

# ROAD R.O.W SERVICE ASSET MANAGEMENT PLAN - 2022

MAY 2022





# ROAD R.O.W SERVICE ASSET MANAGEMENT PLAN - 2022

TOWN OF LINCOLN

DATE: MAY 2022



# TABLE OF CONTENTS

- 1 GOVERNANCE AND LEADERSHIP .....1
- 1.1 Overview .....1
- 1.2 Roles and Responsibilities ..... 2
- 1.3 Goals and Objectives ..... 2
- 1.3.1 Road ROW Service Mission and Goals.....3
- 1.4 Context for Asset Management Plan Document ..... 4
- 1.4.1 Relationship with Other Documents .....4
- 1.4.2 Reference Documents .....5
- 1.4.3 Limitations and Assumptions .....5
- 1.4.4 Implementation and Review .....6
- 2 KNOW YOUR ASSETS..... 7
- 2.1 Context for Information in this Section ..... 7
- 2.1.1 Infrastructure Data Source .....7
- 2.1.2 Minimum Data Requirements .....7
- 2.1.3 Asset Replacement Costs .....8
- 2.1.4 Asset Lifespans .....8
- 2.1.5 Asset Condition .....8
- 2.1.6 Data Assumptions .....9
- 2.1.7 Limitations .....10
- 2.2 State of Infrastructure ..... 11
- 2.3 Know your Assets Improvement Priorities .....14
- 3 MANAGE SERVICE DELIVERY ..... 16
- 3.1 Level of Service .....16
- 3.1.1 Level of Service Development Approach .....17
- 3.1.2 Road ROW Levels of Service .....17
- 3.1.3 Legislative Requirements .....29
- 3.1.4 Level of Service Improvement Priorities .....31
- 3.2 Lifecycle Strategies.....31
- 3.2.1 Management Approach .....31
- 3.2.2 Lifecycle Strategy Terminology .....33
- 3.2.3 Lifecycle strategy Improvement Priorities .....35
- 3.3 Risk Profile..... 35
- 3.3.1 Service Level Risk .....35
- 3.3.2 Connection of Risk to Level of Service .....36
- 3.3.3 Service Level Risks – Road.....37
- 3.3.4 Service Level Risks - Storm .....40

3.3.5	Asset Level Risks .....	43
3.3.6	Connection to Asset Criticality .....	45
3.3.7	Risk Improvement Priorities .....	46
<b>3.4</b>	<b>Resource Needs .....</b>	<b>47</b>
3.4.1	Existing Capacity .....	47
3.4.2	Resource Needs for Current Service Level .....	47
3.4.3	Comparing Resource Needs and Capacity .....	47
3.4.4	Resource Improvement Priorities .....	47
<b>4</b>	<b>FUTURE READY .....</b>	<b>49</b>
<b>4.1</b>	<b>Demand Management .....</b>	<b>49</b>
<b>4.2</b>	<b>Resiliency and Adaptation .....</b>	<b>51</b>
4.2.1	Growth .....	51
4.2.2	Climate Change .....	52
4.2.3	Mitigation Actions .....	54
<b>4.3</b>	<b>Sustainability .....</b>	<b>56</b>
4.3.1	Assessment and Current Performance .....	56
4.3.2	Current Performance .....	56
<b>5</b>	<b>FINANCIAL SUMMARY .....</b>	<b>58</b>
<b>5.1</b>	<b>Context for Information in this Section .....</b>	<b>58</b>
<b>5.2</b>	<b>Financial Forecasts .....</b>	<b>58</b>
5.2.1	Financial Renewal Forecast .....	58
5.2.2	Operations, Maintenance, and Inspections Budget Forecast .....	59
5.2.1	Capital New Asset Forecast (New/Upgrade/Improve/Augment) .....	59
5.2.2	State of Infrastructure Capital Renewal Forecast .....	60
5.2.3	Revenue .....	62
<b>5.3</b>	<b>Funding Strategy .....</b>	<b>62</b>
<b>5.4</b>	<b>Financial Improvement Priorities .....</b>	<b>63</b>
<b>6</b>	<b>CONTINUOUS IMPROVEMENT .....</b>	<b>65</b>
<b>6.1</b>	<b>Asset Management Maturity Assessment .....</b>	<b>65</b>
6.1.1	Assessment Results – Road ROW .....	65
6.1.2	Assessment Results – Stormwater .....	69
6.1.3	Asset Management Maturity Improvement Priorities .....	72
<b>6.2</b>	<b>Asset Management Plan Improvement Actions .....</b>	<b>74</b>
<b>6.3</b>	<b>Implementation Plan .....</b>	<b>78</b>
6.3.1	Continuous Improvement Procedures .....	78

6.3.2 Change Management .....79  
6.3.3 Performance Measurement & Evaluation .....82  
  
7 LIST OF TABLES AND FIGURES .....88  
7.1 List of Tables..... 88  
7.2 List of Figures ..... 89

---

*APPENDICES*

**A LIFECYCLE STRATEGIES**

# 1 GOVERNANCE AND LEADERSHIP

## 1.1 OVERVIEW

The Town of Lincoln is located on the southern shore of Lake Ontario. The municipal road allowance, or road right-of-way (ROW), is a network of land owned and operated by the municipality and is primarily used for the transportation of people as well as goods and services that are essential to the community's ability to function, grow and prosper. In Lincoln, the ROW network is a two-tier system with the majority of ROW being under the jurisdiction of the Town of Lincoln. However, primary collector and arterial type road allowances are typically owned and operated by the Niagara Region.

Although most assets within Regional ROW's are under the jurisdiction of the Niagara Region, the Town of Lincoln is still responsible for many assets within these corridors as well. It is important to note that this AMP provides a plan to manage all roadway assets maintained and operated by the Town of Lincoln, regardless of whether they are located within municipal or Regional ROW.

This AMP also covers assets owned by the Town for the purpose of managing storm water runoff through creeks, drainage channels and stormwater management facilities, as these are essential to the safe operation of roadways and are therefore considered an extension of ROW services.

Road Right-of Ways are Lincoln's largest service area group with the highest number and value of assets. These assets support the community's quality of life and its dynamic economy including agriculture, agrotourism, viniculture, wineries, breweries, and other industries.

The Town of Lincoln's Right-of-way is comprised of the follow core asset categories and asset types:

**Table 1: Town of Lincoln – Transportation assets**

Service Area Asset Management Plan – Road Right-of-Way	
<u>Asset Category</u>	<u>Asset Type</u>
<i>Roads</i>	Pavement
<i>Bridges</i>	Bridge Structures
<i>Culverts</i>	Large culverts (greater than 3m)
	Small culverts (less than 3m)
<i>Active Transportation Facilities</i>	Sidewalks
	Multi-use paths
	Off-road cycling facilities
	Trails
<i>Stormwater management</i>	Storm sewers
	Storm sewer structures
	Stormwater management ponds
	Watercourses
	Ditches and drainage channels
<i>Traffic control and roadside safety</i>	Signage



Service Area Asset Management Plan – Road Right-of-Way	
	Pavement Markings
	Guiderails
	Structures
Streetlights	Functional light standards (HPS, LED)
	Decorative light standards (HPS, LED)

As Lincoln continues to experience growth, it is critical for the Town’s ROW service area to be managed in way that provides a high level of service for the lowest life cycle cost of these assets. This AMP also needs to account for the communities need to adapt and change as the Town continues to grow at a rapid pace, planning for future assets that connect people through the Road ROW network by all modes of transportation, which should add a sense of belonging for both existing and future residents of Lincoln.

## 1.2 ROLES AND RESPONSIBILITIES

The **Chief Administrative Officer** (CAO) is responsible for oversight and administration of the Town’s services. The CAO Implements the policies and direction approved by Council, and with support from the senior management team, develops strategic planning initiatives for the organization.

The **Town’s Public Works Department** is responsible for the stewardship of all core asset categories outlined in the Road ROW AMP. The two service area teams leading this mandate are highlighted below:

1. **Technical Services Department:** responsible for supporting the monitoring and tracking service condition of capital assets as well as planning the rehabilitation and/or replacement of these assets as required. The engineering team also works with the Environmental Services Department for financial planning as it relates to lifecycle strategies for all core capital assets within the Road ROW
2. **Capital Services Department:** responsible for completing capital renewal and upgrade projects. Works closely with all other departments.
3. **Roads and Fleet Department:** responsible for the day-to-day operation and maintenance of core Road ROW assets as required and in accordance with O. Reg 239/02 Minimum Maintenance Standards for Municipal Highways
4. **Planning Department:** Oversees planning initiatives to support effective and responsible growth and development in Lincoln. The department is responsible for a wide variety of functions associated with planning and land use.

## 1.3 GOALS AND OBJECTIVES

The Town of Lincoln’s strategic plan “A Future Fit Lincoln” describes its strategic priorities to build a welcoming, connected, vibrant and resilient community. The long-term vision statement for the Town is:



**A place to grow:**

Youth, aging in place, agriculture – growing crops, farming, greenhouse support, business growth, early childhood development (youth), proper planning and growing smart, growing your family here in Lincoln

**A place to prosper:**

A place for small/medium businesses to succeed, opportunities, job creation, tourism, destination, local markets, festivals, beautification, industrial parks, prosperity, community vibrancy, innovation

**A place to belong:**

Maintain community feeling, connectedness, more local events, support for families, history and heritage, local markets, local and unique festivals, moving around town, one community

---

### ***1.3.1 ROAD ROW SERVICE MISSION AND GOALS***

#### ***Service Mission***

The mission of the Lincoln Road R.O.W Service is ***“Improve safe passage for residents, visitors and businesses and ensuring roadways are passable for emergency response vehicles”***.

#### ***Service Goals***

The ultimate goal of the Lincoln Road R.O.W Service in alignment with its mission statement, is to be proactive in improving road safety and maintaining the road right-of-way.

For safety, the Town have passed a resolution to improve truck safety, and are working closely with the Niagara Region, NRPS, MTO and other agencies on multi-stakeholder and multi-agency strategies.

The Town’s Traffic Safety Program focuses on traffic calming and speed reduction strategies to improve safety for both motorists and pedestrians across the community including:

- Public Education.
- Reducing Road Speed Limits.
- Speed Limit Enforcement.

To ensure that the roadways are safe and accessible, the Town have a 24-hour contact service for queries and complaints, and hazard identification, and a “keep it clear” program. The “keep it clear” program is a communication tool used to notify residents of heavy snowfall events and encourages them to not park on streets to support efficient snow removal.

## 1.4 CONTEXT FOR ASSET MANAGEMENT PLAN DOCUMENT

### 1.4.1 RELATIONSHIP WITH OTHER DOCUMENTS

The Town recognizes the importance of proactive and responsible management of its road right of way infrastructure.

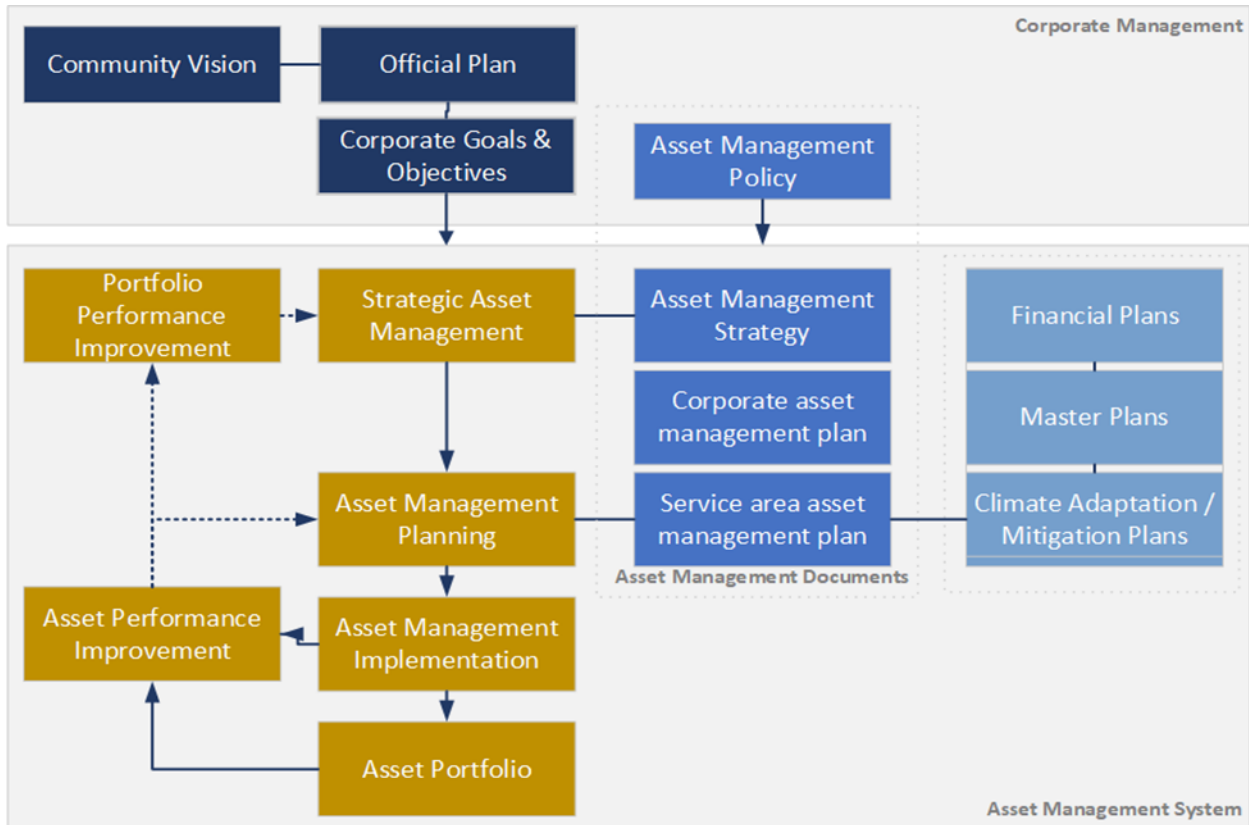
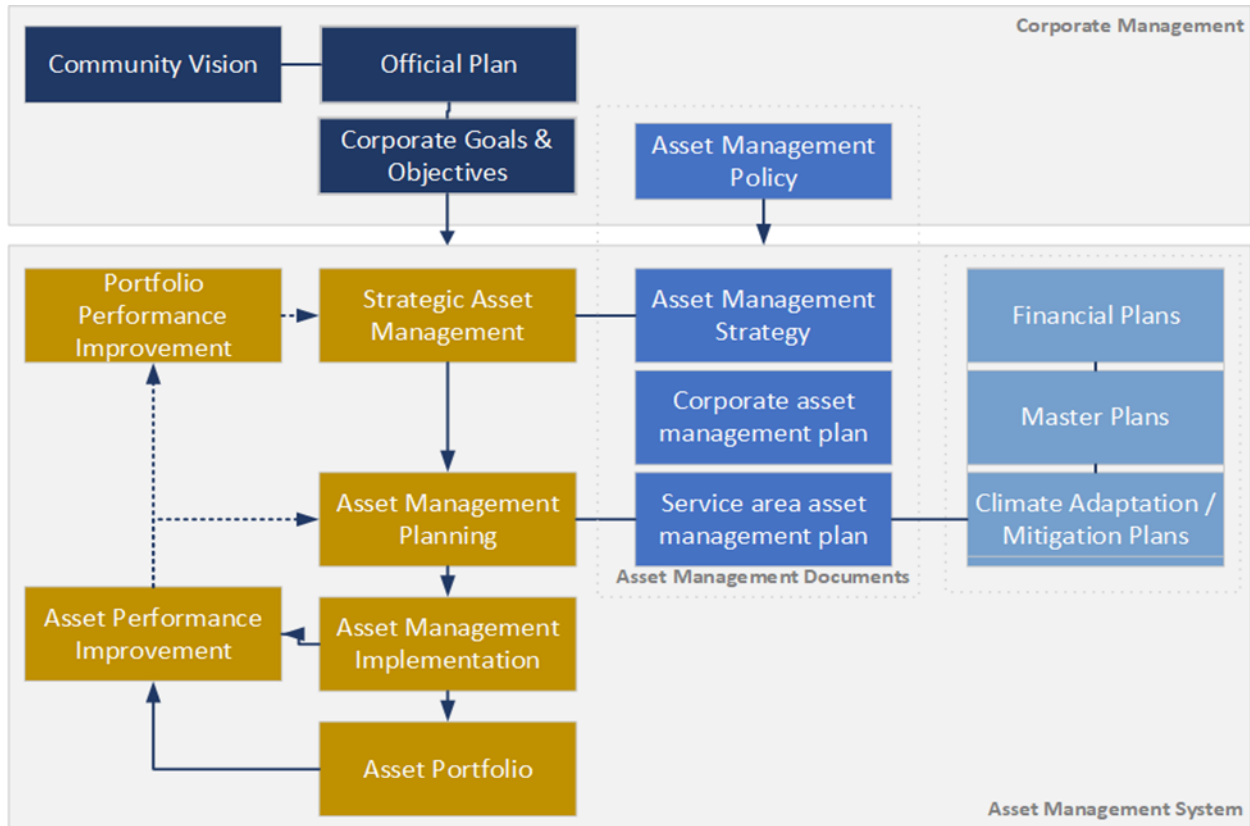


Figure 1 shows the linkage and relationships between asset data and how it informs asset management plans, financial and master planning documents, corporate asset management plans, climate adaptation and mitigation plan and policy statements, which in the Road ROW Service Area Asset Management Plan will strive to meet the goals of a **Future-Fit Lincoln**. These goals are to provide a reliable, effective, and supportive service in a financially responsible way that is aligned to the community vision.



**Figure 1: Relationship to corporate documents**

### 1.4.2 REFERENCE DOCUMENTS

The following other plans and strategies were referenced in the preparation of this Asset Management Plan

- Transportation Master Plan
- Active Transportation Strategy

### 1.4.3 LIMITATIONS AND ASSUMPTIONS

This AMP has been prepared based on the best information available regarding inventory and costs of providing the service, and an understanding of adequate maintenance and renewal of assets in a “whole of lifecycle” manner. Continuous improvement of Lincoln’s asset management practices is essential to collect accurate asset information that can be used to support ongoing quality planning and sustainable infrastructure management.

The limitations faced while writing this plan are summarized in Table 2. Recognizing these limitations will help inform the continuous improvement process for future versions of the asset management plan.

**Table 2: Limitations of the asset management plan**

Limitation	Impact
<i>Asset Data</i>	The Town's inventory is stored in multiple tables and databases and contains gaps and duplicates. A data management plan was developed in 2021 and recommends a centralized database be adopted for all asset inventory. This is still to be implemented.
<i>State of the infrastructure</i>	The state of the infrastructure is based on currently available inventory data.
<i>Asset Criticality</i>	The asset data was limited such that it made assigning criticality in a consistent way difficult. Some datasets had common attributes that made it easy to join datasets, whereas other datasets did not have the common identifier.
<i>Asset Level Risk</i>	The asset data was limited in a way that the likelihood of failure for the asset level risk ratings could not be accurately calculated. Some datasets had age-based condition ratings which results in an assumed likelihood of failure.
<i>Scope of road ROW Service asset management plan</i>	The road ROW Asset Management Plan does not include assets in the Regional or Municipal right-of-way that are not owned by Lincoln.

#### 1.4.4 IMPLEMENTATION AND REVIEW

The road right of way asset management plan documents current practices and information on:

- The quantity, age, condition and value of the assets
- Current levels of service and performance measures
- Current practices for managing the assets
- Risks to service delivery
- Renewal plans and financial strategy

The asset management plan also documents improvement tasks that if addressed will increase the level of understanding of the service provided by the road right of way. An up-to-date asset management plan will empower decision-makers with accurate and complete information in an easy-to-understand format that will support well-informed, evidence-based decisions and identify the right balance between level of service, risks, and available funding, that is in the best interests of the Town. As such, the implementation of this asset management plan must include regular review and update to keep the plan up to date with the latest information, understanding and projections.

The asset management plan should be reviewed every five years at a minimum. Consideration must also be given in each asset management plan update to any changes in the Ontario Requirements 588/17: Asset Management Planning for Municipal Infrastructure.

## 2 KNOW YOUR ASSETS

---

### 2.1 CONTEXT FOR INFORMATION IN THIS SECTION

The following sections describe the current state of infrastructure for the transportation service assets maintained by the Town of Lincoln.

The state of infrastructure of the transportation service includes the following asset groups:

- Local Road
- Collector Road
- Sidewalks
- Bridges
- Major Culverts
- Culverts
- Storm Pipes
- Stormwater Management Facilities / Ponds (SWMF's)
- Oil and Grit Separators (OGS)
- Signs

A summary of state of infrastructure statistics for each asset group is reported in the next section of this plan. These statistics include the quantity of assets in each group, their average age, the total replacement value, graphs showing the condition profile and age profile of the assets, and a long-term financial forecast for replacing existing assets as they reach the end of their useful life.

---

#### 2.1.1 *INFRASTRUCTURE DATA SOURCE*

The inventory data is kept in various sources including CityWide, and in spreadsheets. The data used to develop this asset management plan was outputs from CityWide, outputs from the Town's GIS system, and from the previous road inventory management system.

---

#### 2.1.2 *MINIMUM DATA REQUIREMENTS*

Currency and accuracy of asset data is critical to effective asset management, accurate financial forecasts, and informed decision-making. To produce the state of infrastructure section of the asset management plan, the following attribute data is required:

- Asset Identifier
- GIS Identifier
- Asset Owner
- Asset Status (active, abandoned, not in use etc.)
- Asset Group
- Asset Type
- Install Date or Year
- Estimated Useful Life (EUL)

- Size 1 (diameter, width, height, power etc.)
- Size 2 (length, width, height, quantity etc.)
- Size 3 (area, quantity etc.)
- Material Type
- Replacement Unit Rates

### 2.1.3 ASSET REPLACEMENT COSTS

As part of this inaugural Road Asset Management Plan, the asset replacement values have been estimated using unit rates based on recent projects and Town staff knowledge and reflect the increased costs observed during the pandemic.

### 2.1.4 ASSET LIFESPANS

The lifespans of all road and sidewalk assets have been estimated based on Town staff experience. The lifespans for the signs and stormwater assets are based on lifespans typically experienced by other local municipalities. The following key points are noted:

- Road bases are not expected to be replaced, only the road surface gets renewed.
- An average replacement cost of \$300 per sign has been assumed.

### 2.1.5 ASSET CONDITION

The Town’s road network is assessed for condition using a Pavement Condition Index (PCI). The index is a 7-point scoring system that ranges from 0 to 100 where 0 is failed and 100 is excellent. The index is calculated by deducting a score from 100. The deduction value is calculated by the summation of weighted averages of many defect types by severity level and extent. For this asset management plan, the condition ratings for all road assets will be displayed as a 1 to 5 rating scale where 1 is very good, and 5 is very poor. Table 3 shows the conversion of PCI to a 1 to 5 rating scale. Where PCI wasn’t measured, condition of the road segment was estimated based on age and remaining useful life, as per Table 5.

**Table 3: Condition Scale Conversion – pavement condition index**

PCI Range	PCI Condition Rating	Condition Score	Condition State
85-100	Good	1	Very Good
70-85	Satisfactory	2	Good
55-70	Fair	3	Fair
40-55	Poor	4	Poor
25-40	Very Poor	5	Very Poor
10-25	Serious		
0-10	Failed		

The Town’s bridges and major culverts condition is expressed as a structural condition index (SCI). The SCI is a 5-point rating system that is calculated using a methodology that assesses all structural components and rates them on a percentage of the component in what condition state.

The index is then added up to make the score. The SCI rating system directly translates to the 1 to 5 condition rating scale as shown in Table 4.

**Table 4: Condition Scale conversion – structural condition index**

SCI Range	SCI Condition Rating	Condition Score	Condition State
85-100	Excellent	1	Very Good
70-85	Good	2	Good
60-70	Fair	3	Fair
30-60	Poor	4	Poor
0-30	Very Poor	5	Very Poor

The condition of the remaining stormwater assets and signs has been estimated based on their age and remaining lifespan following the scale shown in Table 5.

**Table 5: Age-based condition rating**

Score	Condition Rating	% of Remaining Useful Life (RUL)	Rating Description
1	<b>Very Good:</b> Fit for the future	RUL ≥ 75%	The infrastructure in the system or network has greater than or equal to 75% of its remaining useful life. It is generally in very good condition, typically new or recently rehabilitated.
2	<b>Good:</b> Adequate for now	75% > RUL ≥ 35%	The infrastructure in the system or network has less than 75% (and greater than or equal to 35%) of its remaining service life. It is in good condition.
3	<b>Fair:</b> Requires attention	35% > RUL ≥ 13%	The infrastructure in the system or network has less than 35% (and greater than or equal to 13%) of its remaining service life. It is in fair condition.
4	<b>Poor:</b> At risk	13% > RUL ≥ 3%	The infrastructure in the system or network has less than 13% (and greater than or equal to 3%) of its remaining service life. It is in poor condition and mostly below standard, with many elements approaching the end of their service life.
5	<b>Very Poor:</b> Unfit for sustained service	RUL < 3%	The infrastructure in the system or network has less than 3% of its remaining service life. It is in very poor, unacceptable condition and should be replaced or rehabilitated.

