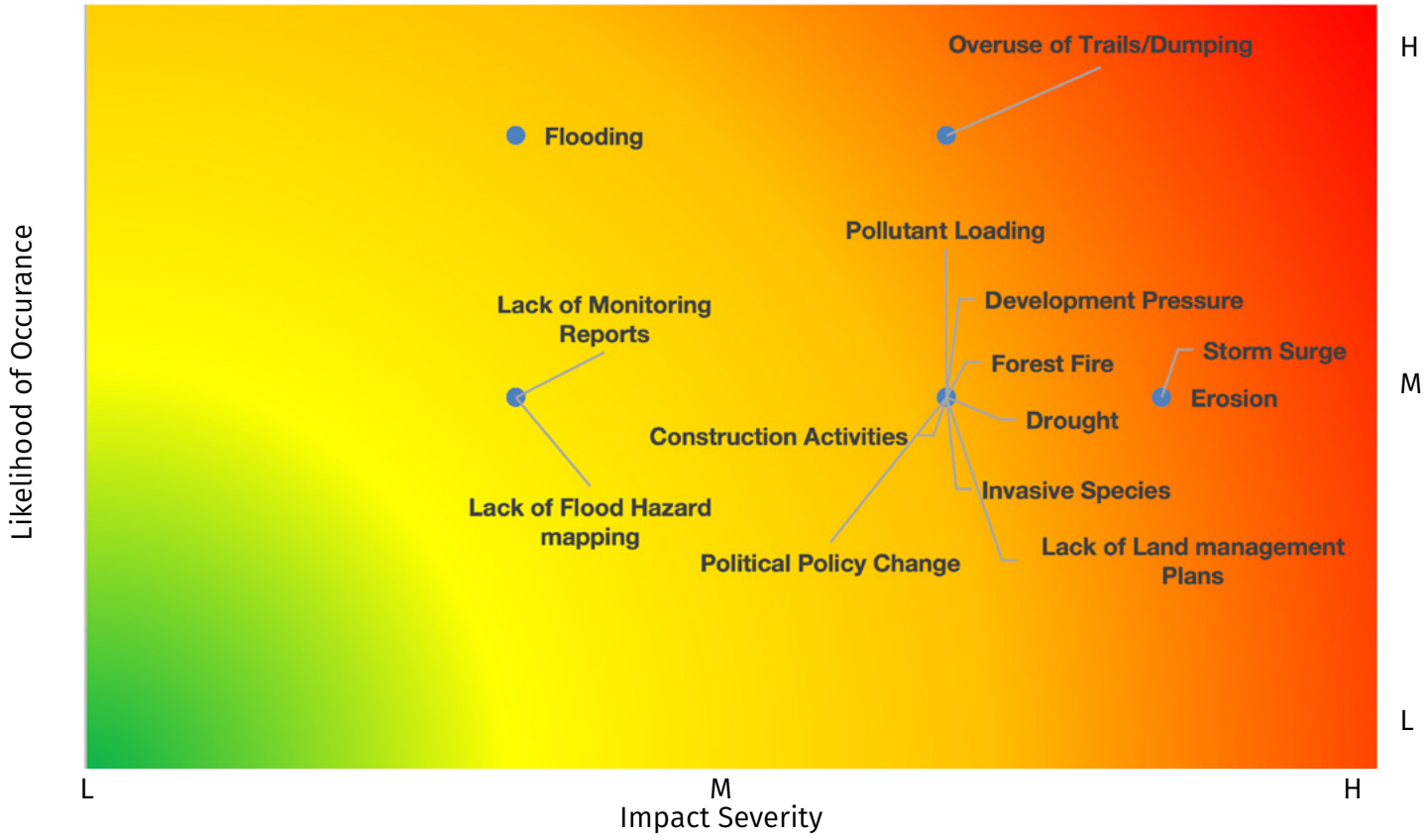

***Figure 9**: Westbank First Nation Risk Map*

Figure 10: District of Lake Country Risk Matrix