## 2.1.6 DATA ASSUMPTIONS

### Road Data



- The road data had some assets that had multiple installation dates. Where multiple values existed, an average install date from those values was used.
- Where surface width was missing, an average width of 7m was assumed.
- It has been assumed that only the surface of a road will be replaced.

### Sidewalk Data

- The sidewalk data had missing installation year attributes. Gaps were filled by assuming the same install year as the road the sidewalk is along.
- Some sidewalk sections had duplicate identifiers. It was found that these segments accounted for sidewalks on both sides of the road. The duplicate sections were suffixed with “A: and “B”.
- Sidewalk data had no width or material attributes. For the purpose of this section, the sidewalks are assumed to be 1.5 metres wide and made of concrete.
- It is recommended that the widths and material types of the sidewalk network are validated, and the asset register updated.

### Bridge & Major Structures

- The bridge and major culvert dataset had missing installation dates and estimated useful life attributes. The bridges were assigned a default estimated useful life value of 70 years, and where install dates were missing, a default install date of 2017 was applied.
- The bridge data was formatted to report the bridge as a single line item.
- It is recommended that each bridge be componentized as this will refine capital renewal and maintenance forecasting.

### Drainage Data

- The storm pipe, oil and grit separator (OGS), and the stormwater management facility (SWMF) data had no asset identifiers. They were assigned a numerical identifier starting at 900000.
- The storm pipe dataset had assets with missing install dates, missing pipe diameters, and lengths. The install dates were assumed to be 1970. The Town assumed that the pipe diameters were 300mm and the lengths 50m.
- The oil/grit separators, and storm management facility data had no estimated useful life values, or unit rates for replacement. The Town identified that these assets were made of concrete and provided unit rates. An assumed lifespan of 100 years (typical for concrete) was applied.
- It is recommended that the Town review and revise the service life of the oil and grit separators and storm management facilities.

### Sign Data

- The sign data had no estimated useful lifespan or unit rates for replacement. The Town identified that the lifespan of a sign was 15 years based on the retro-reflectivity of the face which is the criteria for sign replacement.
- Some signs were missing install dates. A default install date of 2000 was applied to bridge the gaps.
- It is recommended that the Town confirm installation dates of signs and revise data within their asset register and in the state of infrastructure analysis tool.

---

## 2.1.7 LIMITATIONS

### Data Alignment

The asset data used for the state of infrastructure reporting has been sourced from multiple systems. The road asset data comes from the Town's RIMS system and contains attributes including but not limited to:

- Unique RIMS ID
- Road Name
- From Description
- To Description
- Road Class
- Environment (Urban/Rural)
- Length
- Width
- Surface Material Type
- Install Date
- Condition rating

The sidewalks data has alignment to the road data by most sidewalks having a RIMS ID as an attribute. This meant that it was easy to link the datasets. The bridge, drainage, and signs datasets do not have the RIMS ID as an attribute, so to align datasets, the RIMS ID will need to be added to the datasets as a common attribute.

The criticality for bridges and drainage assets used the same criteria as the roads. By not having a common attribute (RIMS ID) meant the road name became the common attribute. It was found that the road names in the bridges and drainage datasets did not match those in the road dataset. Some drainage assets are identified by neighbourhood, so the alignment of information could not be completed.

### Asset Condition

Roads, bridge and major structures, and major culverts have physical condition data. The sidewalks, signs, and smaller drainage assets do not have condition data, therefore for the state of infrastructure reporting, an age-based condition rating was assigned (see Section 2.2)

---

## 2.2 STATE OF INFRASTRUCTURE

Table 6 shows a summary of all road and stormwater assets that are owned by Lincoln and are active and in service.

- Asset type – Lists each asset type (group of similar assets)
- Quantity - The numbers listed in the “quantity” column of the summary table (Table 6) represent the length of linear assets (roads, culverts, and pipes) or the number of point assets (signs, bridges, and storm assets).
- Average Age - The average age of the Road ROW assets at the Town of Lincoln ranges from 9 to 57 years. The average age is weighted for asset replacement cost.
- Average Expected Life - The average expected lifespan of the Road ROW assets is based on the lifespans typical for the materials that they are made of.
- Average Asset Condition - The average condition of the road and stormwater assets at the Town of Lincoln = 2 (“Good”).
- Current Asset Replacement Cost - the replacement costs were calculated using the methodology detailed in Section 2.1.3.

**Table 6: Summary of road asset groups at the Town of Lincoln**

Asset Type	Quantity		Current Average Age (yr)	Average Expected Life (yr)	Average Condition	Current Replacement Cost
<i>Local Road – Road Base</i>	2,076,600	m <sup>2</sup>	-	-	-	\$187,659,100
<i>Local Road – Surface</i>	1,646,300	m <sup>2</sup>	20	20	Good	\$40,932,500
<i>Collector Road – Road Base</i>	557,100	m <sup>2</sup>	-	-	-	\$50,346,500
<i>Collector Road – Surface</i>	426,500	m <sup>2</sup>	17	20	Very good	\$8,977,100
<i>Sidewalks</i>	71	km	33	30	Poor <sup>1</sup>	\$8,383,400
<i>Bridges</i>	45	No.	57	70	Good	\$26,125,000
<i>Major Culverts</i>	192	m	41	98	Good	\$3,567,300
<i>Culverts</i>	3,194	m	50	97	Good	\$6,682,500
<i>Storm Pipes</i>	58	km	34	96	Good	\$27,797,700
<i>SWMF</i>	14	No.	16	100	Very good	\$13,140,900
<i>OGS</i>	4	No.	9	100	Very good	\$210,100
<i>Signs</i>	3804	No.	10	15	Fair	\$1,141,200
<b><i>Asset Total</i></b>			<b>32</b>	<b>59</b>	<b>Good</b>	<b>\$374,963,300</b>

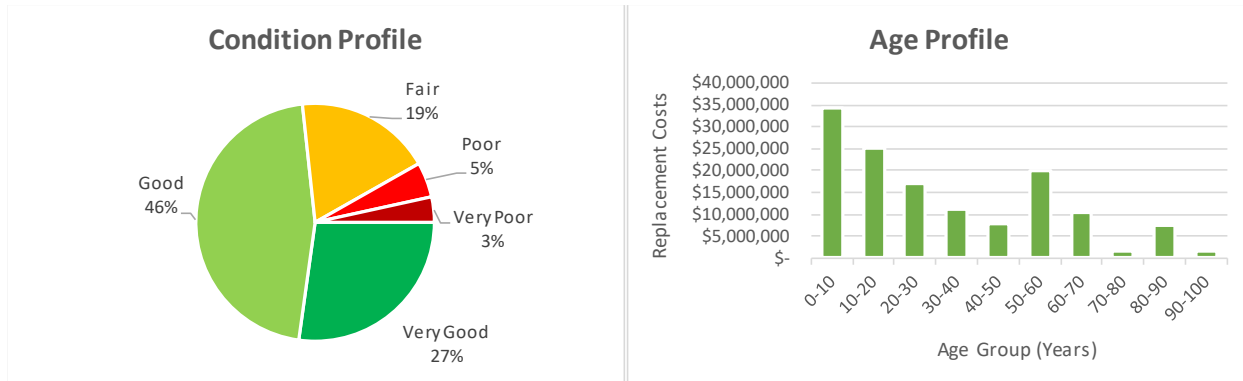
The total current estimated replacement costs for road, sidewalks and stormwater assets that comprise of the transportation service is approximately \$375M (in 2021 dollars). Of note, the average condition of local and collector roads is rated as good and very good respectively even though the average age is near the expected useful life. Condition of road reflect the pavement condition index which includes consideration of the pavement’s condition. Install date should also be reviewed.

For the state of infrastructure reporting, the average age of all assets currently ranges from 10 to 100 years. The age profile graph (Figure 2) shows that most of the transportation assets (by dollar value) fall into the 0 to 10-year age category.

The average condition for all transportation assets is 2 (Table 6), which equates to “Good”. Figure 2 shows that 73% of the assets are in very good or good condition. The remaining 27% of assets are in fair, poor, and very poor condition. The condition states are based on a mix of actual condition ratings supplied by the Town and age-based condition ratings derived as a percentage of the remaining lifespan.

---

<sup>1</sup> The average poor condition of sidewalks is a result of the assumptions made to address the data gaps.



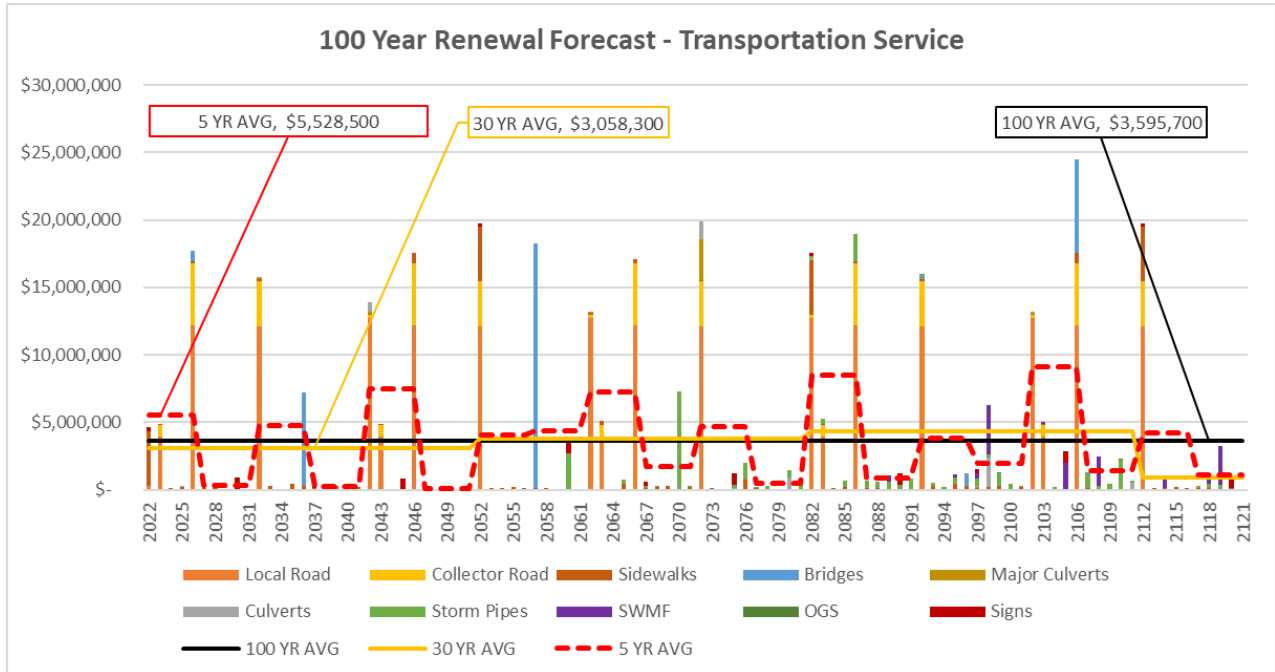
**Figure 2: Condition and age profile**

Figure 3 shows the forecast 100-year renewals. Based on the condition results, there is approximately \$27.6M worth of asset repairs and replacements forecast to occur in the first year of the forecast period. The renewals comprise of \$21.9M worth of road renewals, \$303K worth of sign renewals, and \$4.6M worth of sidewalk replacements.

As the signs and sidewalk condition is age-based, the actual cost for the asset renewals might be significantly less. It is therefore recommended that the Town completes physical condition assessments of their signs and sidewalks to confirm condition and renewal needs.

Over the 100-year forecast period, there are some significant peaks in replacement costs amounting to at least \$15M per year in 2026, 2032, 2046, 2052, 2057, 2066, 2072, 2082, 2086, 2092, 2106 and 2112. The annual average cost to sustainably fund the forecasted renewals over the 100-year period is approximately \$3.6M.

This information is intended to provide context to decision-makers on the overall level of investment required to sustainably fund asset renewals for the forecast period. Note that more detailed analysis at the asset level and assessment of project options would be required for determining budgets for individual capital renewal projects.



**Figure 3: Transportation Service – 100-year renewal forecast**

Note that more detailed analysis at the asset level and assessment of project options would be required for determining budgets for individual capital renewal projects and a consideration for expansion.

## 2.3 KNOW YOUR ASSETS IMPROVEMENT PRIORITIES

Table 7 shows a prioritized list of improvements relating to inventory data.

**Table 7: State of infrastructure improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
1	2	Asset Data	Assign the RIMS identifier to all datasets so that asset groups are better aligned.	High
2	2	Asset Data	The Town have completed an assessment of their asset data across all service areas and developed a data management plan that contains recommendations including: <ul style="list-style-type: none"> <li>Developing a data standard and data hierarchy to ensure consistency</li> <li>Develop a plan to populate missing asset attribute data and review accuracy of existing data, including install date, asset type, dimensions, material, assumed versus unassumed</li> </ul>	High

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
			<ul style="list-style-type: none"> <li>Develop roles and assign responsibility of the management of data</li> <li>Adopt a database software to host data and have a single source of truth</li> </ul>	
3	2	Asset Data	Complete condition inspections on infrastructure such as sidewalks and storm assets and use results to improve capital renewal forecasts.	Medium

# 3 MANAGE SERVICE DELIVERY

## 3.1 LEVEL OF SERVICE

This section describes the Level of Service (LOS) for the Road ROW service that the Town of Lincoln aims to deliver and defines the criteria, measures, and targets that will be used to report achievement.

LOS are the service outcomes that an organization delivers. They are a key driver for decisions on future investments in infrastructure assets. As such, they need to be clearly articulated in terms that end users and decision-makers can understand. Having well defined service levels will allow Lincoln to work with its internal stakeholders (other business units and service areas that use the municipal infrastructure), taxpayers and other stakeholders to find an appropriate balance between affordability and community expectations for level of service.

Performance measures indicate what the customers and stakeholders experience from the service that is delivered. Target values are set for performance measures to deliver the intended level of service. Comparison of performance delivered (measured results) to performance intended (target values) assists the own in both strategic and operational decision making.

Table 8 presents a summary of the approach to describe LOS and performance measures.

**Table 8: Levels of service and performance measure terminology**

Concept	Definition	Example
<i>Levels of service (LOS)</i>	Specific attributes of the service that the Town intends to deliver from the <b>customer point of view</b> .  LOS attributes provide the link between higher level corporate and asset management objectives and more detailed technical and operational objectives. They must all align to give the customer the intended experience of the service.	Well maintained road network that provides safe, efficient travel.
<i>Performance measures</i>	Criteria that can be measured and provide an indication of how the Town is doing in delivering the intended LOS. This can be defined as:  Customer performance measures: Measures describing <b>how the customer receives or experiences the service</b> .  Technical performance measures: Technical criteria <b>the organization can measure to indicate the service level being achieved</b> .	<u>Customer:</u> Number of valid complaints Customer satisfaction survey Accident records <u>Technical:</u> Maintenance records Pavement Condition Index (PCI) thresholds Compliance with road geometric design, and signage standards
<i>Performance targets</i>	The required value (target) for each criterion that is being used as a performance measure. The expectation is that the intended LOS will be achieved if these targets are met.	<u>Customer:</u> >80% satisfaction (from survey) <u>Technical:</u> Percentage of roads by class that exceed PCI thresholds.

### 3.1.1 LEVEL OF SERVICE DEVELOPMENT APPROACH

The Town of Lincoln Steering Committee participated in an initial round-table discussion to:

- Identify key stakeholder groups;
- Define the service criteria and relevant LOS statements; and
- Identify appropriate indicators for measuring performance.

### 3.1.2 ROAD ROW LEVELS OF SERVICE

Table 9 shows the key stakeholder groups, the level of service statement and associated service criteria.

**Table 9: Service criteria and levels of service statements**

Stakeholder group	LOS statement	Service criteria
<i>Commuters</i>	Reliable journeys and well-connected road network	-Reliability -Connectivity
<i>Residents</i>	Road network in good condition with minimal road closures or diversions	-Availability -Quality
<i>Cyclists</i>	Safe and comfortable means to travel around Town	-Safety
<i>Pedestrians</i>	Safe and well-connected network of sidewalks and pathways	-Safety -Connectivity
<i>Farmers, developers</i>	Reliable road network that supports access and loading requirements	-Good Stewardship
<i>Council</i>	Road network that is in good condition and provides value for money	-Quality
<i>Taxpayers</i>	A well managed and well coordinated road network that is in good condition and provides value for money	-Quality -Good Stewardship
<i>Taxi companies, Transit providers</i>	Reliable journeys on a well-maintained and well-connected road network	-Quality -Connectivity -Reliability
<i>Emergency Services</i>	Road network to have consistent design and geometry to support reliable journeys to emergency events	-Reliability
<i>Tourism Industry, local businesses</i>	Well-connected and well-maintained road network that is easy to navigate around Town and to popular destinations	-Connectivity
<i>Schools</i>	<i>Safe access and egress from schools</i>	-Safety



Stakeholder group	LOS statement	Service criteria
<i>Couriers</i>	Reliable journeys on a well-maintained and well-connected road network with minimal closures or detours	-Connectivity -Reliability -Availability
<i>Trucking</i>	Reliable road network that supports access and loading requirements	-Reliability
<i>Quarries</i>	Road network that is well connected to major hauling routes	-Connectivity
<i>Metrolinx</i>	Well managed and well-connected road network that supports active transportation and transit options	-Good Stewardship -Connectivity
<i>MTO, AODA, MMS, Active Transportation committee</i>	Compliance with standards and regulations	Compliance
<i>Age Friendly Citizen Group</i>	Safe and well-connected road network	-Safety -Connectivity
<i>Grimsby, Wainfleet, West Lincoln</i>	Consistency and Effective Coordination	-Consistency and Effective Coordination

The performance measures associated with the service criteria are summarized in Table 10.

**Table 10: Levels of service performance measures**

Service criteria	Performance measure			
	Customer	Current	Technical	Current
<i>Availability</i>	Percentage of bridges with loading or dimensional restrictions	5%		
<i>Compliance</i>			Logs	
<i>Connectivity</i>	Customer feedback	TBD		
<i>Consistency and effective coordination</i>			Integrated projects	
<i>Good stewardship</i>			Asset management plan	Available
<i>Quality</i>			Average PCI Average BCI	Avg PCI = 72 Avg BCI = 71
<i>Reliability</i>	Travel time			
<i>Safety</i>			Crash history	

In addition to the performance measures identified in Table 10, the Town is required by Ontario Regulations for Asset Management (O.Reg.588/17) to report on specific community and technical levels of service for stormwater, roads, bridges and culverts. Table 11 summarized the community levels of service required by O.Reg.588/17.

**Table 11: O.Reg. Community Levels of Service - Road ROW**

Asset	Service Criteria	O.Reg. Requirement	Description
<i>Stormwater</i>	Scope	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system.	See Figure 4
<i>Roads</i>	Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.	See Figure 5
<i>Roads</i>	Quality	Description or images that illustrate the different levels of road class pavement condition.	See Table 13
<i>Bridges and culverts</i>	Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Bridges in the Town of Lincoln allow the movement of heavy transport vehicle, motor vehicles, emergency vehicles, pedestrians and cyclists.
<i>Bridges and culverts</i>	Reliability	Description or images of the condition of bridges and how this would affect use of the bridges.	See Table 14
<i>Bridges and culverts</i>	Reliability	Description or images of the condition of culverts and how this would affect use of the culverts.	See Table 15

Table 12 summarized the technical levels of service required by O.Reg.588/17.

**Table 12: O.Reg. Technical Levels of Service for Road ROW**

Asset	Service Criteria	O.Reg. Requirement	Description
<i>Stormwater</i>	Scope	Percentage of properties in municipality resilient to a 100-year storm	TBD – currently working with Niagara Peninsula Conservation Authority to identify the percentage
<i>Stormwater</i>	Scope	Percentage of the municipal stormwater management system resilient to a 5-year storm.	TBD – currently working with Niagara Peninsula Conservation Authority to identify the percentage
<i>Roads</i>	Scope	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.	Collector roads: 0.43% (205 lane-km) of its total land area Local roads: 0.84% (414 lane-km) of its total land area Arterial roads: 0% (0 lane-km)
<i>Roads</i>	Quality	For paved roads in the municipality, the average pavement condition index value.	PCI = 72
<i>Roads</i>	Quality	For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).	NA (no unpaved roads)
<i>Bridges and culverts</i>	Scope	Percentage of bridges in the municipality with loading or dimensional restrictions.	5%
<i>Bridges and culverts</i>	Reliability	For bridges in the municipality, the average bridge condition index value.	BCI = 71
<i>Bridges and culverts</i>	Reliability	For structural culverts in the municipality, the average bridge condition index value.	BCI = 72

Figure 4 shows a draft of the floodplain extent.

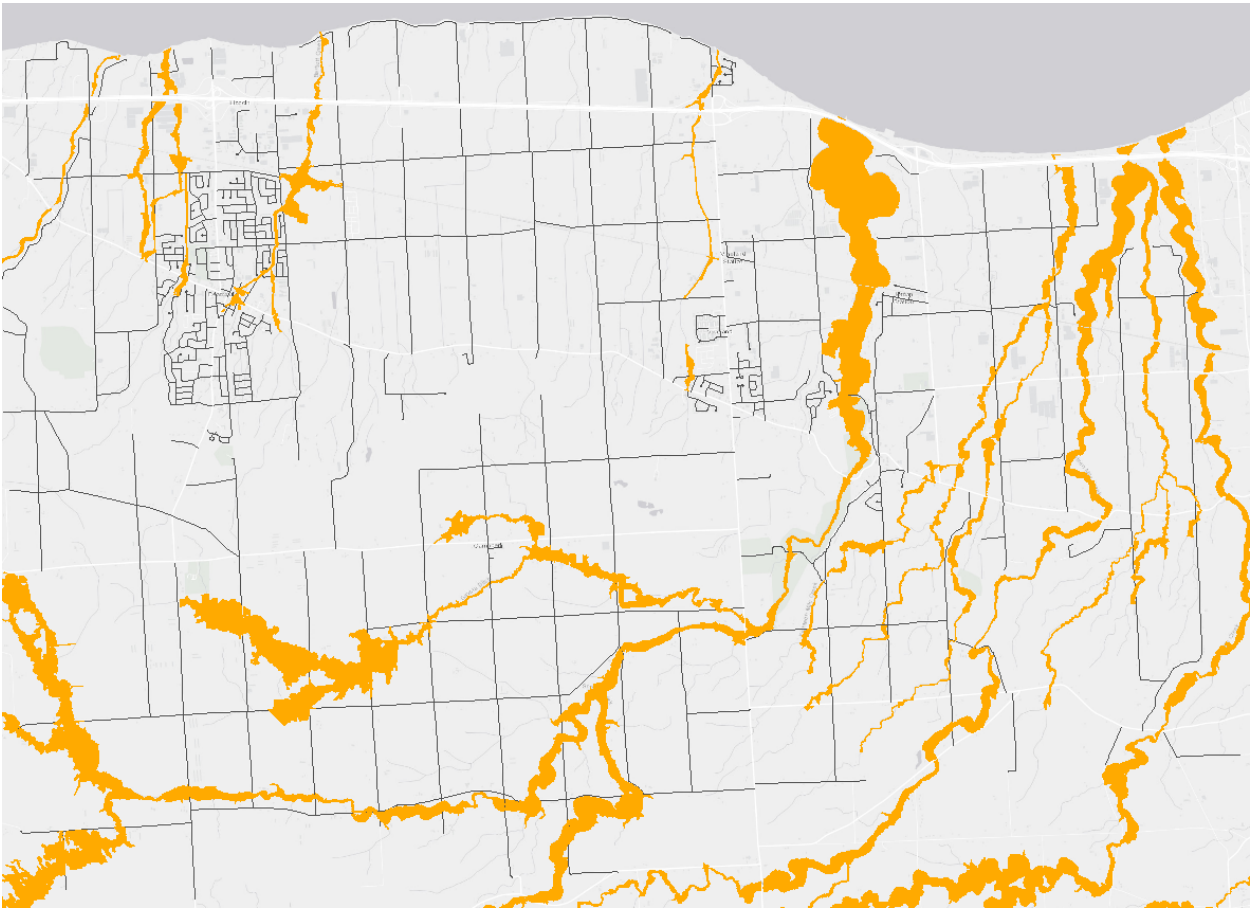


Figure 4: Floodplain extent draft (Source: NPCA)

Figure 5 shows the extent of the road network and how the various areas are connected.