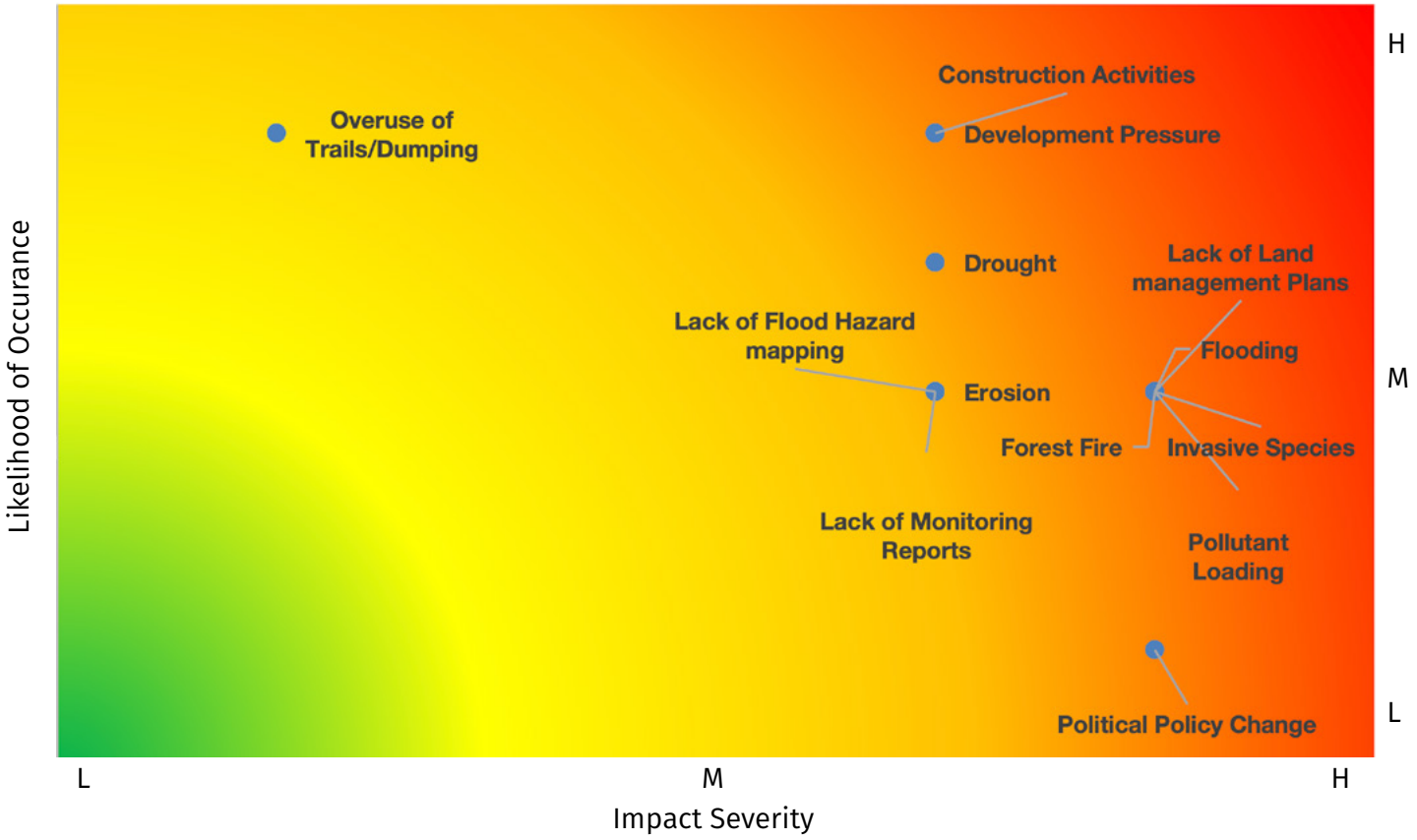

Figure 10: District of Lake Country Risk Map

Figure 11: City of Kelowna Risk Matrix