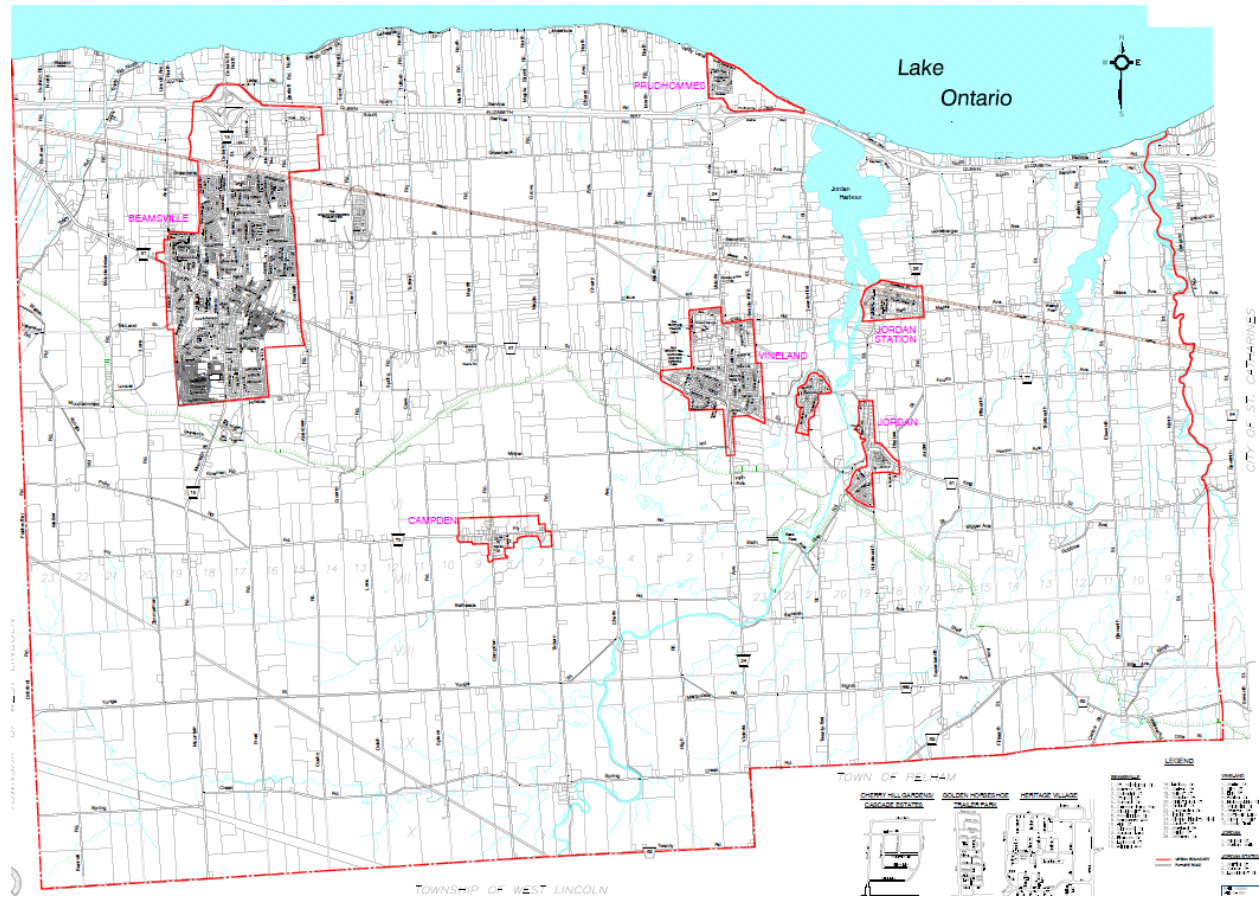





Figure 5: Map of the road network

Photos illustrating the different levels of road pavement condition are shown in Table 13.

**Table 13: Pavement condition photo description**

1-5 condition rating	PCI equivalent	Photo
5 - <i>very poor</i>	0-25	There are no roads at the Town with an PCI below 25
4 – <i>poor</i>	25-40	
3 – <i>fair</i>	40-70	



1-5 condition rating	PCI equivalent	Photo
2 – good	70-85	
1 – very Good	85-100	



Photos illustrating the different levels condition of bridges and how this would affect their uses are shown in Table 14.

**Table 14: Structural condition photo description**

1-5 condition rating	SCI equivalent	Photo	Impact on use
1 - very poor	0-30	There are no bridges with an SCI between 0 and 30	Bridge can still be used however user may experience decrease in comfort ride due to bridge deck surface wearing off. Bridge may




1-5 condition rating	SCI equivalent	Photo	Impact on use
			close at short notice, or possible load restrictions.
2 – poor	30-60		Bridge can still be used. User may experience a decrease in comfort ride due to bridge deck wearing off, or possible load restrictions
3 – fair	60-70		No impact on use


1-5 condition rating	SCI equivalent	Photo	Impact on use
2 – good	70-85		No impact on use
1 – very good	85-100		No impact on use

1-5 condition rating	SCI equivalent	Photo	Impact on use
			

Photos illustrating the different levels condition of culverts and how this would affect their uses are shown in Table 14.

**Table 15: Culverts condition photo description**

1-5 condition rating	SCI equivalent	Photo	Impact on culvert use
5 - very poor	0-30	There are no culverts with a SCI between 0 and 30	The culvert is at a high risk of failing which would reduce or potentially stop the flow of water.
4 – poor	30-60		

1-5 condition rating	SCI equivalent	Photo	Impact on culvert use
			
3 – fair	60-70		
2 – good	70-85		
1 – very good	85-100	There are no photos of culverts with a SCI between 85 and 100	

### 3.1.3 LEGISLATIVE REQUIREMENTS

The services provided by municipal assets must meet the legislative requirements at the municipal, provincial, and federal levels.

Key legislative requirements applicable to municipal organizations as well as the various services and asset groups, are included in Table 16 and Table 17.

**Table 16: Key Legislative Requirements**

Legislation	Requirement
<i>Municipal Government Act (2001)</i>	<p>Sets out role, for 443 of 444 Ontario Municipalities and recognizes them as a responsible and accountable level of government. The Act gives municipalities broad powers to pass bylaws and govern within their jurisdiction. The Act also outlines requirements for municipalities including:</p> <ul style="list-style-type: none"> <li>• Practices and procedures</li> <li>• Accountability and transparency</li> <li>• Finance</li> </ul>
<i>Infrastructure for Jobs and Prosperity Act</i>	<p>The purpose of this Act is to establish mechanisms to encourage principled, evidence-based, and strategic long-term infrastructure planning that supports job creation and training opportunities, economic growth, and protection of the environment, and incorporate design excellence into infrastructure planning.</p>
<i>Municipal Bylaws</i>	<p>Regulations approved by Council to safeguard and protect persons and properties.</p>
<i>Occupational Health and Safety Act</i>	<p>Rules governing health and safety in Ontario's workplaces.</p>
<i>Fisheries and Oceans Canada (DFO)</i>	<p>Provides guidelines and laws to protect fisheries habitat in proximities to roads and bridges.</p>
<i>Planning Act</i>	<p>Provides Direction on municipal planning activities.</p>
<i>Building Code Act</i>	<p>Provides the requirements to adhere to construction safety practices.</p>
<i>Accessibility of Ontarians with Disabilities Act</i>	<p>The purpose of this Act is to benefit all Ontarians by developing, implementing, and enforcing accessibility standards.</p>
<i>Environmental Protection and Enhancement Act</i>	<p>Provides for orderly development of roadway systems while protecting the environment.</p>
<i>Police Services Act</i>	<p>Provides the principles related to Police services.</p>
<i>Fire Protection and Prevention Act</i>	<p>Defines municipal responsibilities for fire protection services.</p>

**Table 17: Water Legislation**

Legislation	Requirement
<i>Water Act</i>	<p>Provides provincial guidance to better manage and protect its water and to streamline water-related administrative processes.</p>

<i>Canada Water Act</i>	Contains provisions for formal consultation and agreements with the Provinces.
-------------------------	--

### 3.1.4 LEVEL OF SERVICE IMPROVEMENT PRIORITIES

Table 18 shows a prioritized list of improvements relating to levels of service.

**Table 18: Level of service improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
4	3.1	Level of Service	Collect and collate a minimum of one year of data for each performance measure that has been identified in Table 10, Table 11, and Table 12 and report on current performance.	High
5	3.1	Level of Service	Set targets for each performance measure based on measured results or regulatory requirements as appropriate.	High
6	3.1	Level of Service	Review levels of service and update as appropriate at a minimum when the asset management plan is updated.	Medium
7	3.1	Levels of service	Identify appropriate analysis to satisfy the requirements from OReg 588/17 pertaining to stormwater management, namely: <ul style="list-style-type: none"> <li>• areas protected from flooding</li> <li>• properties resilient to a 100-year storm</li> <li>• percentage of the stormwater management system resilient to a 5-year storm</li> </ul>	High

## 3.2 LIFECYCLE STRATEGIES

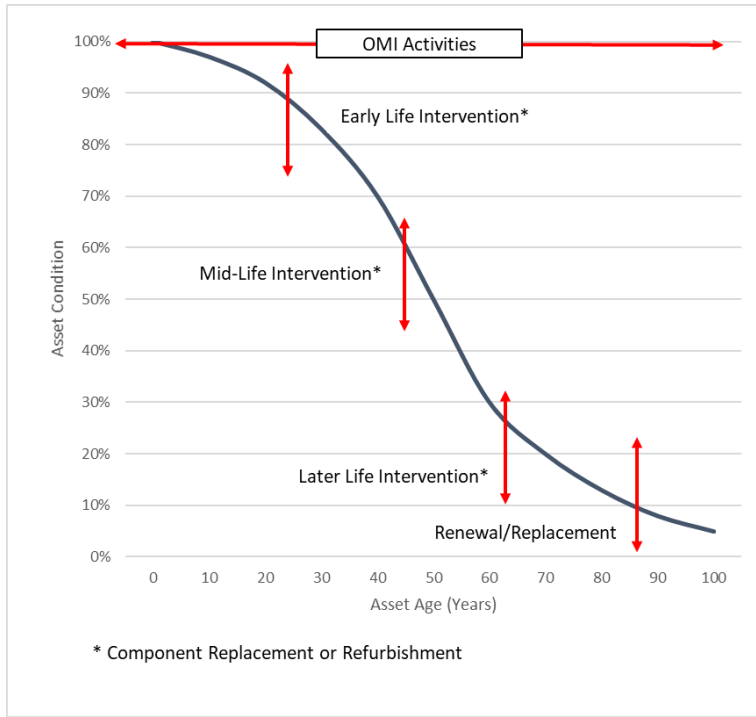
Assets of different types have different lifecycle lengths, deteriorate at different rates, and require different strategies for optimum performance and cost-efficiency over their life cycle.

A lifecycle strategy sets out the planned actions and intended maintenance management methods for an asset throughout its life. The purpose of lifecycle strategies is to maintain assets in an appropriate way that will deliver the required level of service for the least overall cost, while keeping risk at a level acceptable to the Town.

### 3.2.1 MANAGEMENT APPROACH

An asset's lifecycle strategy typically includes the phases shown in Figure 6. However, not all assets have the same management approach. Early life interventions are usually only appropriate for a few asset types

where reliability is a major factor. Other assets have a “run to fail” approach where relevant maintenance is completed as and when required and the asset is replaced at the end of its life. Most assets benefit from mid-life and later-life interventions (component replacements, refurbishments, or major overhauls) so that asset lifespan can be achieved or can be extended beyond original lifespan.



**Figure 6: Lifecycle and intervention strategies for assets**

The management approach for all assets in this Asset Management Plan has been identified and listed in Table 19.

**Table 19: Management approach overview**

Asset Type	Management Approach	Typical Treatment Types
<i>Local Road</i>	Early, Mid, and Late-life Interventions	<ul style="list-style-type: none"> <li>• Crack Sealing</li> <li>• Localized Patching</li> <li>• Mill &amp; Fill</li> <li>• Mill, Fill, and Overlay</li> </ul>
<i>Collector Road</i>	Early, Mid, and Late-life Interventions	<ul style="list-style-type: none"> <li>• Crack Sealing</li> <li>• Localized Patching</li> <li>• Mill &amp; Fill</li> <li>• Mill, Fill, and Overlay</li> </ul>
<i>Sidewalks</i>	Mid-life Interventions	<ul style="list-style-type: none"> <li>• Milling and Crack Sealing</li> </ul>
<i>Bridges</i>	Early, Mid, and Late-life Interventions	<ul style="list-style-type: none"> <li>• Joint Repairs</li> <li>• Deck Repairs</li> <li>• Concrete Repairs</li> </ul>

Asset Type	Management Approach	Typical Treatment Types
Major Culverts (>3m)	Early, Mid, and Late-life Interventions	<ul style="list-style-type: none"> <li>Concrete Repairs</li> <li>Metal Panel Repairs</li> </ul>
Culverts	Run to Fail	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Storm Pipes	Run to Fail	<ul style="list-style-type: none"> <li>N/A</li> </ul>
SWMF	Run to Fail	<ul style="list-style-type: none"> <li>N/A</li> </ul>
OGS	Run to Fail	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Signs	Run to Fail	<ul style="list-style-type: none"> <li>N/A</li> </ul>

Note: All assets are subject to OMI activities

### 3.2.2 LIFECYCLE STRATEGY TERMINOLOGY

The current business practices for lifecycle management have been identified under the following work categories;

- **Operations, Maintenance & Inspections (OMI)**
  - Preventive Maintenance
  - Inspections
  - Operations
  - Reactive Maintenance
- **Renewal and Rehabilitation (R&R)**
  - Early-life Intervention
  - Mid-life Rehabilitation
  - Later-life Rehabilitation
  - End of life

Table 20 shows the definitions of the terminology used for the lifecycle strategy work categories.

**Table 20: Lifecycle strategy work categories**

Terminology	Definition
<i>Preventative Maintenance</i>	These are regularly scheduled activities, completed whilst the asset is still in an “operational” condition. The purpose of preventative maintenance (when they are required), is to ensure the asset achieves its expected life (i.e. does not fail early). Not all assets require or benefit from preventative maintenance activities.



Terminology	Definition
<i>Inspections</i>	There are different types of inspections that can occur throughout the lifecycle of an asset. Some are for checking the asset is operating as planned – these provide early warning for any issues that can then be remedied quickly and less expensively than if the problem remained undetected for some time. Other inspections are for measuring or observing the condition of the assets, or for measuring performance. These provide information for planning renewals and determining if performance targets will be met. Inspections may also be required by legislation, departmental policy, or completed based an industry standard or manufacturers recommendation.
<i>Operations</i>	These are routine activities necessary for the correct operation of the assets. They differ from Preventative Maintenance (PM) activities in that are operational tasks or activities that must occur, or the asset will cease to function as intended (i.e. cease to operate or operate inadequately), whereas an asset will usually continue to operate even if PM tasks are not done, but the overall lifespan of the asset could be reduced and the asset may fail early.
<i>Reactive Maintenance</i>	These activities are physical repairs to an asset that has broken down or is not functioning as required or expected. The repair reinstates the asset to its normal “operating” condition but does not significantly extend the overall life of the asset e.g. it is a repair not a full replacement nor is it an upgrade or major rehabilitation. Maintenance repairs are expected as assets age and are part of the overall lifecycle management, to keep the asset operational for as long as physically and economically viable.
<i>Early Life Interventions</i>	These are treatment options that may be considered when an asset is in the first quarter of its lifespan. Typically, they are rare for most asset types, but some assets do require replacement of component parts at frequent intervals throughout the overall lifespan of the asset.
<i>Mid-Life Interventions</i>	These are treatment options that may be considered when an asset is in the second or third quarter of its lifespan. Most common forms of mid-life rehabilitation are the replacement or refurbishment of component parts that have a shorter lifespan than the overall asset.
<i>Later Life Interventions</i>	These are treatment options considered to be still viable even when an asset is in the fourth quarter of its lifespan. They can include replacement or refurbishment of component parts the same as might be considered for Mid-Life Rehabilitation. However, Later Life Rehabilitation should only be undertaken if it is cost-effective given the potentially short remaining life of the overall asset.

Terminology	Definition
<i>End of Life</i>	These are treatment options considered when an asset is approaching or at the end of its lifespan. Typical options include replacement (renewal) of the asset with an equivalent new asset, major rehabilitation that returns the asset to new or near new status, disposal (removal) of the asset without replacement, retirement of the asset (with or without disposal), divestment of the asset (sale or gift to another's ownership), or upgrade (replace with new asset that will provide an increase in level of service e.g. a bigger asset or higher specification).

The lifecycle strategies for the road and stormwater assets are included in Appendix A.

### 3.2.3 LIFECYCLE STRATEGY IMPROVEMENT PRIORITIES

Table 21 shows a prioritized list of improvements relating to lifecycle strategies.

**Table 21: Lifecycle strategy improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
8	3.2	Lifecycle Strategy	Develop lifecycle strategies for any new assets that become part of the road and storm drainage network.	Medium
9	3.2	Lifecycle Strategy	Review and revise lifecycle strategies if maintenance approach has changed or where new technologies are employed and expand to identify costs and decision processes for each lifecycle strategy.	Medium

## 3.3 RISK PROFILE

Risk is evaluated at both the **service level** and the **asset level**. The importance of this is to provide early warning of all potential issues that could adversely affect delivering the level of service. When risks are known and have a rating, staff can prioritize activities to focus on assets with high-risk ratings.

### 3.3.1 SERVICE LEVEL RISK

Service level risks are the risks that affect the delivery of the service to the Town's customers. In this case, the service provision by Lincoln's Transportation Department is to provide a road network that supports the safe and efficient movement of people and goods.

Service level risks are grouped into 5 categories. The categories and examples of the risks in each category are shown in Table 22.

**Table 22: Service level risk categories**

Category	Description of Common Risk Events
<i>Planning</i>	Regulatory changes, Council changing strategic priorities, demand management, etc.

Category	Description of Common Risk Events
<i>Management</i>	Lack of resources (people) to implement or advance Asset Management, reputational risk, data security risk, etc.
<i>Service Delivery</i>	Outdated or unsupported software or hardware failures, power outages, inadequate stakeholder communication/engagement, etc.
<i>Assets (in General)</i>	Security and safety of physical or information assets from theft/vandalism/cyberattacks, inadequate maintenance and rehabilitation programs to preserve asset value and longevity, etc.
<i>Hazards and Environmental</i>	Extreme weather events, climate change, improper storage or usage of hazardous or toxic materials, etc.

The service risks are characterized by the impact to service delivery and the likelihood of that impact event occurring. The Town has assessed the service level risks in each risk category that are relevant to the road ROW and identified an appropriate action for each risk based on the risk level, as shown in Table 23.

**Table 23: Risk level and action**

Risk level	Recommended action
<i>Very low</i>	Accept: These risks can be tolerated. They should be assessed annually to determine whether the level of risk has changed.
<i>Low</i>	Accept: These risks can be tolerated. They should be assessed annually to determine whether the level of risk has changed.
<i>Medium</i>	Monitor: These risks require a balanced approach to management. They should be included in future risk mitigation plans and assessed at least annually to determine whether levels of risk have changed.
<i>High</i>	Mitigate: These risks should be prioritized. Existing mitigation programs and plans should be modified to include these risks, and where new risks are identified, update mitigation programs and plans. An assessment of the effectiveness of the mitigation programs and plans must be conducted annually and updated as appropriate.
<i>Very High</i>	Take action: These risks cannot be tolerated as they are critical to service delivery. Immediate corrective actions to mitigate risk should be taken. A risk level monitoring program should be developed to reduce or prevent potential reoccurrence of the risk.

### 3.3.2 CONNECTION OF RISK TO LEVEL OF SERVICE

The connection between risk and level of service starts with looking at how the potential risk events from each of the 5 categories affect the service commitments made in section 3.1 and defining a risk outcome (i.e. stating how the risk event would affect the service commitment). For example, how lack of staff resources (which is a management risk) can affect the road quality (which is a service commitment). Therefore, the risk outcome is that a lack of resources will mean that some necessary activities will not get done and road ROW infrastructure will not be fully maintained to the required standards, this will adversely impact asset condition and reduce service reliability.

Figure 7 shows the connection of risk to levels of service.

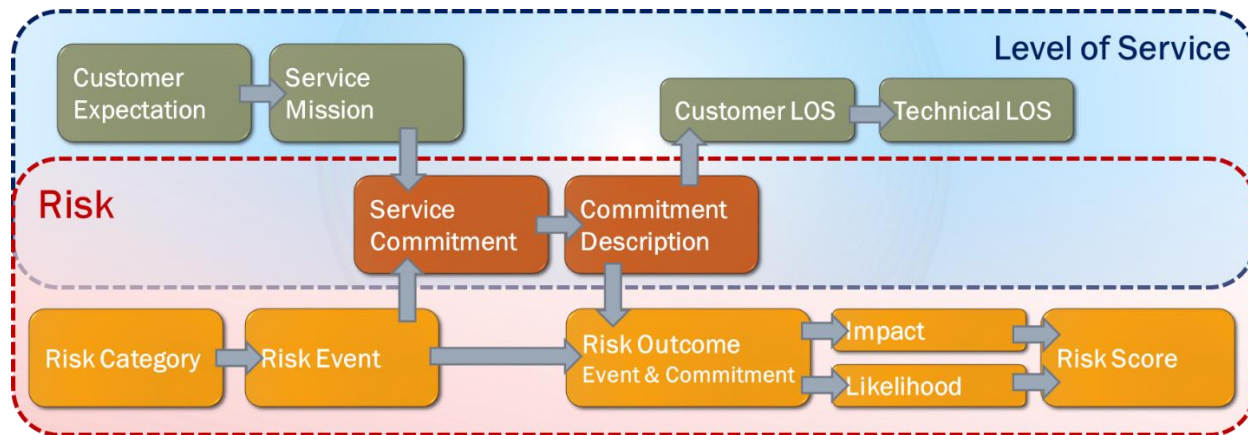


Figure 7: Connection of Risk to Level of Service

### 3.3.3 SERVICE LEVEL RISKS – ROAD

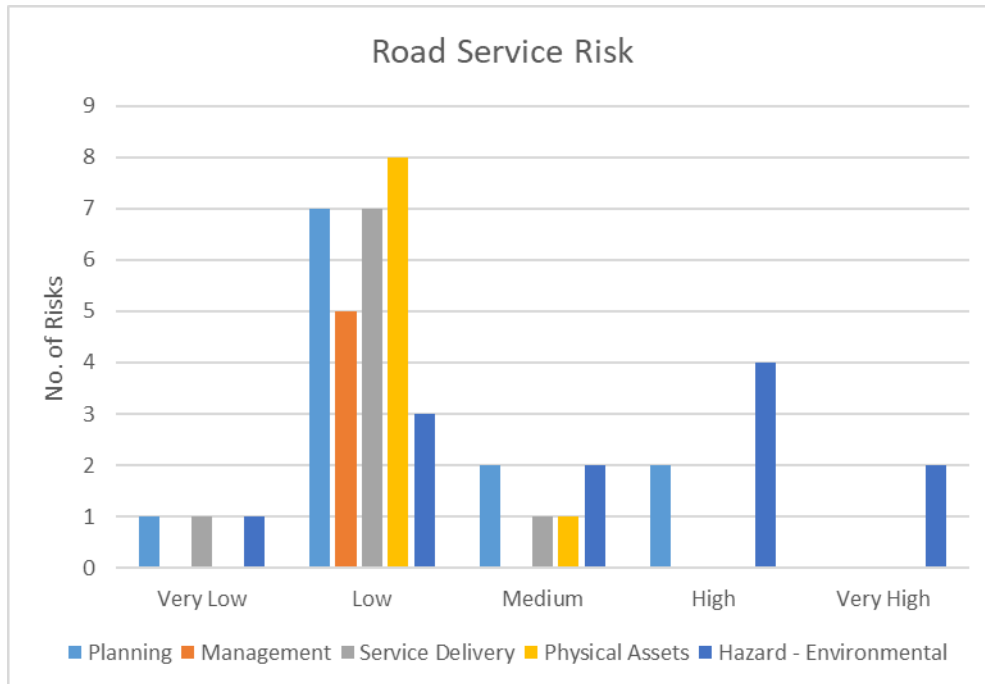
#### 3.3.3.1 RESULTS OF RISK RATINGS

The number of risks rated in each category and the respective scores before risk mitigation are shown in Table 24.

Table 24: Service-level risks – Road Service

Risk Category	Very Low	Low	Medium	High	Very High	Count
<i>Planning</i>	1	7	2	2	-	<b>12</b>
<i>Management</i>	-	5	-	-	-	<b>5</b>
<i>Service Delivery</i>	1	7	1	-	-	<b>9</b>
<i>Physical Assets</i>	-	8	1	-	-	<b>9</b>
<i>Hazard - Environmental</i>	1	3	2	4	2	<b>12</b>
<b>Total</b>	<b>3</b>	<b>30</b>	<b>6</b>	<b>6</b>	<b>2</b>	<b>47</b>

The results of the risk ratings are also shown in a graphical format in Figure 8.



**Figure 8: Service-level risk - Roads**

### *PLANNING RISKS*

The results of the risk ratings showed that 12 planning risks were identified and rated. 10 of the 12 planning risks were rated very low to medium, and 2 risks were rated as high.

The risks that were rated medium relate to potential changes in legislation and change in service demand through population growth and how that increase could affect road condition. Medium risks are required to be monitored and the Town currently monitors pavement surface condition annually. The high-scoring risks relate to potential changes in demand through residential and commercial/industrial developments. The Town has developed a transportation master plan. The plan provides predicted growth statistics and findings indicate that the existing road network can handle the projected growth levels.

High risks need to be mitigated, and the revised risk scoring post mitigation are described further in this section (refer to Figure 9).

### *MANAGEMENT RISKS*

The results of the risk ratings showed that 5 management risks were identified and rated, and all 5 were rated low.

### *SERVICE DELIVERY RISKS*

The results of the risk ratings showed that 9 service delivery risks were identified and rated. 1 risk out of the 9 was rated as a medium risk. The risk rated as medium related to the potential of increases in costs to provide the service, and whether the service could be delivered through current budget levels. To mitigate the risk, the Town frequently monitors the costs to manage and operate the road network and revise their budgets accordingly.

**PHYSICAL ASSET RISKS**

The results of the risk ratings showed that 9 physical risks were identified and rated. 1 risk out of the 9 was rated as a medium risk. The risk rated as medium related to the potential of the Town failing to mitigate any high or very high risks that could affect asset condition. To mitigate the risk, the Town frequently monitors the pavement condition and revise their maintenance and rehabilitation strategies accordingly.

**HAZARD & ENVIRONMENTAL RISKS**

The results of the risk ratings showed that 12 hazard and environmental risks were identified and rated. Out of the 12 risks, 1 risk was rated as a medium, 4 risks were rated as high, and 2 risks were rated as very high. The medium rated risk related to the potential of extreme snow or freeze/thaw events affecting road surface condition. As an action, the Town frequently monitors road condition and revises their maintenance and rehabilitation strategies accordingly.

The high-scoring risks related to the potential of extreme or prolonged wet weather, snow and cold temperatures affecting the road and associated assets such as signals and signs. These risks are mitigated through the Towns minimum maintenance standards. The risks that scored very high related to potential flooding events due to lake level rise. These risks and 2 of the high rated risk still require mitigation planning.

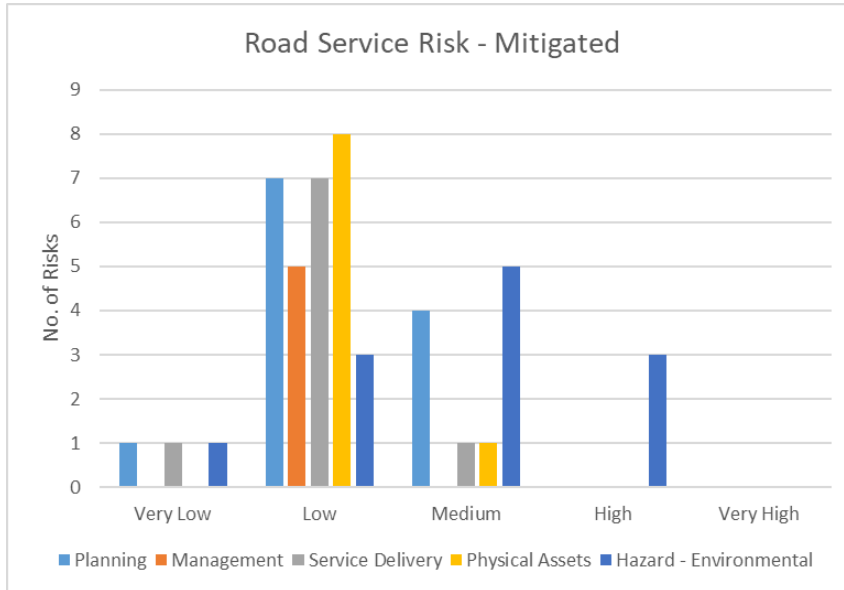
**3.3.3.2 MITIGATION STRATEGIES**

Table 25 shows a summary of the road service risks by score and category after mitigation.

**Table 25: Service-level risk ratings (Post Mitigation) – Road Service**

Risk Category	Very Low	Low	Medium	High	Very High	Count
<i>Planning</i>	1	7	4	-	-	<b>12</b>
<i>Management</i>	-	5	0	-	-	<b>5</b>
<i>Service Delivery</i>	1	7	1	-	-	<b>9</b>
<i>Physical Assets</i>	-	8	1	-	-	<b>9</b>
<i>Hazard - Environmental</i>	1	3	5	3	-	<b>12</b>
<b>Total</b>	<b>3</b>	<b>30</b>	<b>11</b>	<b>3</b>	<b>-</b>	<b>47</b>

Figure 9 shows the number of risks in each category after mitigation measures.



**Figure 9: Service-level risks (mitigated) - Roads**

### PLANNING RISKS

The high-scoring planning risks related to development and industry demand are being mitigated by monitoring road conditions and planning and adapting renewal strategies as required. Additionally, staffing and budgets will be increased.

### HAZARD & ENVIRONMENTAL RISKS

The high and very high scoring hazard and environmental risks related to climate change and weather are being mitigated by careful planning, innovation, increased annual investment, improved maintenance management, enhanced design standards and proactive construction.

#### 3.3.4 SERVICE LEVEL RISKS - STORM

##### 3.3.4.1 RESULTS OF RISK RATINGS

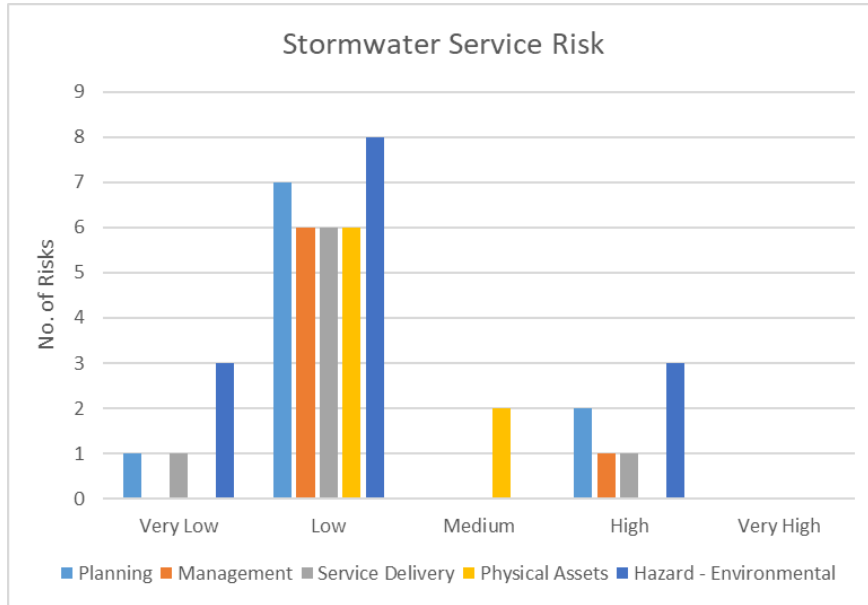
The number of risks rated in each category and their respective scores are shown in Table 26.

**Table 26: Service-level risk ratings: Stormwater Network**

Risk Category	Very Low	Low	Medium	High	Very High	Count
<i>Planning</i>	1	7	-	2	-	<b>10</b>
<i>Management</i>	-	6	-	1	-	<b>7</b>
<i>Service Delivery</i>	1	6	-	1	-	<b>8</b>
<i>Physical Assets</i>	-	6	2	0	-	<b>8</b>

Risk Category	Very Low	Low	Medium	High	Very High	Count
<i>Hazard - Environmental</i>	3	8	-	3	-	<b>14</b>
<b>Total</b>	<b>5</b>	<b>33</b>	<b>2</b>	<b>7</b>	<b>-</b>	<b>47</b>

The results of the risk ratings are also shown in a graphical format in Figure 10.



**Figure 10: Service-level risk - Storm**

### Planning Risks

The results of the risk ratings showed that 10 planning risks were identified and rated. 8 of the 10 planning risks were rated very low and low, and 2 risks were rated as high. The risks that rated very low and low do not require any monitoring or mitigation actions and can be accepted by the Town. The risks that rated as high relate to change in service demand through population growth and the increase in residential, commercial/industrial development affecting maintenance budgets.

High risks need to be mitigated, and the strategies for mitigation and the revised risk scoring post mitigation are described further in this section.

### Management Risks

The results of the risk ratings showed that 7 management risks were identified and rated. 6 out of the 7 risks were rated as low and do not require any monitoring or mitigation actions and can be accepted by the Town. The risk that rated as high relates to lack of condition data affecting maintenance planning and increasing flooding risks if stormwater system is not effectively maintained. High risks need to be mitigated, and the strategies for mitigation and the revised risk scoring post mitigation are described further in this section.

### Service Delivery Risks

The results of the risk ratings showed that 8 service delivery risks were identified and rated. 1 risk out of the 8 was rated as a high risk. The risks that rated very low and low do not require any monitoring or



mitigation actions and can be accepted by the Town. The risk rated as high relates to the increases in costs to provide the service, and whether the service could be delivered through current budget levels. As an action, the Town frequently monitors the costs to manage and operate the storm network and revises their budgets accordingly.

Physical Asset Risks

The results of the risk ratings showed that 8 physical risks were identified and rated. 2 risks out of the 8 was rated as a medium risk. The risks that rated low do not require any monitoring or mitigation actions and can be accepted by the Town. The risks rated as medium relate to asset failures in the storm sewer network affecting the quality and reliability of the service and user safety. As an action, the Town frequently monitors condition and revises their maintenance and rehabilitation strategies accordingly.

Hazard & Environmental Risks

The results of the risk ratings showed that 14 hazard and environmental risks were identified and rated. Out of the 14 risks, 3 risks were rated as high. The high-scoring risks relate to extreme weather events affecting reliability of service and the safety of the users. The high and very high risks require mitigation actions which are described later in this section.

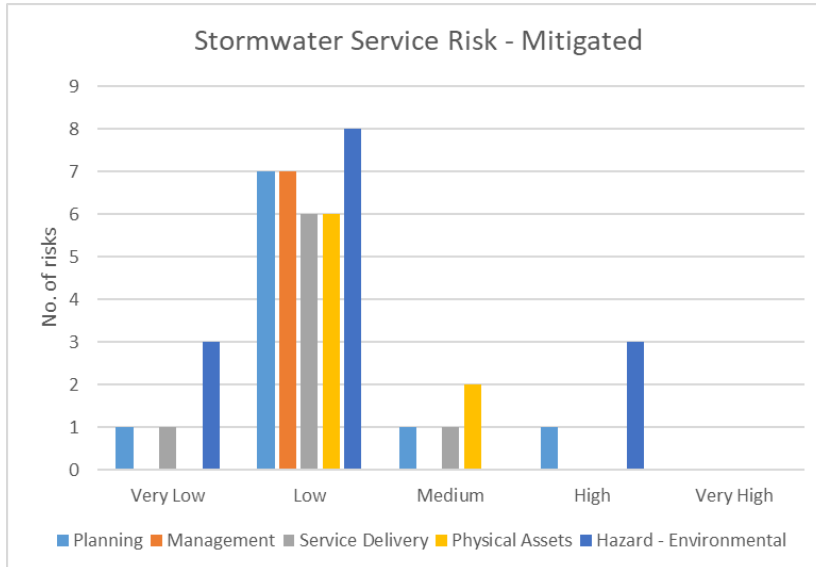
**3.3.4.2 MITIGATION STRATEGIES**

Table 27 shows a summary of the stormwater service risks by score and category after mitigation.

**Table 27: Service-level risk ratings (Post Mitigation) – Stormwater Service**

Risk Category	Very Low	Low	Medium	High	Very High	Count
<i>Planning</i>	1	7	1	1	-	<b>10</b>
<i>Management</i>	-	7	-	-	-	<b>7</b>
<i>Service Delivery</i>	1	6	1	-	-	<b>8</b>
<i>Physical Assets</i>	-	6	2	-	-	<b>8</b>
<i>Hazard - Environmental</i>	3	8	3	-	-	<b>14</b>
<b>Total</b>	<b>5</b>	<b>34</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>47</b>

Figure 11 shows the number of risks in each category after mitigation measures.



**Figure 11: Service-level risks (mitigated) - Stormwater**

Planning Risks

The Town has plans in place for development growth and appropriate budget increase is forecasted. Additionally, enhanced design standards and proactive construction has been identified to improve reliability of stormwater services.

Management Risks

The Town will increase the level of detail during inspections and will plan for higher frequency inspections to improve appropriate timing of preventative maintenance and capital upgrades.

Service Delivery Risks

The high risk relating to potential higher costs to deliver service, in particular for the high costs related to cleaning ponds are being mitigated with appropriate asset management planning.

Hazard & Environmental Risks

The high hazard and environmental risks are being mitigated through increased monitoring and inspections pre and post events, as well as improved budgeting preparedness. Additionally, changes to system design will be implemented to account for potential lake level rise.

**3.3.5 ASSET LEVEL RISKS**

The results of **asset level risk** assessments are considered when reviewing lifecycle strategies to determine the most appropriate treatments, preventative maintenance, and inspection frequencies for a particular asset or group of assets. Both asset level risk and service risks are considered in prioritizing capital works projects and other funding decisions.

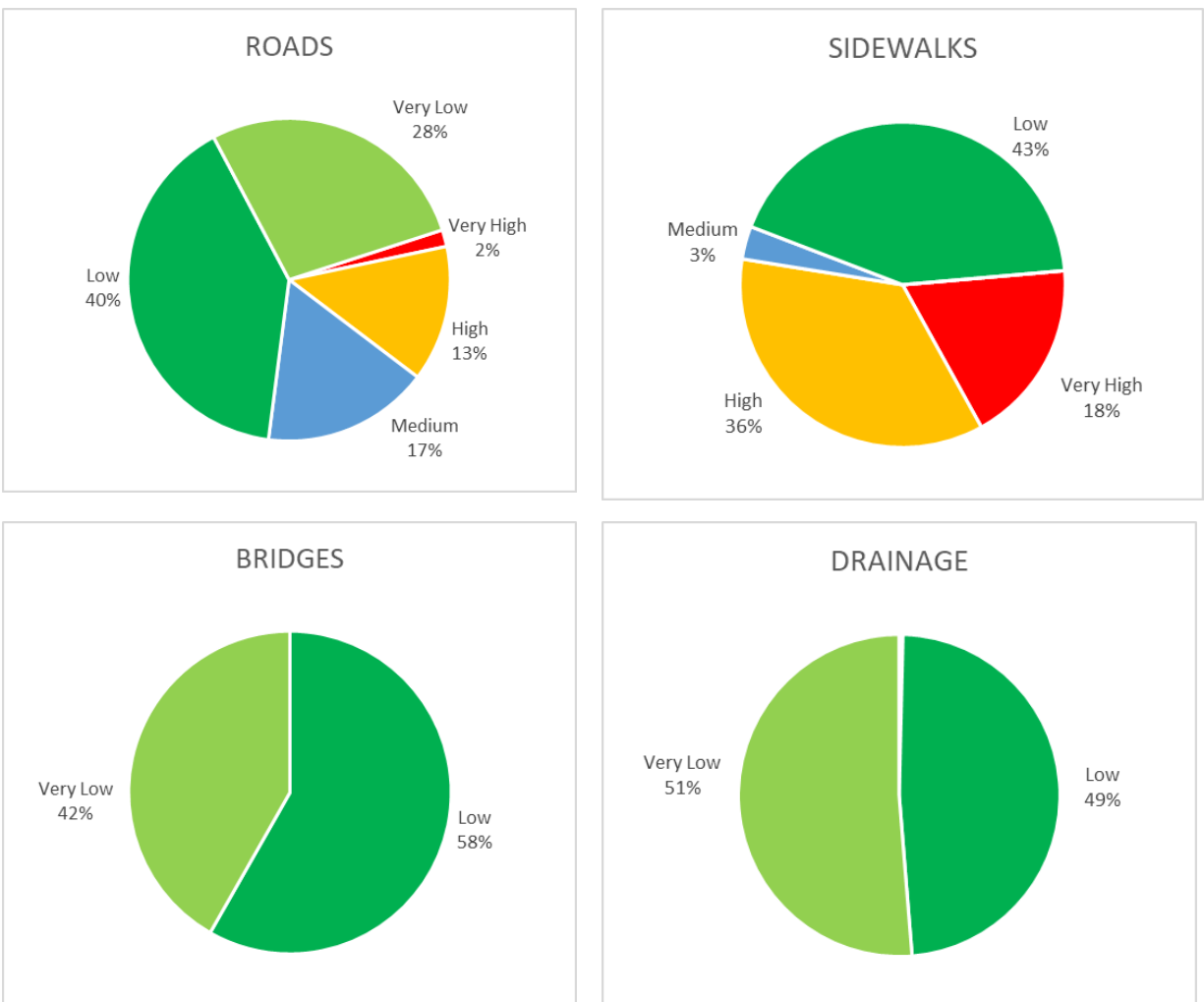
Asset level risks are calculated by multiplying the individual consequence of failure for each asset with the likelihood of that asset failing. For an initial assessment, the likelihood and consequence of failure for the assets are a 1-5 rating based on:

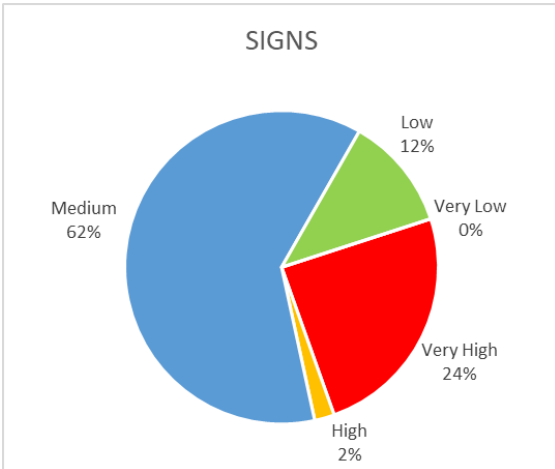
- Likelihood of failure: the 1-5 age-based condition rating or 1-5 measured condition state that is based on physical condition assessments (see Table 3, Table 4 and Table 5).

- Consequence of failure: the 1-5 criticality rating for each asset (see criticality ratings in section Table 28).



The results from the asset level criticality ratings are shown in Figure 12.





**Figure 12: Asset risk**

The results of the asset risk ratings show that there are very high-risk assets in roads (<1%), sidewalks, and signs.

### *DESCRIPTION OF HIGH-RISK ASSETS*

The very high-risk road sections are rural collector roads (high criticality) that have reached the end of their expected useful life. Similarly, all very high risks sidewalks are along collector roads. The sidewalks average rating is due to assumed age profiles.

The install date for most signs is assumed to be the same as the road they are on and results in signs being beyond their useful lifespan.

#### Mitigation

To mitigate the high and very high rated asset level risks it is recommended that the Town review the condition of all signs and sidewalks and address any assumed install date.

### *3.3.6 CONNECTION TO ASSET CRITICALITY*

The criticality of the asset or component of an asset is defined by its effect on the operation of an asset system if the asset failed. For example, if a bridge abutment was to fail, the bridge would become unsafe and impassable to traffic.

The assets in the scope of this Asset Management Plan have been rated for criticality using the criteria in Table 28.

**Table 28: Criticality criteria**

Asset Type	Asset Criteria	Criticality Rating
<i>Roads, Sidewalks, and Bridges</i>	Rural Local	2 - Low
	Urban Local	3 - Medium

Asset Type	Asset Criteria	Criticality Rating
	Rural Collector	4 - High
	Urban Collector	5 – Very High
<i>Culverts, Storm Pipes, SWMF's, and OGS's</i>	Urban Roads - Pipe Diameter 0-500mm	1 – Very Low
	All Rural road drainage infrastructure Urban Roads - Pipe Diameter 500-1000mm	2 - Low
	Urban Roads - Pipe Diameter 1000-1500mm	3 - Medium
	Urban Roads - Pipe Diameter 1500-2500mm	4 - High
	Urban Roads Pipe Diameter >2500mm	5 – Very High
<i>Signs</i>	Other Signs	3 - Medium
	Warning Signs	4 - High
	Regulatory Signs	5 – Very High

### 3.3.7 RISK IMPROVEMENT PRIORITIES

Table 29 shows a prioritized list of improvements relating to risk.

**Table 29: Risk improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
10	3.3	Risk	Develop and implement mitigation strategies for all high or very high service level risks and track their effectiveness.	High
11	3.3	Risk	Complete condition assessments on assets to improve understanding of likelihood of failure for asset level risks. Where asset level risks remain high or very high, add assets into renewal or rehabilitation programs.	High
12	3.3	Risk	Following inventory data improvement, in particular addressing missing install dates, review and revise asset level risks in State of Infrastructure Dashboard and report in next iteration of this Asset Management Plan	Medium

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
13	3.3	Risk	Review asset risk approach to consider if other aspects such as functionality and capacity should be included, in particular for signs and sidewalks.	Medium

## 3.4 RESOURCE NEEDS

This section compares available resource demand versus capacity and identifies whether there is enough capacity for the existing staff to take on new tasks or if additional resources are required.

### 3.4.1 EXISTING CAPACITY

The first step in identifying resource needs is to understand the current available hours for all staff and what tasks are currently completed as part of the Transportation Service. For reporting purposes, the activities are grouped into the following categories:

- Administration
- Operations
- Asset Management
- Contract Management
- Capital Projects

The Town are yet to complete the resource planning/assessment.

### 3.4.2 RESOURCE NEEDS FOR CURRENT SERVICE LEVEL

The next stage is to record the hours spent on each of the activities in each category over a year. In a workshop, Lincoln's transportation staff participated in recording the hours (in a resource planning spreadsheet tool), for all resources and all activities that fulfill the current service levels.

### 3.4.3 COMPARING RESOURCE NEEDS AND CAPACITY

Once the information is captured, a comparison will be made between required resources to deliver the level of service and current resource availability.

The reports available from the tool will include:

- Summary of Resource Demand (resource type and quantity needed to deliver the level of service)
- Utilization Graph (comparison of resource need to current availability)

### 3.4.4 RESOURCE IMPROVEMENT PRIORITIES

Table 30 shows a prioritized list of improvements relating to resource management.

**Table 30: Resource improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
14	3.4	Resources	Complete resource assessment as described in this section and populate the asset management plan.	High
15	3.4	Resources	Re-assess resourcing requirements every 2 to 3 years and report resource levels.	Low

# 4 FUTURE READY

---

## 4.1 DEMAND MANAGEMENT

Drivers affecting demand include things such as population change, regulations, changes in demographics, seasonal factors, climate change, vehicle ownership rates, consumer preferences and expectations, technological changes, economic factors, agricultural practices, and environmental awareness.

The main demands for new Road ROW services are created by growth and development. Growth is a critical infrastructure demand driver for most infrastructure services. As such, the Town must not only account for the lifecycle cost for its existing asset portfolio, but those of any anticipated and forecasted capital projects associated specifically with growth.

Lincoln is one of the fastest growing municipalities in Niagara. During the 25 years between 1986 and 2011 the population of the Town increased by about 8,100 people or at an annual rate of 1.4%. Currently, the Town of Lincoln has a population of ~25,000 and is expected to grow by 50% by 2031.

In conjunction with raw population growth, the type of shift in demographics can also dictate how the Town will allocate its infrastructure investments. As the demographics change and the Town assumes responsibility of new infrastructure, the level of strain on various critical and supplementary infrastructure services will shift to reflect the needs of the residents.

---

### 4.1.1 DEMAND ASSESSMENT

The Town has assessed the following drivers for the Road ROW service:

- Population growth
- More people working from home
- Changes in demographics
- Increase of flood or washout events
- Increase in commercial or industrial development
- Increase in heat events
- Legislative changes

The drivers are assessed for impacts to health and safety of the Town's residents and of the businesses and the impact the growth drivers have on the assets that provide Road ROW services and the ability of the Town to continue to provide required levels of service.

The results of the assessment are shown in Table 31.

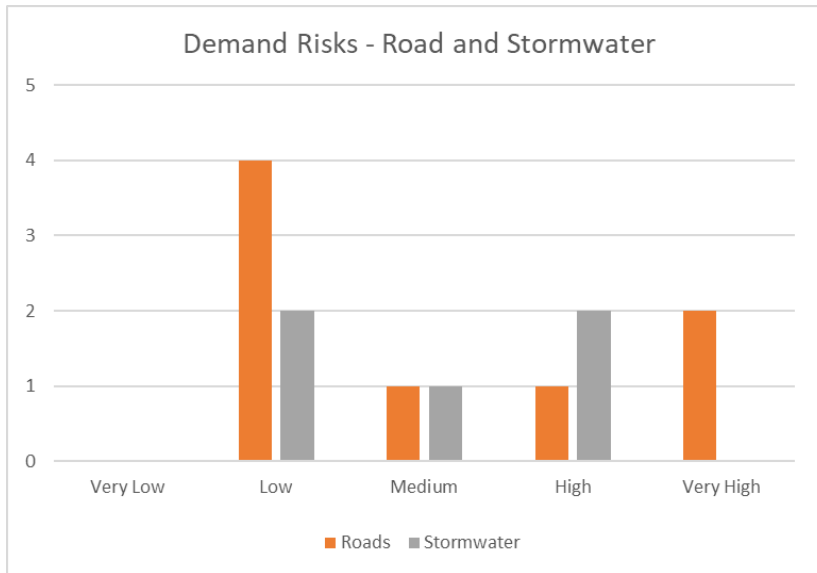
**Table 31: Initial Demand Assessment Results**

Demand Driver	Very Low	Low	Medium	High	Very High	Count
Road	0	4	1	1	2	8
Stormwater	0	2	1	2	0	5
<b>Total</b>	<b>0</b>	<b>6</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>13</b>

The drivers that were identified has high or very high impact include increase in population, increase in commercial/industrial development and changes to the town's demographics.



The results are also shown in graphical form in Figure 13.



**Figure 13: Initial Demand Assessment Result**

## MITIGATION

As part of the demand assessment, a mitigation measure was identified for any high or very high impacts.

The impact of population growth in the Town is mitigated by tracking condition annually to monitor rate of deterioration due to potential increase in traffic volumes and load post construction. Additionally, roads are monitored for speed and traffic calming measures are implemented as appropriate.

A truck bypass in Beamsville and possible escarpment crossing have been identified as long-term mitigation for the increase in commercial or industrial development.