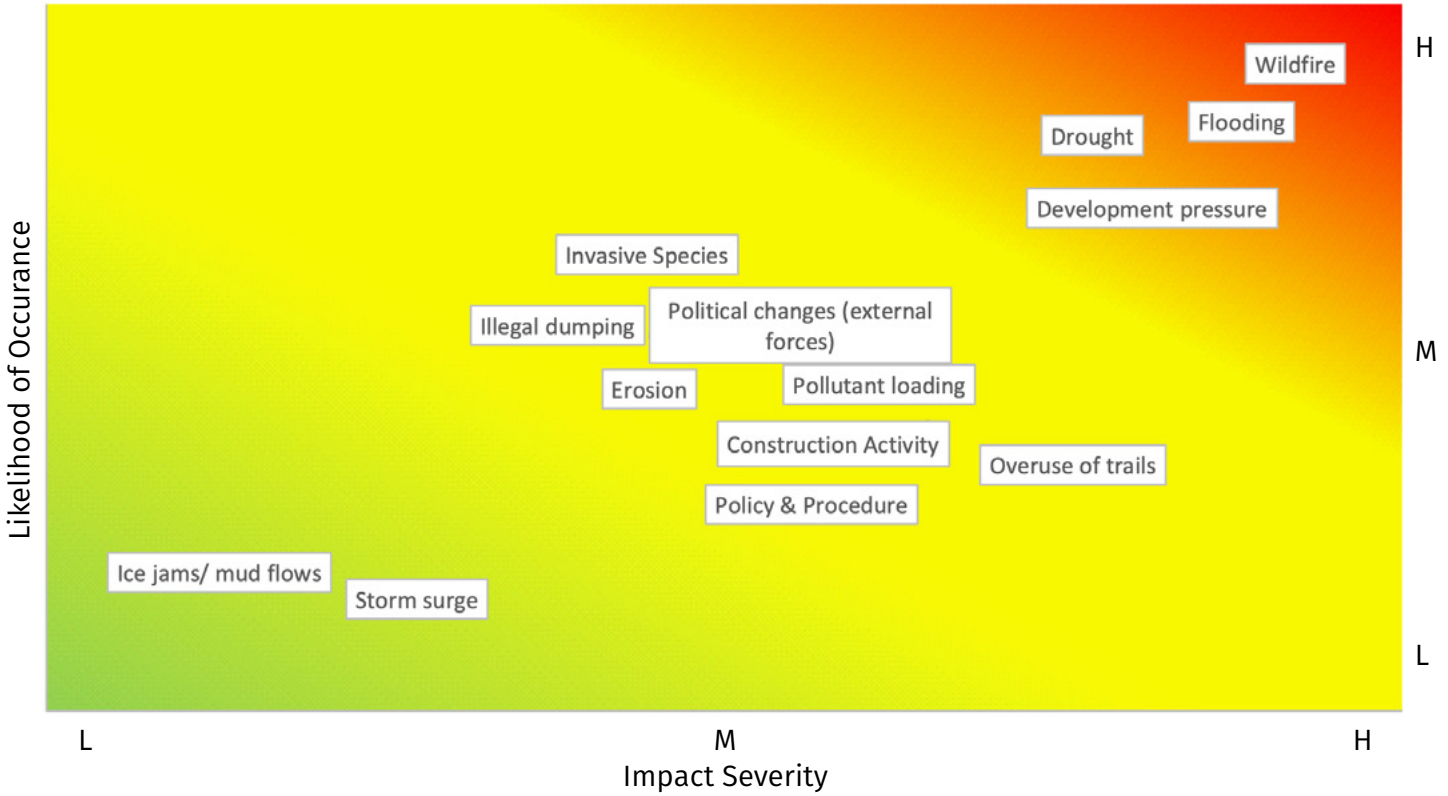

Figure 11: City of Kelowna Risk Map

Figure 12: City of West Kelowna Risk Map