The Transportation Master Plan identifies areas of focus include active transportation and mobility initiatives to address changes in demographics.

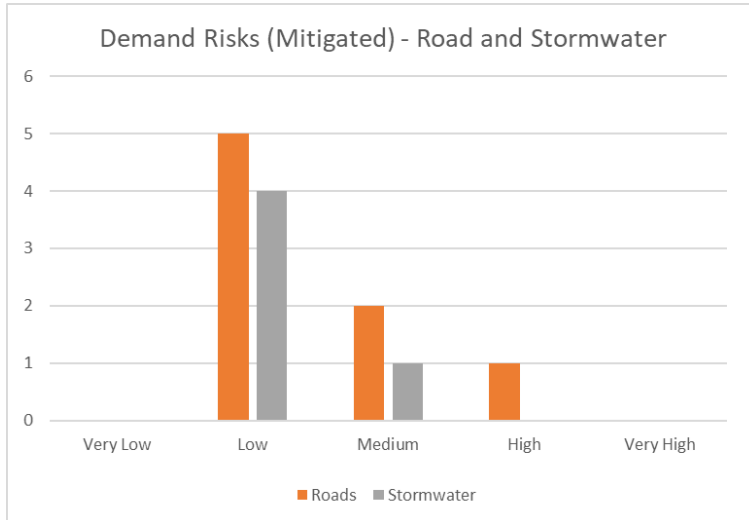
Table 32 shows the impacts to the water and wastewater systems after mitigation.

**Table 32: Mitigated Demand Assessment Results**

Demand Driver	Very Low	Low	Medium	High	Very High	Count
Road	0	5	2	1	0	8
Stormwater	0	4	1	0	0	5
<b>Total</b>	<b>0</b>	<b>9</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>13</b>

Note that the reduction in demand risk rating shown in Table 32 will not be realized until the proposed mitigation measures are implemented.

The results are shown graphically in Figure 14.



**Figure 14: Mitigated Demand Assessment Results**

#### 4.1.2 DEMAND MANAGEMENT IMPROVEMENT PRIORITIES

Table 33 shows the prioritized improvement tasks related to demand management.

**Table 33: Demand Improvement Tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
16	4.1	Demand management	Annually revise the demand risk as mitigation measures are implemented and at least annually to update for changes in demand drivers.	Low

## 4.2 RESILIENCY AND ADAPTATION

The resilience of our critical infrastructure is vital to our customers and the services we provide. To adapt to changing conditions and grow over time we need to understand our capacity to respond to possible disruptions and be positioned to absorb disturbance and act effectively in a crisis to ensure continuity of service. Resilience is built on aspects such as response and recovery planning, financial capacity and crisis leadership.

### 4.2.1 GROWTH

Asset management planning must consider potential future impacts on the services being delivered. Demand for new services will be managed through a combination of managing existing assets, upgrading of existing assets and providing new assets to meet demand and demand management. Demand management practices can include non-asset solutions, insuring against risks and managing failures.

---

#### 4.2.2 CLIMATE CHANGE

The Town has completed a Corporate Climate Adaptation Plan (CCAP) as a guideline to support and inform climate adaptation at the Corporate municipal level. It outlines how the municipality will adapt its assets, operations, and services to the current and future impacts of climate change.

The development of a CCAP for the Town of Lincoln is supported by the 2016 Asset Management Plan which states, *“infrastructure is inextricably linked to the economic, social and environmental advancement of a community”* and that *“broader environmental and weather patterns have a direct impact on the reliability of critical infrastructure services”*.

The Town’s 2014 Official Plan also affirms, *“reviewing opportunities for reducing the impact of climate change, meeting the challenges of climate change and other environmental issues through integrated solutions, and incorporating low impact design and other site design strategies to mitigate environmental impacts”*.

The development of a CCAP is also driven and supported by the 2017 Growth Plan for the Greater Golden Horseshoe, of which a guiding principle is to *“integrate climate change considerations into planning and managing growth such as planning for more resilient communities and infrastructure – that are adaptive to the impacts of a changing climate”*.

Climate projections shown in Table 34 for the Town of Lincoln are based on RCP 8.5 climate models from [www.climatedata.ca](http://www.climatedata.ca) which is a collaboration between:

- Environment and Climate Change Canada
- Computer Research Institute of Montréal
- Ouranos
- Pacific Climate Impacts Consortium
- Prairie Climate Centre, and
- Habitat Seven.

**Table 34: Temperature and precipitation projections**

Variable	Sub-Variable	Average (1976-2005)	2050 Projection	2100 Projection	Trend
<b>Temperature</b>	Hottest day °C	33	37	40	↑
	Mean Temp °C	9	12	15	↑
	Min. Temp °C	4	7	11	↑
	Max. Temp °C	13	16	19	↑
	Days Over 30 °C	11	47	91	↑
	Coldest Day °C	-20	-13	-8	↑
	Days Below -15°C	8	0	0	↓
	Days Below -25°C	0	0	0	↓
	Frost Days	124	85	46	↓
	Cooling Degree Days	328	670	1200	↑
	Growing Degree Days 10°C	1390	1996	2725	↑
	Growing Degree Days 5°C	2390	3096	3977	↑
	Cumulative Degree Days >0 °C	3657	4440	5526	↑
	Heating Degree Days	3402	2669	2011	↓
	Ice Days (below 0°C)	48	24	6	↓
	Tropical Nights >18°C	26	61	106	↑
	Tropical Nights >20°C	10	39	84	↑
	Tropical Nights >22°C	2	18	60	↑
<b>Precipitation</b>	Total Precipitation	864	1016	955	↑
	Max 1 Day Total mm	39	39	38	↓
	Wet Days >10mm	26	33	32	↑
	Wet Days >20mm	6	9	9	↑

The overall risk and vulnerability of the Town to each projected impact was assessed to determine its priority and if action to address the impact would be taken. By assessing vulnerability and risk, the following climatic threats were identified as a top priority to the Town of Lincoln, within the corporate scope (refer Figure 15)

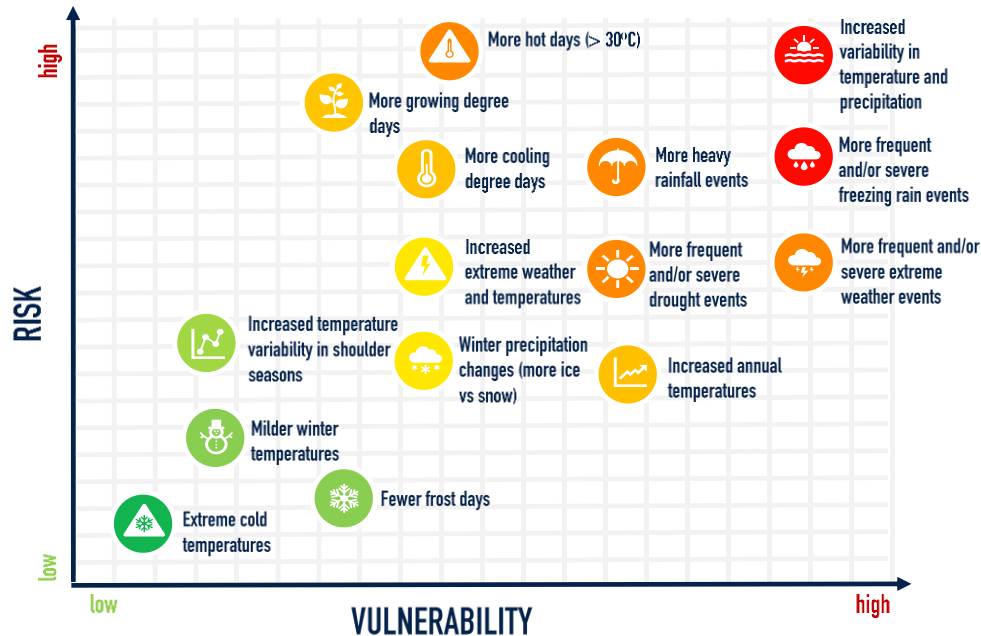


Figure 15: Risk and vulnerability

### 4.2.3 MITIGATION ACTIONS

#### GROWTH:

In order to manage growth, the Town can investment more into service areas and/or reduce the need for investment by considering the following strategies:

- **Extending service lives of assets through better maintenance** – Targeted preventative maintenance, and operational practices that preserve the asset can extend an assets lifespan and reduce long term costs.
- **Earlier interventions with lower lifecycles costs** – Early, low cost interventions in an asset lifecycle may lengthen service lives. Failing to do early interventions (where they are appropriate, practical, and cost effective), and replacing assets only when they fail is generally more expensive.
- **Accept reduced service levels** –Lower levels of quality, availability, consistency, and/or reliability of service or less consistency of service may be acceptable in order to lower operational and capital costs.
- **Fewer services** – Eliminating non-essential services saves on operating and capital costs.
- **Alternative revenues** – Alternatives to tax increases may include development cost charges or user fees as examples.

---

**CLIMATE:**

The Town of Lincoln is committed to providing its community with an equitable, sustainable, and prosperous quality of life. In order to adapt, manage, and reduce the impacts of climate change, the Town has committed to 47 actions that the municipality will undertake to adapt to climate change. Adapting assets and the asset management process to anticipated climate change are included in the following goals:

**Goal 1:** Integrate climate change considerations into Town strategies, plans, policies, procedures, operations, & services

**Goal 2:** Increase resiliency & adaptive capacity within economic development, community services, parks, & recreation

**Goal 3:** Protect natural resources, promote ecosystem services, & minimize environmental degradation

**Goal 4:** Mitigate harmful consequences of extreme weather & emergency events

**Goal 7:** Consider climate change impacts in built infrastructure & asset management

**Goal 8:** Increase climate change literacy among staff & public

The trends from climate change that have been identified by Lincoln include rising lake levels and more frequent and prolonged high intensity storms.

The issues stemming from these trends include:

- Flooding and flash flooding from the escarpment
- Erosion that will reduce available roadway platform width and impact road stability and roadside safety.
- Damage to infrastructure as a result of high winds.
- Forecast changes in levels of service (if applicable)

Mitigation measures have not been currently developed but possible pipe capacity analysis to cope with 50 or 100-year storm levels will be considered at design phase for new or replacements.

---

**4.2.4 RESILIENCY AND ADAPTATION IMPROVEMENT PRIORITIES**

Table 35 shows the improvement priority related to resiliency and adaptation.

**Table 35: Resiliency and adaptation improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
17	4.2	Resiliency & Adaptation	Review climate change forecasts regularly and modify adaptation plan if appropriate	Low

## 4.3 SUSTAINABILITY

For this inaugural Asset Management Plan, the Transportation team is using the Service Sustainability Assessment Tool (SSAT) which was prepared by Asset Management BC (AMBC). This tool that highlights where the service sustainability may be threatened and provides feedback on performance of business practice that contribute to service sustainability.

Service sustainability requires balancing service delivery with good governance and strong finances. Many communities have a strong understanding of service delivery itself, that is, how services are delivered, in what quantity, to whom, and where. In fact, much of the work of local government is in the delivery of services. Good governance provides consistent and transparent decision-making that takes a long-term view. Strong finances are key to being able to deliver a service affordably over time.

By assessing the three components of sustainable service delivery together, the SSAT provides clear feedback on strengths and gaps in each component.

### 4.3.1 ASSESSMENT AND CURRENT PERFORMANCE

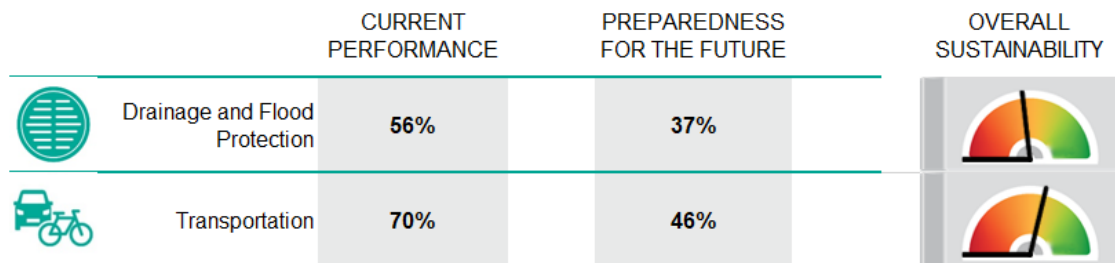
The Town of Lincoln's Transportation staff completed the Service Sustainability assessment by rating statements that correspond to the current situation of the Transportation Service and to their level of future preparedness.

### 4.3.2 CURRENT PERFORMANCE

The results of the SSAT assessment are reported in 3 lenses:

- Elected Officials (Council/Public)
- Directors (Senior Management)
- Managers (Service Delivery Team)

The results of the assessments for drainage and flood protection and transportation are shown in Figure 16:



**Figure 16: Transportation sustainability assessment results**

### CURRENT SUSTAINABILITY

The results for the Town's current sustainability performance for drainage and flood protection scores 56%. From a service delivery perspective, the drainage network is of a size that meets current demands, but the

condition of half the drainage infrastructure is fair, and includes some assets where condition was estimated based on age. Financially, there are enough reserves to fund improvements and renewals.

The results for the Town’s current sustainability performance for transportation scores 70%. From a service delivery perspective, the transportation network is in good condition, and provides multi-modal transportation options. There are sufficient reserves to fund improvements and renewals, and citizen engagement is well planned.

### *FUTURE PREPAREDNESS*

The results for the Town’s future preparedness for drainage and flood protection scores 37%. Whilst there are existing processes and procedures to manage water run-off and limits to impervious areas, a number of plans require updates to better manage flood protection and renewal forecasting. Additionally, while there are significant data gaps for stormwater systems, improvement projects to address those gaps are being initiated in 2022.

The results for the Town’s future preparedness for transportation scores 46%. Existing community and transportation master plans are in place to support active transportation and increase multi-modal transportation options throughout the Town.

### *4.3.3 SUSTAINABILITY IMPROVEMENT PRIORITIES*

Table 36 shows a prioritized list of improvements relating to sustainability.

**Table 36: Sustainability improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
18	4.3	Sustainability	Develop plans, processes, and procures to improve decision-making and community engagement for the drainage and flood protection service.	Medium
19	4.3	Sustainability	Develop plans, processes, and procures to improve safety and community engagement for the transportation service.	Medium
20	4.3	Sustainability	Annually re-assess services against AMBC Sustainable Service Assessment Tool (SSAT).	Medium



# 5 FINANCIAL SUMMARY

## 5.1 CONTEXT FOR INFORMATION IN THIS SECTION

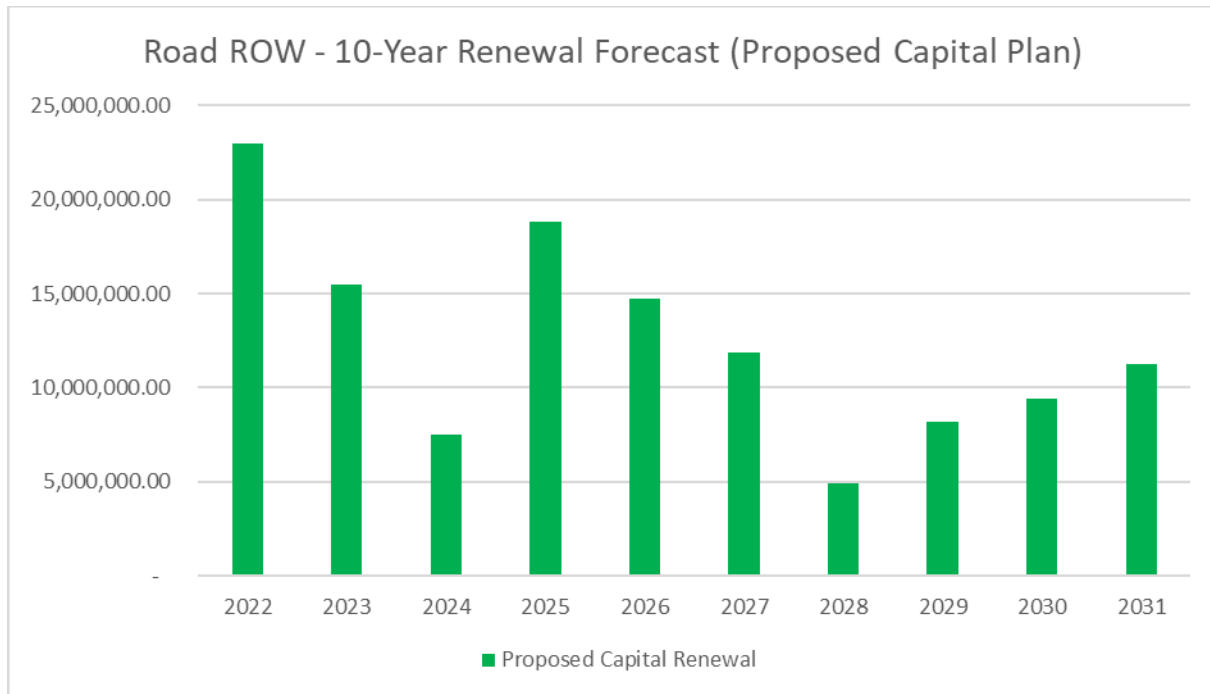
This section provides an overview of the costs to provide the services, the distribution of the expenses for each of the services provided, the operations and maintenance forecasts, and the capital renewal and new asset forecasts. The data used for this section is the proposed Capital Plan for 2022-2031, the 2021 and the State of the Infrastructure forecast (Section 2.2).

## 5.2 FINANCIAL FORECASTS

### 5.2.1 FINANCIAL RENEWAL FORECAST

The renewal forecast capital plan includes for replacement with like-for-like of **existing** assets only and is based on the forecasts in the proposed 2022-2031 Capital Plan.

The replacements costs from the capital plan shown in Figure 17 for the Road ROW services have been forecasted over the next 10 years.



**Figure 17: Road ROW 10-year renewal forecast (Proposed Capital Plan)**

The total budget for the 10-year capital forecast period is \$125 million for renewal of existing assets.

## 5.2.2 OPERATIONS, MAINTENANCE, AND INSPECTIONS BUDGET FORECAST

The operations budget forecast includes operations, preventative maintenance, reactive maintenance, and inspections activities.

The operations and maintenance forecast in Figure 18 shows the proposed funding allocated for operations and maintenance activities to be completed on road ROW assets over the next 10 years. The values between 2023 and 2031 have been estimated using an escalation factor of 3% per annum to reflect expected growth.

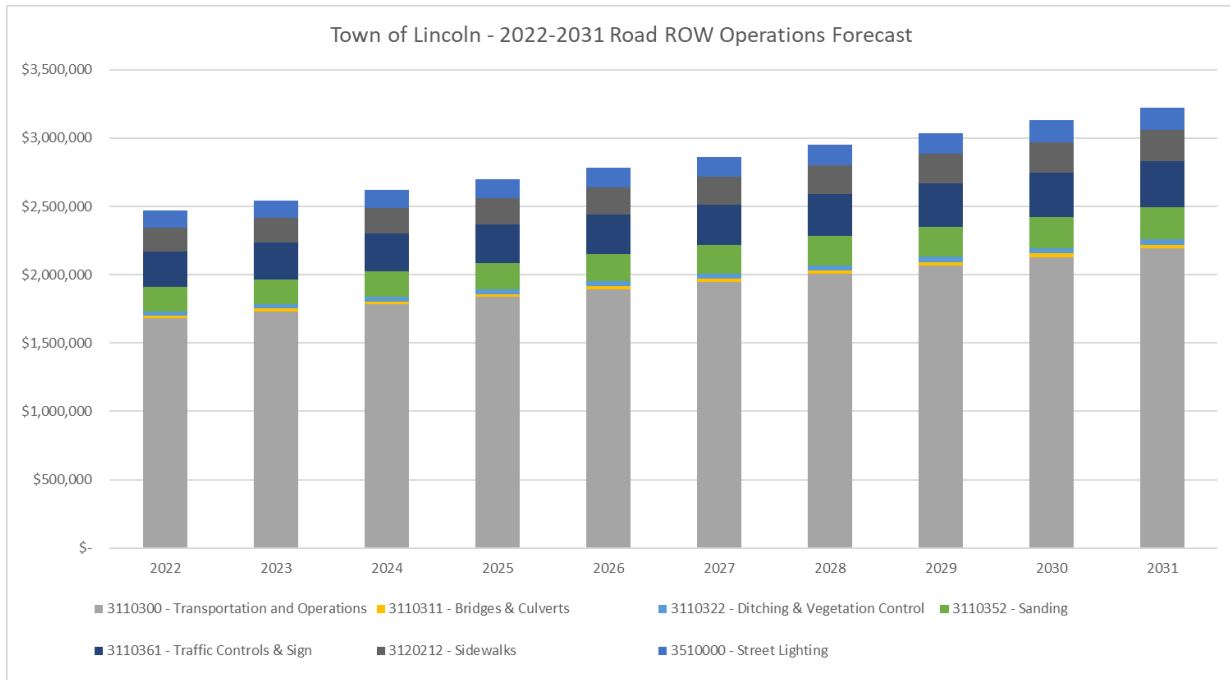
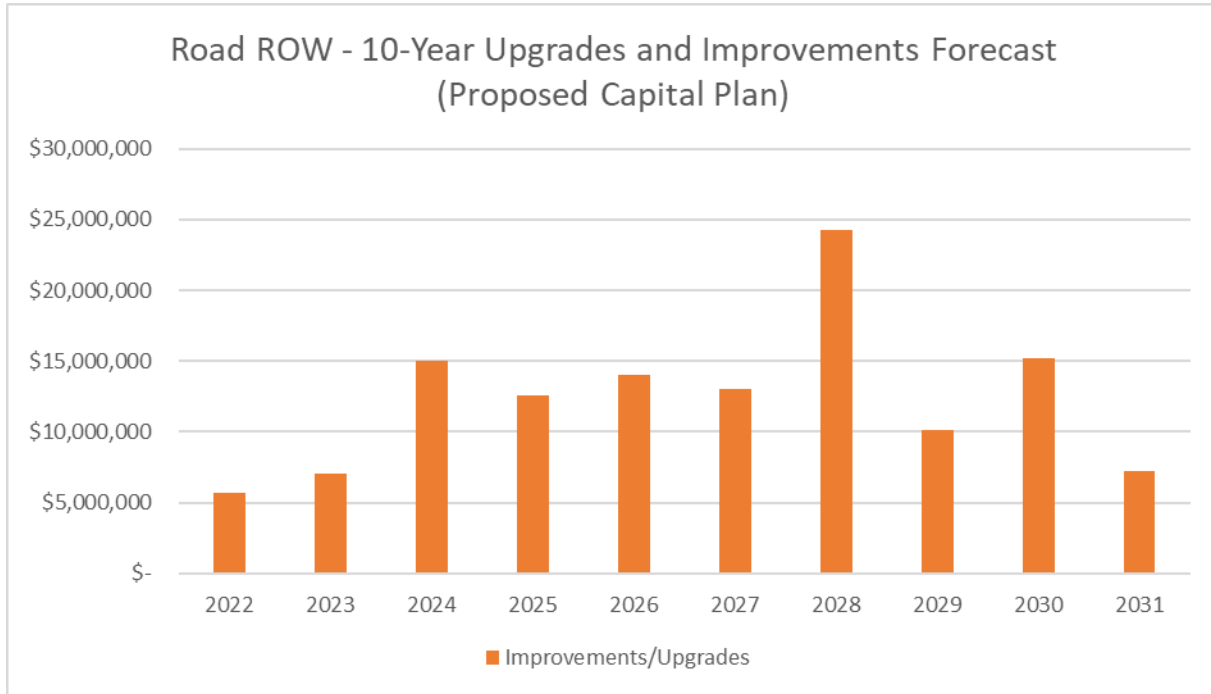


Figure 18: Road ROW – 10-year operations and maintenance budget

## 5.2.1 CAPITAL NEW ASSET FORECAST (NEW/UPGRADE/IMPROVE/AUGMENT)

The Capital New Asset forecast includes new assets added to the road ROW network, as well as upgrades to support growth, improvements, and augmentation of the existing infrastructure as opposed to renewals that are a replacement of an existing asset with the equivalent. These are typically identified in response to growth and are included in the Proposed Capital Plan.

Figure 19 shows the 10-year forecasted upgrades of existing assets and new assets to support growth.

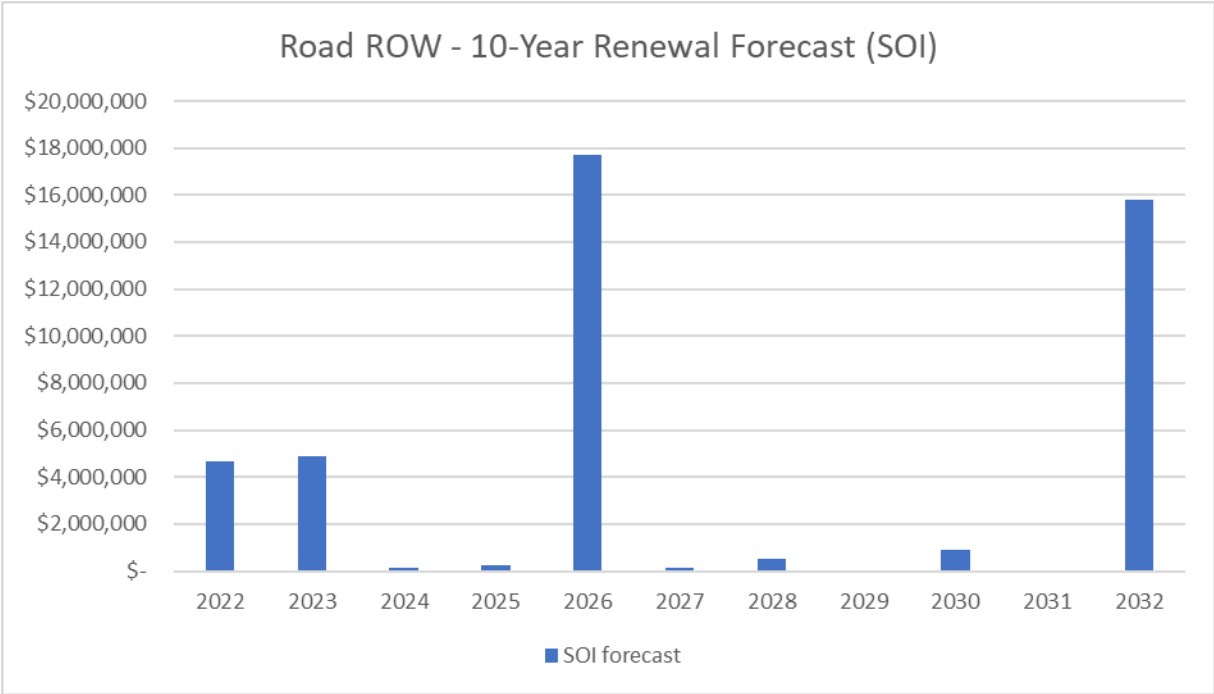


**Figure 19: Transportation 10-year condition-based renewal forecast**

### 5.2.2 STATE OF INFRASTRUCTURE CAPITAL RENEWAL FORECAST

The State of Infrastructure Capital Renewal Forecast includes for replacement with like-for-like of existing assets only. The forecast values are based on the state of infrastructure analysis as described in Table 5. The forecast is shown in 2021 dollars.

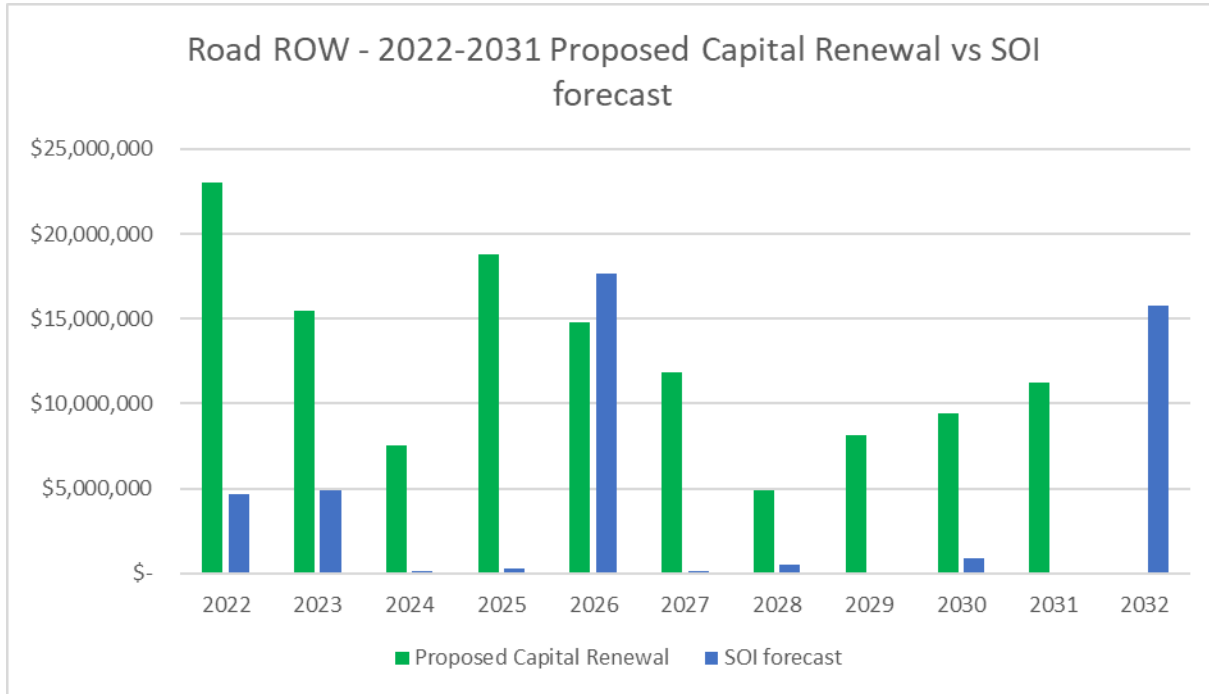
Figure 20 shows the SOI capital renewal forecast over the next 10 years. It is important to note that this renewal forecast is based on lifecycle timing only at this time.



**Figure 20: Road ROW – 10-year age-based renewal forecast**

The costs of the age-based renewals over the next 10-year period equate to \$29.2 million.

Figure 21 shows a comparison of the forecast renewal and rehabilitation projects in the 2022-2031 Proposed Capital Plan to the forecast asset renewals identified in the State of Infrastructure. The Proposed Capital Plan includes projects based on lifecycle and renewals based on observed condition or operational concerns.



**Figure 21: Comparison between the 10-year proposed capital plan and the SOI renewal forecast**

The total 10-year Proposed Capital Plan for renewals is approximately 4 times higher than the 10-year renewal forecast from the State of the Infrastructure forecast (\$125M vs \$29M). Some of the renewal projects have been driven by growth, expansion or coordination with wider renewal projects. It is recommended that completeness and accuracy of the inventory is reviewed and the age-based renewal forecast updated as well as a review of unit costs.

### 5.2.3 REVENUE

Capital works, operations and maintenance of road ROW services are currently funded by the following sources of revenues:

- Development charges
- Taxes
- Grants

A financial plan update and review of forecasted revenues are currently underway. The initiatives include an in-depth review of sources of revenues and levels of rates. The information will be included in the next iteration of the asset management plan.

## 5.3 FUNDING STRATEGY

The total planned expenditures (Figure 22) are approximately \$89.2 million and includes Proposed Capital Plan as well as operations and maintenance.

Outcomes of the financial plan will be incorporated in a future iteration of the asset management plan and compared against forecasted expenditures.

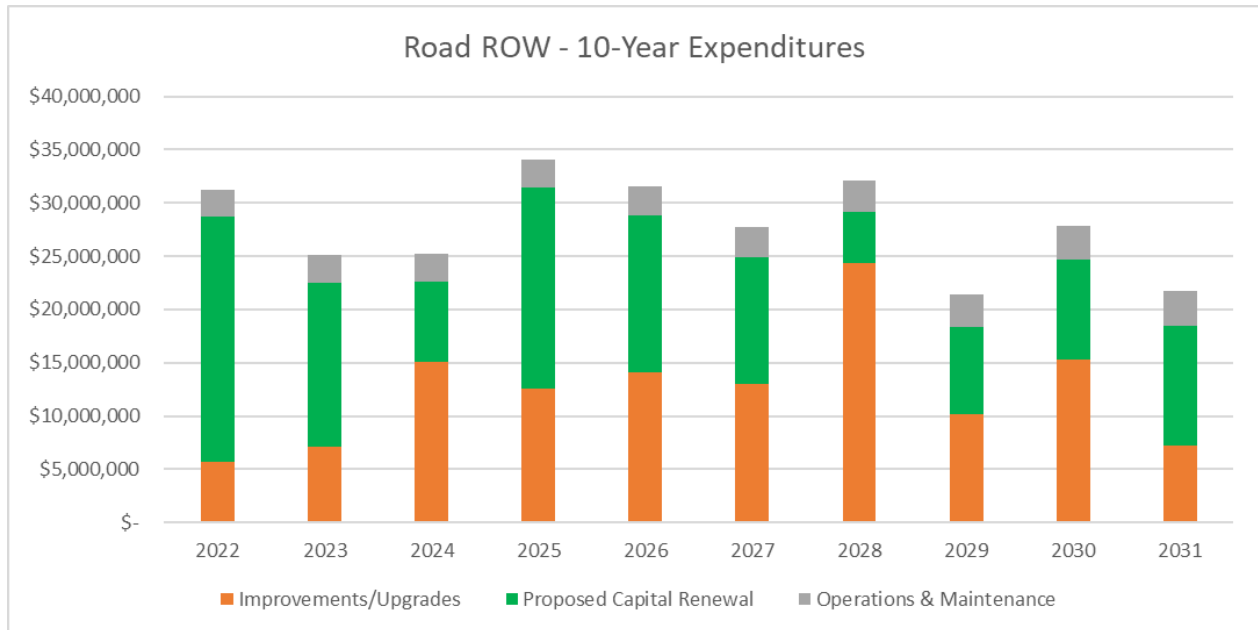


Figure 22: 10-Year total forecasted expenditures

## 5.4 FINANCIAL IMPROVEMENT PRIORITIES

Table 37 shows the improvement priority related to financial strategy.

Table 37: Financial improvement tasks

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
21	5	Finance	Incorporate the financial sections with update revenues, including reserves forecast once the financial plan is completed.	High
22	5	Finance	Develop a structured process for long-term budgeting decisions to be made considering costs of service delivery and meeting levels of service.	High
23	5	Finance	Review unit rates at a minimum for each new iteration of the asset management plan and update replacement costs as appropriate	High
24	5	Finance	Update the asset management plan with the 10-year capital forecast once approved by Council	High
25	5	Finance	Develop a process to track and separate operations, preventative and reactive maintenance, and inspections costs.	Medium

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
26	5	Finance	Develop a process to track and separate capital renewals and rehabilitation costs from capital upgrades, improvements, and new assets.	Medium
27	5	Finance	Record actual costs as assets are replaced to provide local information for unit cost reviews to improve accuracy of financial forecasts for asset renewals.	Medium
28	5	Finance	Evaluate target levels for capital reserve funding, that more closely align to the long-term investment requirements of the service areas that make up the Town's infrastructure portfolio as part of the Water and Wastewater Rate Study and Financial Plan Updates	Medium
29	5	Finance	Establish a formalized prioritization method for evaluating investment alternatives for the Town's capital program. An objective assessment of the risk, service priority and strategic alignment for each investment alternative is one common method to accomplish this.	Medium
30	5	Finance	Where appropriate, coordinate asset management planning with neighbouring municipalities and the region	Medium
31	5	Finance	Develop a formal project prioritization (investment prioritization) and decision-making process	Medium

# 6 CONTINUOUS IMPROVEMENT

## 6.1 ASSET MANAGEMENT MATURITY ASSESSMENT

An assessment of the water and wastewater service’s asset management practices was completed to evaluate service area capabilities and develop a work plan towards enhanced asset management maturity. The results are scored from 1 to 4 based on eight key improvement categories:

1. Leadership and Commitment
2. Financial Capacity
3. Know Your Assets
4. Know Your Financial Situation
5. Understand Decision Making
6. Manage Asset Lifecycle
7. Know the Rules
8. Monitor Sustainability

The rating for each question was based on the scale shown in Table 38.

**Table 38: Maturity Rating Description**

Rating	Description
1	None: does not exist or has not been started at this stage
2	Started: some work has begun, or some parts of the asset management practice are available, but progress is less than 40% complete
3	Progressing: work is underway, and progress is more than 40% complete, but there is still more to do
4	Complete: the required targets, standards, and/or outcomes for the asset management practice are completed, available, and in use in the business

### 6.1.1 ASSESSMENT RESULTS – ROAD ROW

Assessment results were recorded in a spreadsheet designed for benchmarking the Town’s asset management practices. Staff can use the spreadsheet tool to re-evaluate asset management maturity in subsequent years and report progress.

Figure 23 provides a radar chart completed in 2020 that shows the maturity scores of the Road ROW Service.





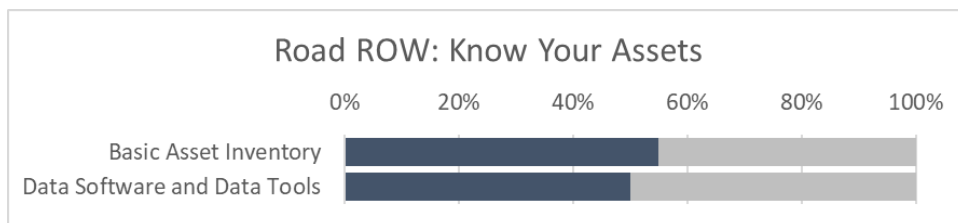
**Figure 23: Asset Management Maturity Assessment - Road ROW**

The leadership and commitment and financial capacity criteria of the maturity assessment were assessed at a corporate level rather than by service area. The results for asset management practices for the water service are described below.

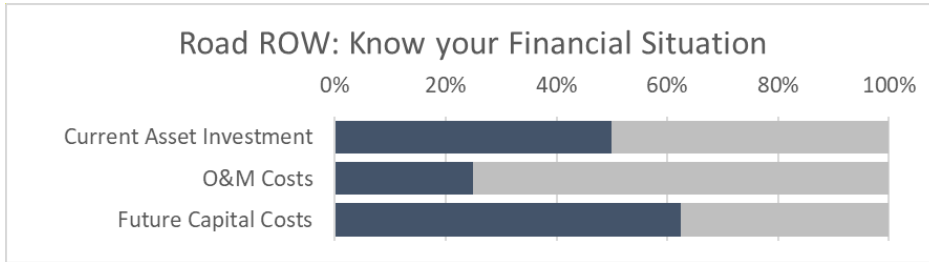
### AM PRACTICES & INFORMATION - ROAD

The assessment for the remaining six categories of Asset Management Practice and Information were completed in 2020 for the road service. The following section provides comments on the key points.

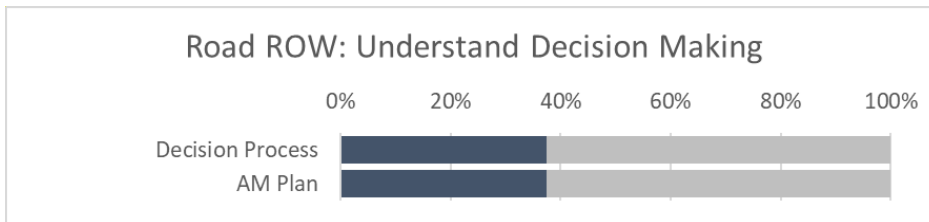
- Know Your Assets:** Datasets exist for road assets in several spreadsheets however the Town is in the early stages of linking assets (e.g. sidewalks to roads). Some data is available for other types of assets (e.g., sidewalks, streetlights) Some attributes are assumed rather than measured or verified.



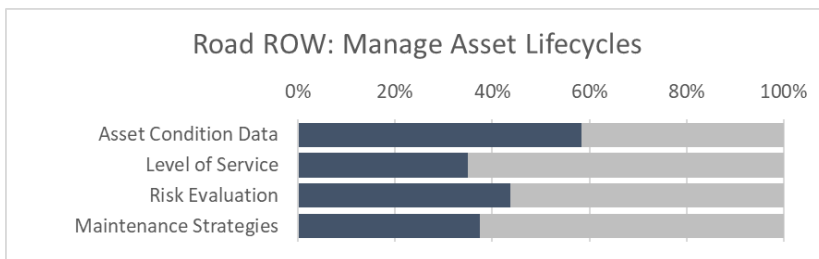
- Know Your Financial Situation:** The road service has anecdotal information available to evaluate the current and future financial situation for service delivery. The asset replacement costs are based on assumed values and useful life information based on industry lifespans and past experience rather than what is experienced in the field. There is cost information regarding operations and maintenance activities but not recorded at an asset level. Several studies are available and considered when considering future projects (e.g. growth analysis, active transportation, master plan).



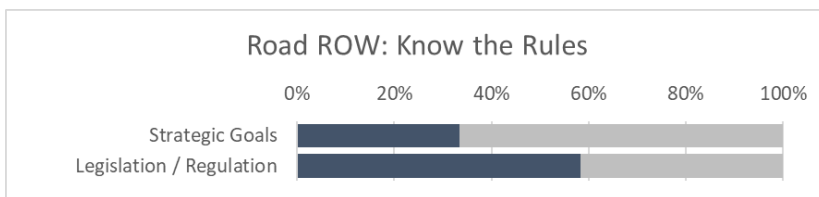
- Understand Decision-Making:** Decision-making processes across most asset groups are informal and based on the knowledge through background studies, reports and expert judgment of experienced staff. Most decision processes and criteria are not formally documented, although the outcome of decisions and some rationale is reported on a case-by-case basis. The quality and reliability performance of the road service is not officially tracked. At the time of assessment, the asset management plan and levels of service were in early stages.



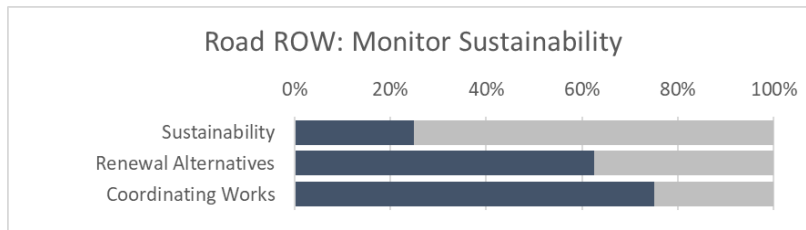
- Manage Asset Lifecycle:** Current condition data is available and assessed every 4 years. A total cost of service has not been completed and would not be possible with the current level of information available. Critical assets are known to staff through experience and there is no formal management plan in place to manage critical assets although risks are informally considered in decision-making. There are some documented standard operating procedures and staff generally follow provincial guidelines for minimum maintenance.



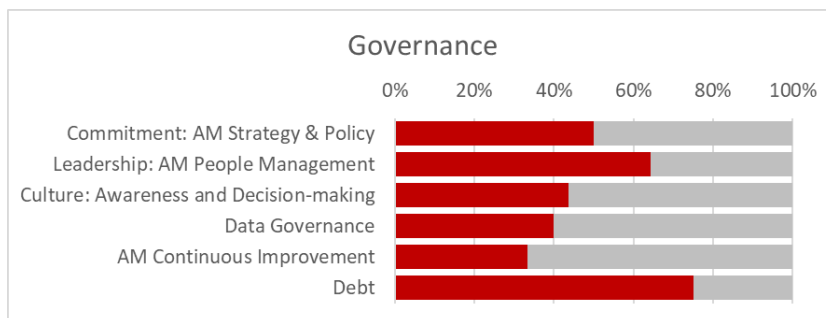
- Know the Rules:** There is a corporate strategic plan but department and service delivery goals have not been officially defined with the exception of liability requirements. Compliance documents have available on hard copies but not easily available for reporting.



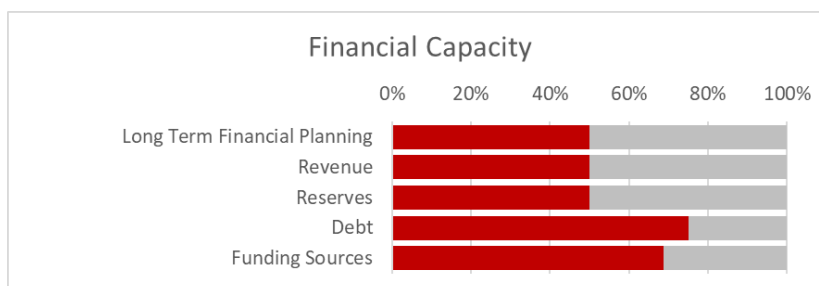
- Monitor Sustainability:** Sustainability goals are currently under development for the road service. All alternatives are considered when looking at renewal options however the process is informal. There is informal coordination within departments and across departments.



- Leadership and Commitment:** Lincoln has an asset management policy but does not yet have an asset management strategy or a defined asset management framework. There is an established asset management focus group and there is a strong culture of teamwork across the service areas, however the group does not have any terms of reference and the roles and responsibilities for asset management are still in the development phase. The leadership team is empowering staff to deliver asset management practices but dedicated resources have not been established and asset management practices to identify and report on key issues are in early phase of development. There is no formalized data governance document or data structure model.



- Financial Capacity:** Lincoln produces short term (5-10 years) financial plans. Plans rarely consider long term planning horizons of 20-30 years or more. The level of current revenue is deemed adequate in the short term but there is no supporting information available too if they are adequate for longer term financial sustainability and service delivery. Some reserves are in place but there is not sufficient information to understand if they are adequate. Similarly, there is insufficient information to determine if revenues are adequate for the long-term. Debt levels have been rated as reasonable and stable, but long-term sustainability is uncertain because a long-term assessment and plan are still to be established. Funding sources for the short to medium term are well understood and there is medium to low risk of significant change, but little is understood of longer-term risks or vulnerabilities.



## 6.1.2 ASSESSMENT RESULTS – STORMWATER

Figure 24 provides a radar chart completed in 2020 that shows the maturity scores of the Stormwater Service.

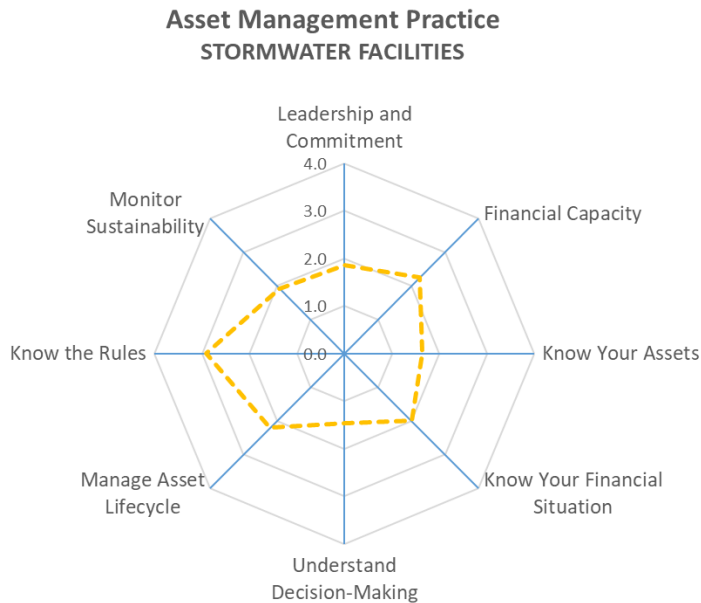
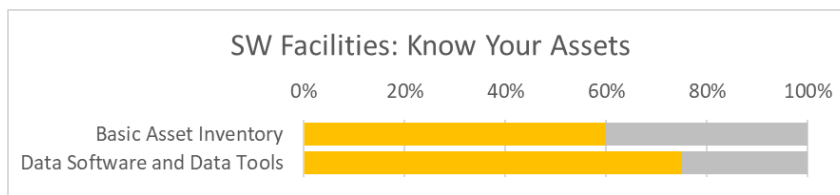


Figure 24: Asset Management Maturity Assessment – Stormwater

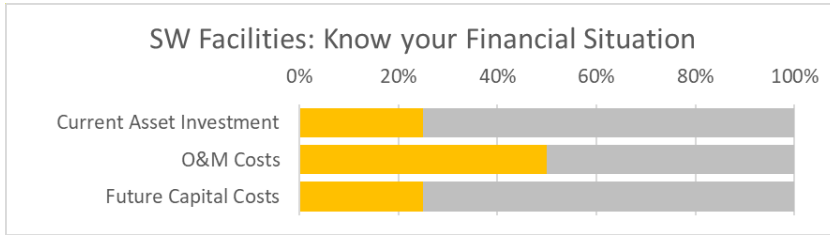
## AM PRACTICES & INFORMATION - STORMWATER

The assessment for the remaining six categories of Asset Management Practice and Information were completed in 2020 for the stormwater service. The following section provides comments on the key points.

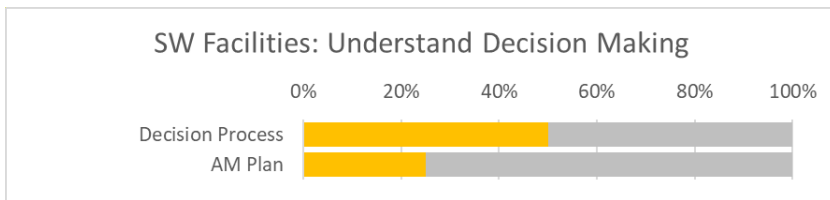
- Know Your Assets:** Inventory is available in paper and scanned format but not in a database. Each stormwater management facility is tracked as a single asset and components are not tracked individually.



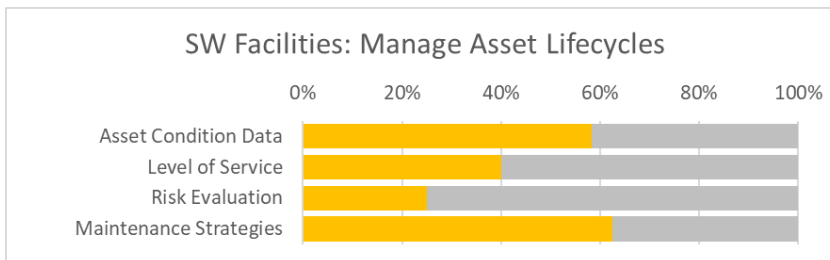
- Know Your Financial Situation:** The stormwater service has anecdotal information available to evaluate the current and future financial situation for service delivery. The asset replacement costs are based on assumed values and useful life information based on industry lifespans rather than what is experienced in the field. There is cost information regarding operations and maintenance activities. Future capital cost are not well understood.