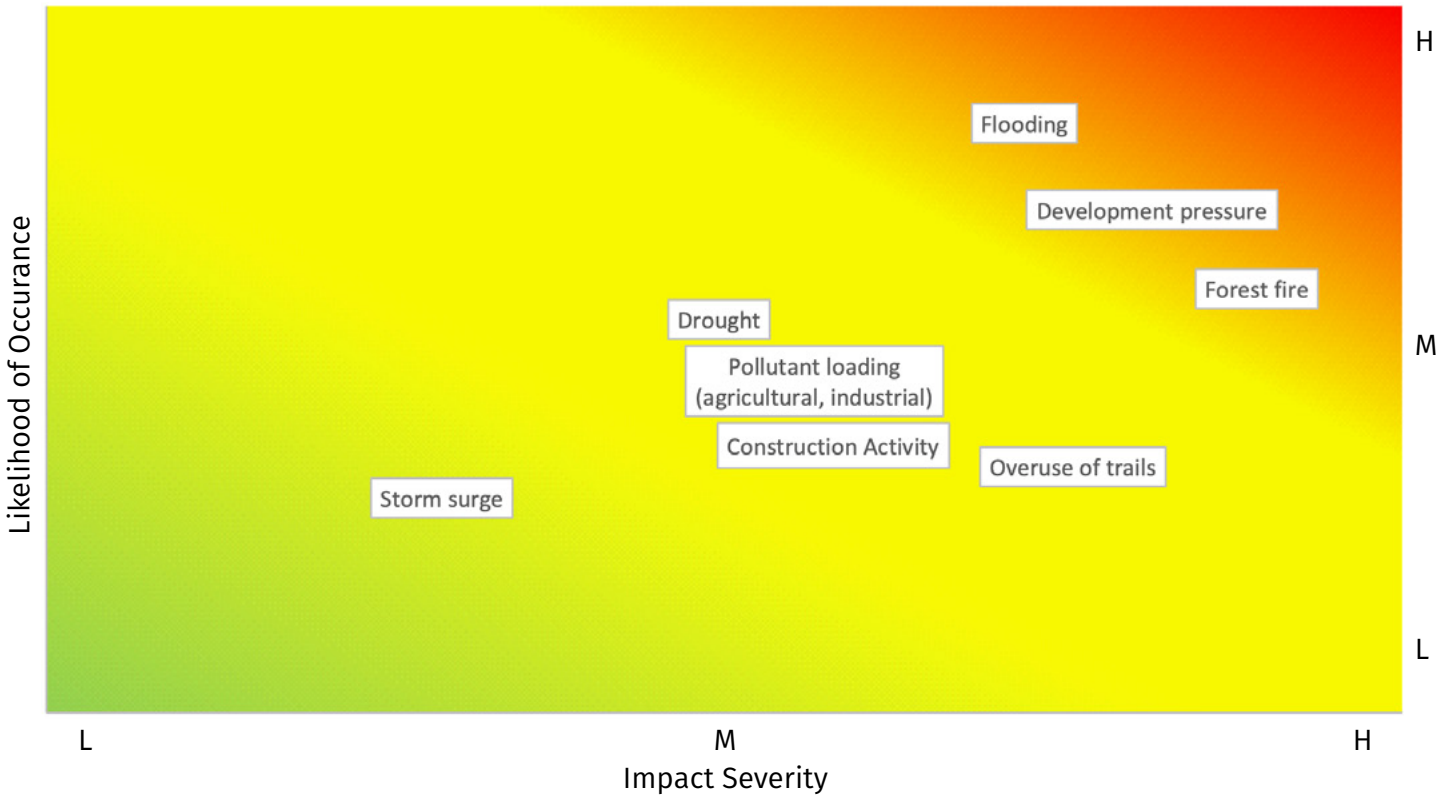

Figure 12: City of West Kelowna Risk Map

LEGEND Minor Moderate Major Severe

Municipal Natural Assets Initiative