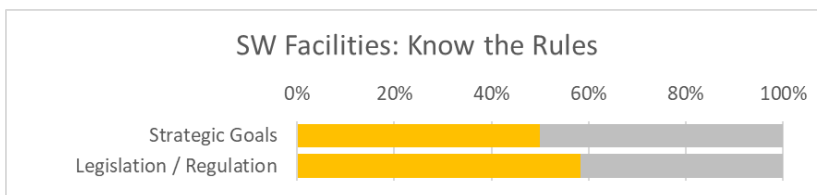
- Understand Decision-Making:** Decision-making processes across most asset groups are informal and based on the knowledge through background studies, reports and expert judgment of experienced staff. Most decision processes and criteria are not documented although annual inspection results are documented and analyzed. At the time of the assessment, an asset management plan had not been developed, but has been addressed with the development of this plan.



- Manage Asset Lifecycle:** Stormwater management facilities are inspected annually and condition is well understood. Budgets are developed as a result of the inspections. Total cost of service has not been formally developed for each stormwater management facility. Risk is not formally managed but known issues are being managed informally. There are quality standards in place that outline inspection frequency and functional designs inform standard operating procedures.

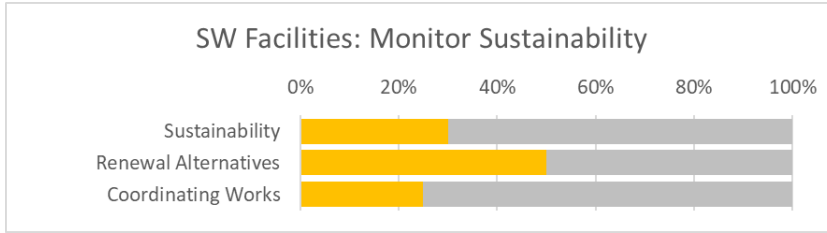


- Know the Rules:** There are monthly stakeholder meetings and standardized agreements in place. Legislation and rules are generally documented and accessible to staff but results are only informally recorded.

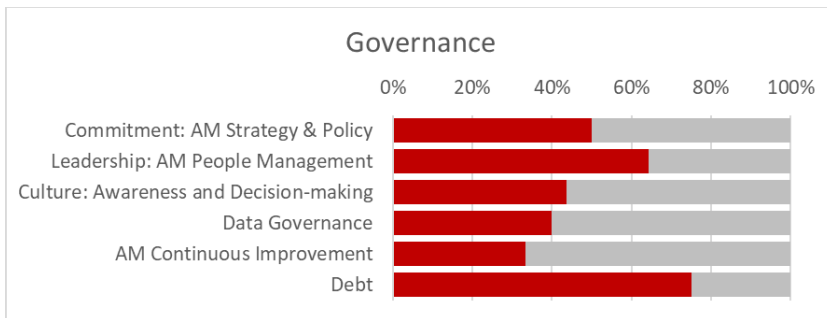


- Monitor Sustainability:** Sustainability goals are yet to be developed. Asset management assessments for environmental, financial, and social sustainability need to be undertaken in the

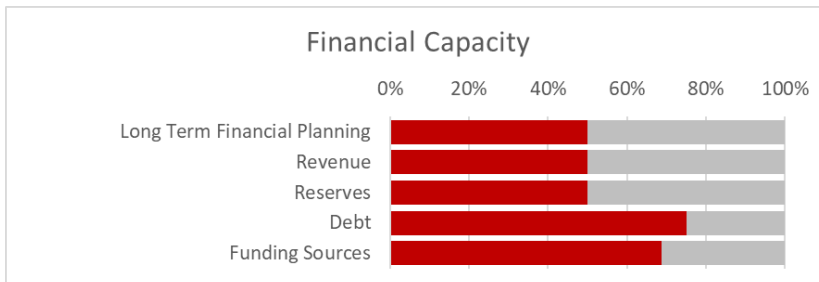
future when suitable measured information is available. Climate adaptation planning is underway. There is no formal process for coordination of work between departments.



- Leadership and Commitment:** Lincoln has an asset management policy but does not yet have an asset management strategy or a defined asset management framework. There is an established asset management focus group and there is a strong culture of teamwork across the service areas, however the group does not have any terms of reference and the roles and responsibilities for asset management are still in the development phase. The leadership team is empowering staff to deliver asset management practices but dedicated resources have not been established and asset management practices to identify and report o key issues are in early phase of development. There is no formalized data governance document or data structure model.



- Financial Capacity:** Lincoln produces short term (5-10 years) financial plans. Plans rarely consider long term planning horizons of 20-30 years or more. The level of current revenue is deemed adequate in the short term but there is no supporting information available too if they are adequate for longer term financial sustainability and service delivery. Some reserves are in place but there is not sufficient information to understand if they are adequate. Similarly, there is insufficient information to determine if revenues are adequate for the long-term. Debt levels have been rated as reasonable and stable, but long-term sustainability is uncertain because a long-term assessment and plan are still to be established. Funding sources for the short to medium term are well understood and there is medium to low risk of significant change, but little is understood of longer-term risks or vulnerabilities.



### 6.1.3 ASSET MANAGEMENT MATURITY IMPROVEMENT PRIORITIES

Table 39 shows the areas for improvement that were identified as part of the 2020 maturity assessment. Most of these tasks have been completed since doing the maturity assessment.

The remaining tasks were considered for recommended improvement actions for this asset management plan. The improvement action list is given in Table 40. Column “Action No.” in Table 39, provides a link between the remaining maturity assessment tasks and the recommended improvement actions in in Table 40, as relevant. Note that one task is not currently relevant but may be considered as a potential future task and another task will be included in the corporate asset management plan.

**Table 39: Asset Management Improvement Strategy Tasks (2020 AM Maturity Assessment)**

Task No.	Category	Task/Activity	Description	Action No.
1	Data	Data Structure	Includes defining the core attributes to be recorded, data formats, naming conventions, etc.	2
2	Data	Data Governance	Includes the data structure and adds data roles & responsibilities plus the purpose and intended use of the data and the main standard business processes (or operating procedures) for creating, updating, and maintaining asset data.	2
3	Data	Data Capture	Includes data gap assessment, prioritizing what to capture, defining method for data capture, and developing a data capture program (prioritized schedule of data capture work).	1, 3
4	AMP	Renewal Forecast	Includes completing a State of Infrastructure (SOI) assessment based on the most up to date asset data and collaborating with Lincoln to define typical unit replacement costs and lifespans, then using this data to forecast the timing and cost of asset replacements for a long-term forecast.	Done
5	AMP	Basic Level of Service	This begins with a basic LOS description of expectations for each stakeholder group and identifying performance measures (what to measure and what targets to be achieved).	Done
6	AMP	Advanced Level of Service	This will build on the basic LOS details but will expand to include details on Customer LOS, Technical LOS, Operational LOS, and consider both current and future states.	Done

Task No.	Category	Task/Activity	Description	Action No.
7	AMP	State of Infrastructure	This is an analysis of current asset data to determine the quantity, condition, and age of each asset, its expected lifespan and replacement value, its current book value, and its expected replacement year.	Done
8	AMP	Basic Lifecycle Strategies	This begins with a basic description of the lifecycle management of groups of assets detailing the types and frequency of inspections, any preventative maintenance activities, any significant rehabilitation treatments that will be done during its life and what happens at the end of its life (and how is replacement managed).	Done
9	AMP	Advanced Lifecycle Strategies	This builds on the basic lifecycle strategies and expands to provide more details and costs and specify decision processes and any data monitoring or analysis.	9
10	AMP	Basic Risk Assessment	This begins with assigning a rating for the criticality of each asset in regard to delivering the service, combined with a rating for the likelihood of the asset failing (based on its age and expected remaining life) to generate a basic risk rating.	Done
11	AMP	Advanced Risk Assessment	This builds on the basic risk rating to consider other aspects of consequence in addition to service delivery and analyses failure likelihood in more detail including failure on functionality and capacity as well as physical failure, to derive a more detailed risk analysis.	13
12	AMP	Service Plan Documents	This is to collate AMP components into a Service Delivery Plan for each significant service area.	No longer relevant. Potential Future Task
13	AMP	Corporate Plan Document	This is to generate a summary corporate AMP document that provides highlights from each Service Delivery Plan and collated corporately significant data such as financial forecasts, state of the infrastructure, level of service performance, risk profiles and major issues or vulnerabilities.	See Corporate Asset Management Plan



Task No.	Category	Task/Activity	Description	Action No.
14	People	Resource Plan	This is a detailed plan identifying the resources required to complete work and comparing these to available resources to quantify the gap (i.e., resources needed) and facilitate decisions on what tasks to do when and whether to use internal or external resource as well as providing evidence for requests for additional staff. It can be completed just for AM improvement work, or it can be for all work including operations and maintenance tasks required to deliver agreed levels of service as well as managing capital works programs and administrative tasks as well as other council initiatives as and when they are being considered or have been adopted.	Done
15	Software Tools	Functional Requirements	This is the first step required before considering purchase of software to assist AM. It is a process of identifying and prioritizing what each department needs the system to do. This prioritized list of requirements can then be used as a measure for objective comparison and rating of software options from vendors.	Done
16	Governance	Goals and Objectives	This includes to identify the primary objectives of AM for the organization and key goals (with measurable targets) that will help the organization achieve those objectives.	Done
17	Business Management	Procedures and Decisions	The first step is to identify key decision processes that should have some controls or documentation to ensure they consider all relevant information, involve all the right people, and the decision made in a consistent way that can be explained.	Done

## 6.2 ASSET MANAGEMENT PLAN IMPROVEMENT ACTIONS

Table 40 shows a prioritized list of improvement actions/tasks collated from each section of this asset management plan.

**Table 40: Asset management plan improvement tasks**

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
1	2	Asset Data	Assign the RIMS identifier to all datasets so that asset groups are better aligned.	High
2	2	Asset Data	The Town have completed an assessment of their asset data across all service areas and developed a data management plan that contains recommendations including: <ul style="list-style-type: none"> <li>Developing a data standard and data hierarchy to ensure consistency</li> <li>Develop a plan to populate missing asset attribute data and review accuracy of existing data, including install date, asset type, dimensions, material, assumed versus unassumed</li> <li>Develop roles and assign responsibility of the management of data</li> <li>Adopt a database software to host data and have a single source of truth</li> </ul>	High
3	2	Asset Data	Complete condition inspections on infrastructure such as sidewalks and storm assets and use results to improve capital renewal forecasts.	Medium
4	3.1	Level of Service	Collect and collate a minimum of one year of data for each performance measure that has been identified in Table 10, Table 11, and Table 12 and report on current performance.	High
5	3.1	Level of Service	Set targets for each performance measure based on measured results or regulatory requirements as appropriate.	High
6	3.1	Level of Service	Review levels of service and update as appropriate at a minimum when the asset management plan is updated.	Medium
7	3.1	Levels of Service	Identify appropriate analysis to satisfy the requirements from OReg 588/17 pertaining to stormwater management, namely: <ul style="list-style-type: none"> <li>areas protected from flooding</li> <li>properties resilient to a 100-year storm</li> </ul> percentage of the stormwater management system resilient to a 5-year storm	High

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
8	3.2	Lifecycle Strategy	Develop lifecycle strategies for any new assets that become part of the road and storm drainage network.	Medium
9	3.2	Lifecycle Strategy	Review and revise lifecycle strategies if maintenance approach has changed or where new technologies are employed and expand to identify costs and decision processes for each lifecycle strategy.	Medium
10	3.3	Risk	Develop and implement mitigation strategies for all high or very high service level risks and track their effectiveness.	High
11	3.3	Risk	Complete condition assessments on assets to improve understanding of likelihood of failure for asset level risks. Where asset level risks remain high or very high, add assets into renewal or rehabilitation programs.	High
12	3.3	Risk	Following inventory data improvement, in particular addressing missing install dates, review and revise asset level risks in State of Infrastructure Dashboard and report in next iteration of this Asset Management Plan	Medium
13	3.3	Risk	Review asset risk approach to consider if other aspects such as functionality and capacity should be included, in particular for signs and sidewalks.	Medium
14	3.4	Resources	Complete resource assessment as described in this section and populate the asset management plan.	High
15	3.4	Resources	Re-assess resourcing requirements every 2 to 3 years and report resource levels.	Low
16	4.1	Demand Management	Annually revise the demand risk as mitigation measures are implemented and at least annually to update for changes in demand drivers.	Low
17	4.2	Resiliency & Adaptation	Review climate change forecasts regularly and modify adaptation plan if appropriate	Low
18	4.3	Sustainability	Develop plans, processes, and procures to improve decision-making and community engagement for the drainage and flood protection service.	Medium
19	4.3	Sustainability	Develop plans, processes, and procures to improve safety and community engagement for the transportation service.	Medium

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
20	4.3	Sustainability	Annually re-assess services against AMBC Sustainable Service Assessment Tool (SSAT).	Medium
21	5	Finance	Incorporate the financial sections with update revenues, including reserves forecast once the financial plan is completed.	High
22	5	Finance	Develop a structured process for long-term budgeting decisions to be made considering costs of service delivery and meeting levels of service.	High
23	5	Finance	Review unit rates at a minimum for each new iteration of the asset management plan and update replacement costs as appropriate	High
24	5	Finance	Update the asset management plan with the 10-year capital forecast once approved by Council	High
25	5	Finance	Develop a process to track and separate operations, preventative and reactive maintenance, and inspections costs.	Medium
26	5	Finance	Develop a process to track and separate capital renewals and rehabilitation costs from capital upgrades, improvements, and new assets.	Medium
27	5	Finance	Record actual costs as assets are replaced to provide local information for unit cost reviews to improve accuracy of financial forecasts for asset renewals.	Medium
28	5	Finance	Evaluate target levels for capital reserve funding, that more closely align to the long-term investment requirements of the service areas that make up the Town's infrastructure portfolio as part of the Water and Wastewater Rate Study and Financial Plan Updates	Medium
29	5	Finance	Establish a formalized prioritization method for evaluating investment alternatives for the Town's capital program. An objective assessment of the risk, service priority and strategic alignment for each investment alternative is one common method to accomplish this.	Medium
30	5	Finance	Where appropriate, coordinate asset management planning with neighbouring municipalities and the region	Medium

Action No.	AMP Section	AM Practice Area	Task Description	Action Priority
	5	Finance	Develop a formal project prioritization (investment prioritization) and decision-making process	Medium

## 6.3 IMPLEMENTATION PLAN

In addition to documenting current state and business practices in the management of the Town's Road and storm drainage network, the asset management plan provides recommended improvement tasks as described in Section 6.2. These improvement tasks will:

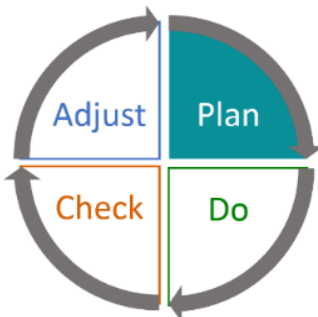
- increase the level of understanding of the assets and services provided.
- improve the accuracy of financial forecasts and risk assessments; and
- provide decision-makers with accurate and complete information in an easy-to-understand format to assist them with making evidence-based decisions for the best use of available funding and the best interests of the region and its communities.

### 6.3.1 CONTINUOUS IMPROVEMENT PROCEDURES

The Town will adopt a continuous improvement approach. A continuous improvement approach includes a regular review and adjustment process to keep the asset management plan up to date with the latest information, understanding, and forecasts. This can also be described as a 'Plan, Do, Check, Adjust,' process (based on the Deming Cycle).

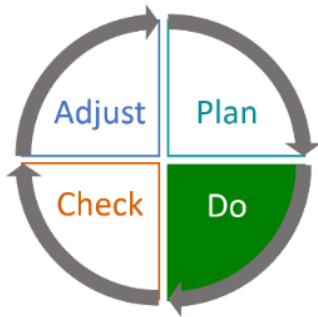
This four-step process can be used to generate on-going iterative improvements to the asset management plan and all business processes for the management of the assets and the delivery of the service, and to facilitate responsible adaptation to change. Each phase of the four-step process is described below, starting with the implementation or 'Do' phase for this asset management plan as the development of this AMP was the first iteration of the 'Plan' phase.

The review cycle for implementing and updating the AMP should be done annually. However, it may be done every two years where little change has occurred. The timing for the asset management plan update is preferably prior to the annual budget process. This will facilitate consideration of outcomes and inclusion of updated forecasts into the financial planning process.



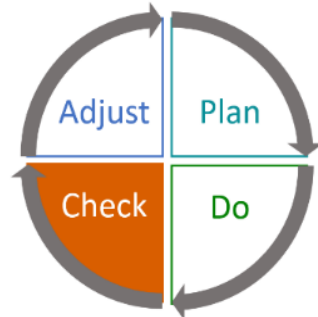
#### PLAN

- Collate available data and analysis results
- Consider data and analysis results in relation to objectives
- Document outcomes and recommendations
- Update assessment of limitations and assumptions
- Update asset management plan, consult and confirm for implementation



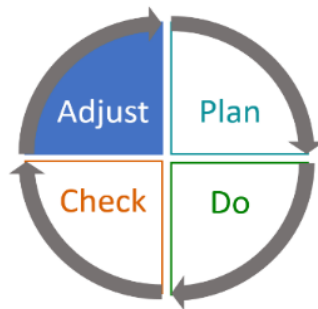
**DO**

- Schedule, fund, and complete improvement tasks
- Improve asset and cost data
- Monitor, manage, and mitigate risk
- Manage assets and deliver required service
- Measure and record performance



**CHECK**

- Review performance results
- Analyze asset and cost data
- Re-assess state of infrastructure and risk ratings
- Re-assess state of asset management practice
- Report achievements



**ADJUST**

- Update improvement tasks and plan
- Adjust lifecycle strategies
- Adjust priorities and targets
- Update forecasts

**Figure 25: Continuous improvement cycle**

### 6.3.2 CHANGE MANAGEMENT

Several improvements have been identified in Section 6.1.3 of the asset management plan. Other improvement tasks have been identified in the data management plan and the asset management maturity assessment. Some of the improvements may likely require some form of change management strategy as described below.

#### GENERAL CHANGE MANAGEMENT STRATEGY

##### Relationships

Managing relationships within the Town is crucial for the successful implementation of asset management practices. Helping staff see the path, providing them with the resources they need to succeed, and clear communication will support the Town on its path to creating a cultural shift and ingraining asset management practices into all levels of the organization.

There are several strategies the Town can implement to increase the likelihood of effecting a change successfully. These strategies include:

### Establishing a Clear Vision

Developing a clear and concise vision statement for how asset management will impact the organization is the first step toward general agreement on what the organization wants to achieve with the change. The vision will also support communicating the change to staff. Any communication should ultimately align with vision and will help staff to envision how their tasks align and support the organizational goal.

### Mapping the Journey

One of the main reasons why implementing a change can fail is because an organization tried to implement too many change initiatives too quickly, and without prioritization. Being over ambitious can harm the process as people may need time to adjust to the change. Providing too many tasks without alignment to an objective can also confuse staff. Identifying areas of focus and mapping out the journey can help the team understand the steps needed to reach the end goal. Reviewing the implementation can provide a sense of how ambitious the Town intends to be in implement changes, what the changes are, which areas of the organization will be affected, and when. A strategy can then be prepared prior to rolling out the change to minimize staff resistance.

### Prioritize People and Leverage the Champions

Change is not possible without its people and changing an organization’s culture takes time. People have different tolerances for embracing change and by identifying champions for change and empowering them to deliver results can be an effective strategy for change. The Town can identify a sponsor and create an asset management working group which can be open to anyone who is interested in leading the change. Facilitating weekly or monthly meetings to provide updates on quick wins, and schedules can keep momentum. By creating this collective group of passionate people who have bought into the change can increase the Town’s likelihood of success.

### Anticipate and Manage Resistance to Change

Any change can be disruptive to a person’s role, and a person may resist a change for various reasons. Being aware of the reasons why people may resist a change and having a set of prepared response strategies can help to communicate a change in a positive way. For example, some individuals may think that Asset Management practices create unnecessary work that provides little value. A strategy to counteract this claim is to help the individual treat it as a new challenge to be solved. One could also reiterate how the practices will support better decision making. Table 41 includes some sample reasons why people resist change, sample scenarios, as well as strategies to minimize staff resistance.

**Table 41: Reasons why people resist change, and strategies to minimize resistance**

Reasons People Resist the Change	Anticipated Scenario	Strategy to Minimize the Resistance
<i>Parochial self interest – Individuals are concerned with the implications for themselves</i>	Some individuals may become frustrated because they feel as though the new tasks will create unnecessary work.	It’s a new challenge to be solved! Reiterate how the practices will support better decisions.
<i>Misunderstanding due to miscommunication or inadequate information</i>	Asset management can sound like a large undertaking and some may not understand it.	When communicating, keep it simple. Leverage subject matter experts
<i>Low tolerance for change due to a sense of insecurity or lack of patience</i>	People may fear that their jobs are being replaced by technology.	Highlight that it is an opportunity for development.

Reasons People Resist the Change	Anticipated Scenario	Strategy to Minimize the Resistance
<i>Different assessment of the situation – disagree over the need for change or the advantages.</i>	May have a different understanding for the level of effort vs the benefit. If they don't understand the benefit, the level of effort may not seem worth the time.	Opportunity to participate and shape the outcome.
<i>Individual challenges with implementing the change</i>	Some field staff do not enjoy working with computers daily and may resist the requirement to input data into a computer or system.	Pairing up a senior person with a data manager will support succession planning while reducing the need for a person being forced to learn new systems.
<i>Loss in momentum</i>	A member may have been on-board, but over time change was not seen and interest and momentum are lost.	Submit an internal anonymous survey that asks question to gauge the level of engagement.

## GENERAL CHANGE READINESS ASSESSMENT

### Assess the Town's Change Readiness

A change readiness assessment can be completed to understand how prepared an organization is to undertake a major change. The assessment can consider how an organization manages its assets, and how it adapts to change. An Asset Management change readiness assessment can evaluate the organization's context for change based on the components in Table 42.

**Table 42: Sample change readiness assessment categories and components**

Category	Component
<i>Employee readiness</i>	<ul style="list-style-type: none"> <li>-Awareness and perception of change</li> <li>-Support for and commitment to change</li> <li>-Understanding the ability to implement the required skills and behaviours</li> </ul>
<i>Organizational context</i>	<ul style="list-style-type: none"> <li>-Goals and alignment</li> <li>-Leadership Support</li> <li>-Organizational structure and culture</li> <li>-Authority and initiative for decision-making</li> <li>-Communication and engagement</li> <li>-Residual of previous change efforts</li> <li>-Resources available for the change</li> </ul>

The feedback from this assessment can then inform a change management strategy that can accompany an asset management implementation plan.

## GENERAL CHANGE COMMUNICATION

### Communicate the Change



Before communicating a task to staff members, it is important to be clear on what you need them to do and how they'll succeed. Below are some considerations to help prepare and plan for discussions when implementing a change.

- **Consider who is involved** and why they may resist the change. Communicate what the AM benefits will be.
- **Align the task with the vision** to provide purpose to the change.
- **Does the team have what they need to be successful?** Do they need training, additional resources, or new software and tools?
- **Will their role change?** What do you think some of their fears will be? How can you support them through the change?
- **Be clear about the task** and communicate what is involved, what the proposed change is, why the change is needed, what the major effects will be, and how the process will be managed.

---

## *GENERAL CHANGE PROCESS*

### **Develop a Change Management Team**

Developing and implementing a change management team can support business process improvement initiatives and can help drive cultural transformation, focusing on building agility, accountability, and employee empowerment.

### **Provide Training to Support Staff**

Implementing asset management can feel like a large undertaking to many. Providing training to introduce asset management concepts will allow staff to “speak the same language”. Training staff on what AM can do for them creates a personal connection as they now understand how AM will make their role more effective.

### **Monitoring**

The Town should schedule a recurring monitoring schedule to review progress. It should include metrics on how the organization plans to measure success and review whether the organization is achieving its objectives. A process for receiving staff feedback should be established to determine focus areas for adjustment. Lastly, upon reflecting on the progress to date, the Town should review whether additional support is needed.

---

## *6.3.3 PERFORMANCE MEASUREMENT & EVALUATION*

### *PERFORMANCE MONITORING*

To inform and support improvement, it is necessary to monitor current performance, and to review performance outcomes compared to the intended outcomes. Performance Monitoring & Evaluation (PME) is therefore an integral part of implementing robust Asset Management.

Monitoring and evaluating the performance of the assets and services will help to improve the reliability and consistency of service delivery.

The primary objective for performance measurement is not reporting performance; it is managing performance to achieve a specific target.

This section describes the three key performance measurement processes for asset management that will evaluate whether the Road ROW Service management team are:

- Completing the asset management improvement tasks;
  - Achieving asset management and the maturity targets, and;
  - Improving asset data that will support evidence-based decisions.
- 

### *REPORTING PROGRESS ON IMPROVEMENT TASKS*

At least annually review and report the percent complete for each improvement task listed in this asset management plan, the data management plan, and the asset management maturity assessment. Compare results to the schedule of work planned for completion in that year. It would also be useful to compare the hours spent on each task and the total expenses for the year compared to budget hours and expenses. This will inform whether each task is on track for completion on time and to budget and identify areas of concern for any tasks that are not on track. However, the ability to do this detailed reporting will depend on whether records are kept of staff time and expenses for work done on each task throughout the year. The minimum requirement is to report annually on the overall percent complete for scheduled improvement tasks.

At least annually the schedule for asset management improvement tasks must be reviewed and revised. Completed tasks should be removed, and new tasks added where necessary. New completion dates should be agreed for tasks that are partially complete. All other tasks in the asset management improvement plan, including tasks that were scheduled for completion during the year but have not been started, should be reassessed for priority and where appropriate assigned new start and completion dates. Any tasks that are no longer required should be removed from the plan.

This annual review and updating of the improvement program should also consider the outcomes of re-assessment of asset management Maturity and re-assessment of Asset Data quality.

---

### *REPORTING PROGRESS ON MATURITY ASSESSMENT*

The asset management maturity assessment process is described in Section 6.1. To measure improvements of asset management maturity, a re-assessment should be completed (at least annually) and the results from each year compared to the previous year. Where appropriate, add a comparison to the first year of the program.

The step-by-step instruction for completing a re-assessment of asset management maturity using the assessment tools included in the “Notes” tab of that assessment tool. Each year a new copy of the analysis spreadsheet can be made so changes are easily tracked over time.

## 2018 Asset Management Maturity Assessment



**Figure 26: Reporting progress on asset management maturity - example**

The Asset Management Maturity assessment tool provides several automated infographics and tables for reporting current results and comparing results to previous results and to any future targets if these have been set. The following diagram is an example.

The assessment tool provides further detail if required, for the results within each of the categories summarized in the graph above.

The results of the annual asset management maturity re-assessment provide important input to decisions on the continued relevance and the appropriate priority for asset management improvement tasks. Asset management maturity results should therefore be considered in the annual review and revision of the asset management improvement plan.

---

### **REPORTING ON PROGRESS OF IMPROVEMENTS TO ASSET DATA**

The currency and accuracy of asset data is critical to effective asset management, accurate financial forecasts, and informed decision-making. However, even more important than this is knowing what the reliability of the information is. Even data that is not highly accurate can be of benefit to decision-makers provided the accuracy is declared.

The Town has yet to develop a consistent data structure for recording asset information. A data management plan has been developed to support staff in understanding the attributes required to develop asset registers for all asset groups and locations and understand the significant impact on the accuracy of assessments for when each asset may need replacing and how much it will cost to replace.

As staff build their asset register and collate available asset information, the accuracy of these key attributes can be recorded in the relevant columns for confidence rating. This will facilitate measurement of the asset data quality and reporting on improvements in data quality.

The confidence ratings for asset data are a numerical value between 1 and 5, as appropriate to each asset record and each key attribute. A score of 1 indicates high confidence and 5 indicates low confidence. An

example of how this is used would be, if the size of an asset (such as a buried pipeline) is known but its material type is not known, and its install date is not certain but has been reasonably assumed from the age of other assets in the area, then its confidence ratings would be 1 for the size attribute, 4 or 5 for material type and a 2 or 3 for install date depending on how compelling the supporting data is.

The general description for each confidence level is:

1. Data is verified as factual (accurate)
2. Data is known with a high level of certainty, but it may not be verified as factual (there is a small possibility of error)
3. Data has been reasonably assumed or determined from other known facts. There is a moderate level of certainty and a moderate possibility for error.
4. Data has been assumed or determined from some indicator, but the opportunity for error (at an asset level) is high.
5. Data is a default value assigned as a temporary measure until better information is available, because at this time, the correct data is not known, nor can it be reasonably assumed from known facts or some indicator.

Annually, an assessment should be made to determine the quantity (and completeness) of recorded asset data and the confidence profile for the recorded information.

The process will include to:

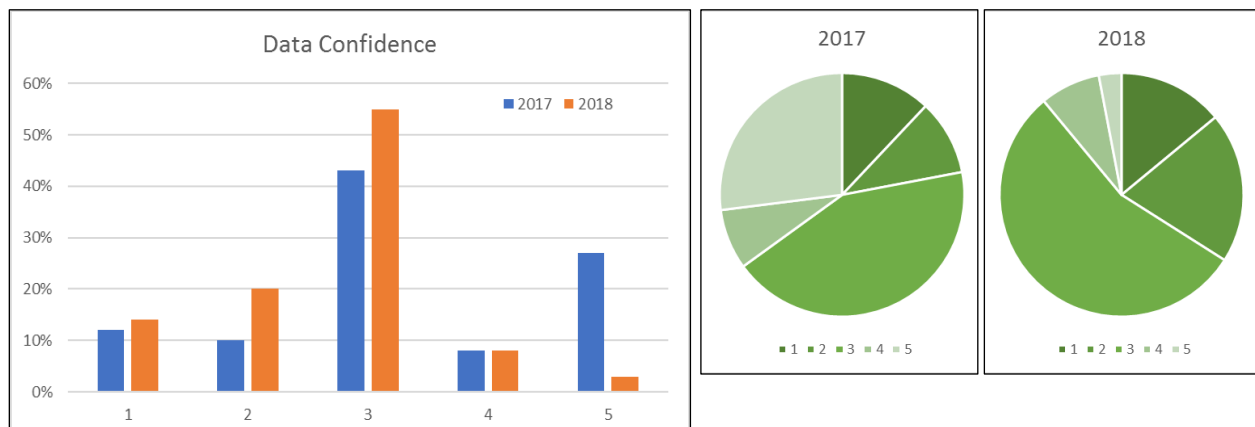
- Report the number of recorded assets
- Calculate the percent (by value) of asset records that have confidence ratings 1 to 5
- Graph results with comparison to the previous year's result

The change in the number of assets recorded in the asset register will advise decision-makers of how complete the asset data is and any analysis results that are based on current asset data.

The change in the confidence ratings for key attributes will advise decision-makers of how accurate the asset data is and therefore, how confident they can be in any analysis results that are based on that asset data.

The following are examples of data quality graphs.

Both examples quantify the change (improvement) in data confidence from one year to the next. The graphs show a reduction in very low confidence records (rating of 5) and an increase in moderate and good confidence records (ratings of 3 and 2).



While staff are building their asset register, and until confidence ratings for key attributes have been recorded in the data register, it is recommended that a high-level data quality assessment is done for each asset group.

Table 43 describes a set of data confidence grades (class A to class E) that can be used by the transportation team for classifying data reliability at a high-level. This is different to the 1 to 5 confidence ratings that would be entered against each asset record in the asset register. The 1 to 5 ratings are for asset-level assessments whereas the A to E ratings are for an overall view when detailed data for asset-level assessments is not available.

The data quality assessment using the A to E ratings is a subjective assessment but based on knowledge of the accuracy and completeness of the data set (i.e. it is a judgement call made by a suitably experienced person or team who are very familiar with the dataset).

**Table 43: High-level data confidence ratings**

Data Grade	Data Confidence	Description
A	Highly Reliable	An asset inventory exists and is appropriately structured with asset type and sub-type classifications; the inventory includes key attribute information* for every asset and this information is highly reliable.
B	Reliable	An asset inventory exists and is appropriately structured with asset type and sub-type classifications; the inventory includes reliable information for most key attributes of most assets; where information is missing or unreliable, a reasonable estimate can be made based on known values (i.e. based on values for similar assets connected to or located close to the asset, or an average of known values for assets of the same type etc.).
C	Some Uncertainty	An asset inventory exists but it may not be complete and it may or may not have an appropriate structure with asset type and sub-types, or these may not be fully populated; the inventory has a mixture of reliable and unreliable (or missing) information for key attributes for many assets; replacement costs may be based high-level average values or derived from purchase cost multiplied by an annual default percentage; useful life values may also be based on high-level average values or a default assumption.
D	Very Uncertain	An asset inventory exists but may not be complete and it may or may not have an appropriate structure; most key attribute information is missing or has low reliability; but some known, default, or assumed values do exist for some assets.
E	Unknown	An asset inventory does not exist, or it contains very little data.

\* Key attribute information includes asset type and sub-type classification, install date, relevant size information, material type, and estimated unit cost and useful life values. Table 44 is an example of a high-level data quality report for facilities;

**Table 44: Data confidence ratings example**

<b>Asset Group</b>	<b>Asset Type</b>	<b>Install Date</b>	<b>Relevant Size</b>	<b>Material</b>	<b>EUL</b>	<b>EUC</b>
<i>Roads</i>	A	B	A	A	B	D
<i>Sidewalks</i>	A	B	B	A	B	D
<i>Bridges &amp; Major Culverts</i>	A	D	C	C	D	D
<i>Storm Mains</i>	A	B	C	D	D	D
<i>Culverts</i>	A	B	C	D	D	D
<i>Signs</i>	D	D	C	D	D	D
<i>Storm Facilities</i>	A	B	C	C	D	D

The results for one year can be compared to previous year(s) and the change in data quality can be shown graphically (in the same way as reporting for asset-level data quality).

# 7 LIST OF TABLES AND FIGURES

---

## 7.1 LIST OF TABLES

---

### *TABLES*

TABLE 1: TOWN OF LINCOLN – TRANSPORTATION ASSETS .....	1
TABLE 2: LIMITATIONS OF THE ASSET MANAGEMENT PLAN .....	6
TABLE 3: CONDITION SCALE CONVERSION – PAVEMENT CONDITION INDEX .....	8
TABLE 4: CONDITION SCALE CONVERSION – STRUCTURAL CONDITION INDEX.....	9
TABLE 5: AGE-BASED CONDITION RATING .....	9
TABLE 6: SUMMARY OF ROAD ASSET GROUPS AT THE TOWN OF LINCOLN .....	12
TABLE 7: STATE OF INFRASTRUCTURE IMPROVEMENT TASKS .....	14
TABLE 8: LEVELS OF SERVICE AND PERFORMANCE MEASURE TERMINOLOGY .....	16
TABLE 9: SERVICE CRITERIA AND LEVELS OF SERVICE STATEMENTS .....	17
TABLE 10: LEVELS OF SERVICE PERFORMANCE MEASURES .....	18
TABLE 11: O.REG. COMMUNITY LEVELS OF SERVICE - ROAD ROW .....	20
TABLE 12: O.REG. TECHNICAL LEVELS OF SERVICE FOR ROAD ROW .....	21
TABLE 13: PAVEMENT CONDITION PHOTO DESCRIPTION .....	24
TABLE 14: STRUCTURAL CONDITION PHOTO DESCRIPTION.....	25
TABLE 15: CULVERTS CONDITION PHOTO DESCRIPTION .....	28
TABLE 16: KEY LEGISLATIVE REQUIREMENTS .....	30
TABLE 17: WATER LEGISLATION .....	30
TABLE 18: LEVEL OF SERVICE IMPROVEMENT TASKS .....	31
TABLE 19: MANAGEMENT APPROACH OVERVIEW .....	32
TABLE 20: LIFECYCLE STRATEGY WORK CATEGORIES.....	33
TABLE 21: LIFECYCLE STRATEGY IMPROVEMENT TASKS .....	35
TABLE 22: SERVICE LEVEL RISK CATEGORIES .....	35
TABLE 23: RISK LEVEL AND ACTION .....	36
TABLE 24: SERVICE-LEVEL RISKS – ROAD SERVICE.....	37
TABLE 25: SERVICE-LEVEL RISK RATINGS (POST MITIGATION) – ROAD SERVICE .....	39
TABLE 26: SERVICE-LEVEL RISK RATINGS: STORMWATER NETWORK .....	40

TABLE 27: SERVICE-LEVEL RISK RATINGS (POST MITIGATION) – STORMWATER SERVICE.....	42
TABLE 28: CRITICALITY CRITERIA .....	45
TABLE 29: RISK IMPROVEMENT TASKS.....	46
TABLE 30: RESOURCE IMPROVEMENT TASKS .....	48
TABLE 31: INITIAL DEMAND ASSESSMENT RESULTS .....	49
TABLE 32: MITIGATED DEMAND ASSESSMENT RESULTS .....	50
TABLE 33: DEMAND IMPROVEMENT TASKS.....	51
TABLE 34: TEMPERATURE AND PRECIPITATION PROJECTIONS .....	53
TABLE 35: RESILIENCY AND ADAPTATION IMPROVEMENT TASKS .....	55
TABLE 36: SUSTAINABILITY IMPROVEMENT TASKS.....	57
TABLE 37: FINANCIAL IMPROVEMENT TASKS .....	63
TABLE 38: MATURITY RATING DESCRIPTION.....	65
TABLE 39: ASSET MANAGEMENT IMPROVEMENT STRATEGY TASKS (2020 AM MATURITY ASSESSMENT) .....	72
TABLE 40: ASSET MANAGEMENT PLAN IMPROVEMENT TASKS.....	74
TABLE 41: REASONS WHY PEOPLE RESIST CHANGE, AND STRATEGIES TO MINIMIZE RESISTANCE .	80
TABLE 42: SAMPLE CHANGE READINESS ASSESSMENT CATEGORIES AND COMPONENTS .....	81
TABLE 43: HIGH-LEVEL DATA CONFIDENCE RATINGS .....	86
TABLE 44: DATA CONFIDENCE RATINGS EXAMPLE .....	86

## 7.2 LIST OF FIGURES

### FIGURES

FIGURE 1: RELATIONSHIP TO CORPORATE DOCUMENTS.....	5
FIGURE 2: CONDITION AND AGE PROFILE .....	13
FIGURE 3: TRANSPORTATION SERVICE – 100-YEAR RENEWAL FORECAST .....	14
FIGURE 4: FLOODPLAIN EXTENT DRAFT (SOURCE: NPCA).....	22
FIGURE 5: MAP OF THE ROAD NETWORK .....	23
FIGURE 6: LIFECYCLE AND INTERVENTION STRATEGIES FOR ASSETS .....	32
FIGURE 7: CONNECTION OF RISK TO LEVEL OF SERVICE .....	37
FIGURE 8: SERVICE-LEVEL RISK - ROADS.....	38
FIGURE 9: SERVICE-LEVEL RISKS (MITIGATED) - ROADS.....	40



FIGURE 10: SERVICE-LEVEL RISK - STORM .....	41
FIGURE 11: SERVICE-LEVEL RISKS (MITIGATED) - STORMWATER .....	43
FIGURE 12: ASSET RISK .....	45
FIGURE 13: INITIAL DEMAND ASSESSMENT RESULT .....	50
FIGURE 14: MITIGATED DEMAND ASSESSMENT RESULTS .....	51
FIGURE 15: RISK AND VULNERABILITY .....	54
FIGURE 16: TRANSPORTATION SUSTAINABILITY ASSESSMENT RESULTS.....	56
FIGURE 17: ROAD ROW 10-YEAR RENEWAL FORECAST (PROPOSED CAPITAL PLAN).....	58
FIGURE 18: ROAD ROW – 10-YEAR OPERATIONS AND MAINTENANCE BUDGET .....	59
FIGURE 19: TRANSPORTATION 10-YEAR CONDITION-BASED RENEWAL FORECAST.....	60
FIGURE 20: ROAD ROW – 10-YEAR AGE-BASED RENEWAL FORECAST .....	61
FIGURE 21: COMPARISON BETWEEN THE 10-YEAR PROPOSED CAPITAL PLAN AND THE SOI RENEWAL FORECAST .....	62
FIGURE 22: 10-YEAR TOTAL FORECASTED EXPENDITURES .....	63
FIGURE 23: ASSET MANAGEMENT MATURITY ASSESSMENT - ROAD ROW .....	66
FIGURE 24: ASSET MANAGEMENT MATURITY ASSESSMENT – STORMWATER .....	69
FIGURE 25: CONTINUOUS IMPROVEMENT CYCLE.....	79
FIGURE 26: REPORTING PROGRESS ON ASSET MANAGEMENT MATURITY - EXAMPLE .....	84

# APPENDIX

# A LIFECYCLE STRATEGIES

## LIFECYCLE STRATEGIES – ROADS – PAVED ROADS

Roads - Paved Roads

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>		Road Patrols Roads needs study every 4-5yrs Some traffic data collection	Street Sweeping Winter maintenance operations Litter and debris removal Shoulder grading	Pothole repairs Road drainage improvements Hot mix patching	<b>Variable</b>	
<b>New</b>					<b>Replace</b>	
<b>R&amp;R</b>	crack sealing	Tar & chip single surface Micro-surfacing Reinforced surface treatment Bonded wearing course	Mill & pave wearing surface (urban) Pulverize , grade and souble surface treatment (Rural)	Reconstruct road at end of life including base structure and drainage improvements	<b>Variable</b>	
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – ROADS - SIDEWALKS

### Roads - Sidewalks

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>		Annual Visual Inspection	Sidewalk Sweeping Snow clearance Litter & Debris Removal Trip Hazard Repairs	surface drainage repairs	Variable	
	<b>New</b>				<b>Replace</b>	
<b>R&amp;R</b>				Sidewalk Replacement at end of life	Variable	
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – ROADS - SIGNS

### Roads - Signs

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		Annual visual inspection Annual retro-reflectivity survey		Reactive Sign and Post replacement	Variable	
	<b>New</b>				<b>Replace</b>	
<b>R&amp;R</b>				Sign Replacement at end of life	Variable	
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – ROADS – ROAD MARKINGS

Roads - Road Markings

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		Annual road marking inspections	Annual refresh	Reactive re-lining		We want to discuss this program in the AMP
<b>R&amp;R</b>				Re-apply Road Markings at end of life		
					1 year?	Durables?
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

New

Replace

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – ROADS – STREET LIGHTING

Roads - Street Lighting

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		Bi-annual visual condition inspections		Reactive repairs or replacements	Variable	
<b>R&amp;R</b>				Replace street light at end of life	Variable	
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – ROADS – BOUNDARY FENCING

Roads - Boundary Fencing

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments	
<b>OMI</b>				Reactive fence repairs	Variable		
<b>New</b>	—————					<b>Replace</b>	
<b>R&amp;R</b>				Replace fence at end of life	Variable		
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>		

Current Activities

Future Improvement Activities



## LIFECYCLE STRATEGIES – ROADS - GUIDERAILS

Roads - Guiderails

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		Annual visual condition inspections		Reactive repairs or replacements	Variable	
<b>New</b>					Replace	
<b>R&amp;R</b>				Replace guiderail at end of life	Variable	
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – BRIDGES & LARGE CULVERTS

Bridges and Large Culverts

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>	- spot welding on Bailey Bridge - rip-rap scour/erosion protection	- Road patrols and visual safety inspections - bi-annual inspections by qualified engineer to OSIM standards - Structural reviews and condition assessments	- cleaning and routine maintenance as required - Channel cleaning/clearing as required	- Structural repairs as required		
<b>New</b>	-----					<b>Replace</b>
<b>R&amp;R</b>		- Road surface replacement and waterproofing	- Rehabilitation of structure as identified through a detailed bridge condition assessment (depending on life-cycle costing evaluation)	Replace structure at end of useful life		
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – RETAINING SYSTEM

Retaining systems

		Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>			Road patrols		-Repairs as required		
	<b>New</b>						<b>Replace</b>
<b>R&amp;R</b>			-Localized retaining system repairs	-Localized retaining system repairs	-Replacement at end of life -Replacement of gabion baskets with armour stone or other approved material - Evaluate if old structure systems can be replaced with naturalized sustainable "living wall" type retaining systems	<b>25years</b>	
		<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM - MAINS

Stormwater System - Mains

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		-CCTV inspections		- Flush mains, as needed - Spot repairs	Varies	Mains are of different sizes and materials.
	<b>New</b>				<b>Replace</b>	
<b>R&amp;R</b>				- Replace at end of life, with a road reconstruction project, to meet future demand	Varies	- Material varies
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM - CULVERTS

Stormwater System - Culverts

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>	-Debris removal from inlets in advance of forecasted weather events - Based on inspections, replacing culverts before failure	-High priority culverts are formally inspected every 2 years (OSIM) - Low priority culverts routinely inspected on a rolling basis (5 year cycle)	- Snow removal prior to melting (for the inlets) - Debris removal	- Replacement of culverts based on public feedback or routine road patrols	Varies	Materials and sizes vary
<b>New</b>					<b>Replace</b>	
<b>R&amp;R</b>			-Culvert lining on larger / more expensive culverts to extend life of asset	-Replace at failure of asset	Varies	-Materials vary: (Corrugated Metal 25 years Concrete 100 years HDPE 50 years)
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM - DITCHES

**Stormwater System - Ditches**

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>	<ul style="list-style-type: none"> <li>- Road-side mowing</li> <li>- Look for areas prone to washout and monitor (increase inspection on these areas); increase rip rap in areas that require</li> </ul>	<ul style="list-style-type: none"> <li>- Routine MMS Patrols (frequency depends on road classification - 7 day or 30 day frequency)</li> <li>- Problem areas are inspected prior to forecasted weather events</li> </ul>	<ul style="list-style-type: none"> <li>- Snow removal prior to melting (in the ditches)</li> <li>- Silt removal</li> </ul>	<ul style="list-style-type: none"> <li>- Spot repairs on rip rap and washout</li> <li>- Bank restoration (typically after washout)</li> <li>- Clean out ditches</li> <li>- Remove standing water</li> </ul>	N/A	
<b>New</b>					<b>Replace</b>	
<b>R&amp;R</b>		<ul style="list-style-type: none"> <li>- Clean out programs to maintain capacity of the ditch</li> </ul>	<ul style="list-style-type: none"> <li>- Bank stabilization</li> </ul>	<ul style="list-style-type: none"> <li>- Reconstruction to establish back to original design, completed with road construction</li> <li>- Ditch reconstruction programs to improve drainage</li> </ul>	50-75 years	<ul style="list-style-type: none"> <li>- Reconstruction is associated with road construction</li> </ul>
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM - MANHOLES

Stormwater System - Manholes

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>	<ul style="list-style-type: none"> <li>- Increase preventative maintenance, based on future routine inspection</li> <li>- Clean out as required, based on future routine inspections</li> </ul>	<ul style="list-style-type: none"> <li>- Routine inspections (5-year cycle)</li> </ul>		<ul style="list-style-type: none"> <li>- Rebuild the adjustment units</li> <li>- Repair benching and parging around pipes</li> <li>- Clean out the debris</li> </ul>	Varies	
<b>New</b>	Replace					
<b>R&amp;R</b>		<ul style="list-style-type: none"> <li>- Rebuild adjustment units, as part of road resurfacing</li> </ul>		<ul style="list-style-type: none"> <li>- Replace at the end of life</li> </ul>	100 years+	Material is concrete
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM - CATCHBASINS

Stormwater System - Cathbasins

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		- Annual routine inspections	- Annual cleanout program - Snow removal prior to melting (for the inlets)	- Rebuild the adjustment units - Clean out the debris	Varies	
<b>New</b>	Replace					
<b>R&amp;R</b>		- Rebuild adjustment units, as part of road resurfacing		- Replace at the end of life	100 years+	Material is concrete
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities



## LIFECYCLE STRATEGIES – STORMWATER SYSTEM – INLET/OUTLET STRUCTURES

**Stormwater System - Inlet/Outlet Structures**

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>	Debris removal in advance of forecasted weather events	Inspect in advance of forecasted weather events	- Snow removal prior to melting (for the inlets) - Debris removal	Debris Removal Repairs as required	N/A	
<b>New</b>					<b>Replace</b>	
<b>R&amp;R</b>				Reconstruct end of life	50-75 years	- Reconstruction is associated with road construction
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM – PONDS

Stormwater System - Ponds

	Preventative Maintenance	Inspections	Operations	Reactive Maintenance	EUC	Comments
<b>OMI</b>		<ul style="list-style-type: none"> <li>- Maintenance inspections twice yearly</li> <li>- Detail bi-annual inspections for all settling ponds</li> </ul>	<ul style="list-style-type: none"> <li>- Grass mowing</li> <li>- Fencing repairs</li> <li>- Outlet structure repairs</li> </ul>	<ul style="list-style-type: none"> <li>- Clear debris from outlet/inlet structures</li> <li>- Erosion control/repairs</li> </ul>		
<b>New</b>					<b>Replace</b>	
<b>R&amp;R</b>		<ul style="list-style-type: none"> <li>- rehabilitation and sediment cleaning as required</li> </ul>		<ul style="list-style-type: none"> <li>- rehabilitation and sediment cleaning as required</li> <li>- retrofit opportunities to be more environmentally inclusive and create community amenities</li> </ul>		
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities

## LIFECYCLE STRATEGIES – STORMWATER SYSTEM – DRAINAGE CHANNELS

**Stormwater System - Drainage Channels**

	<b>Preventative Maintenance</b>	<b>Inspections</b>	<b>Operations</b>	<b>Reactive Maintenance</b>	<b>EUC</b>	<b>Comments</b>
<b>OMI</b>		- Annual maintenance inspections	- Grass mowing - Fencing repairs - inlet/outlet structure repairs	- Clear debris - Erosion control/repairs		
<b>New</b>	-----					<b>Replace</b>
<b>R&amp;R</b>		- rehabilitate eroded channel sections		- retrofit opportunities to be more environmentally inclusive and create community amenities		
	<b>Early Life Interventions</b>	<b>Mid-life Rehab</b>	<b>Later Life Rehab Option</b>	<b>End of Life</b>	<b>EUL</b>	

Current Activities

Future Improvement Activities