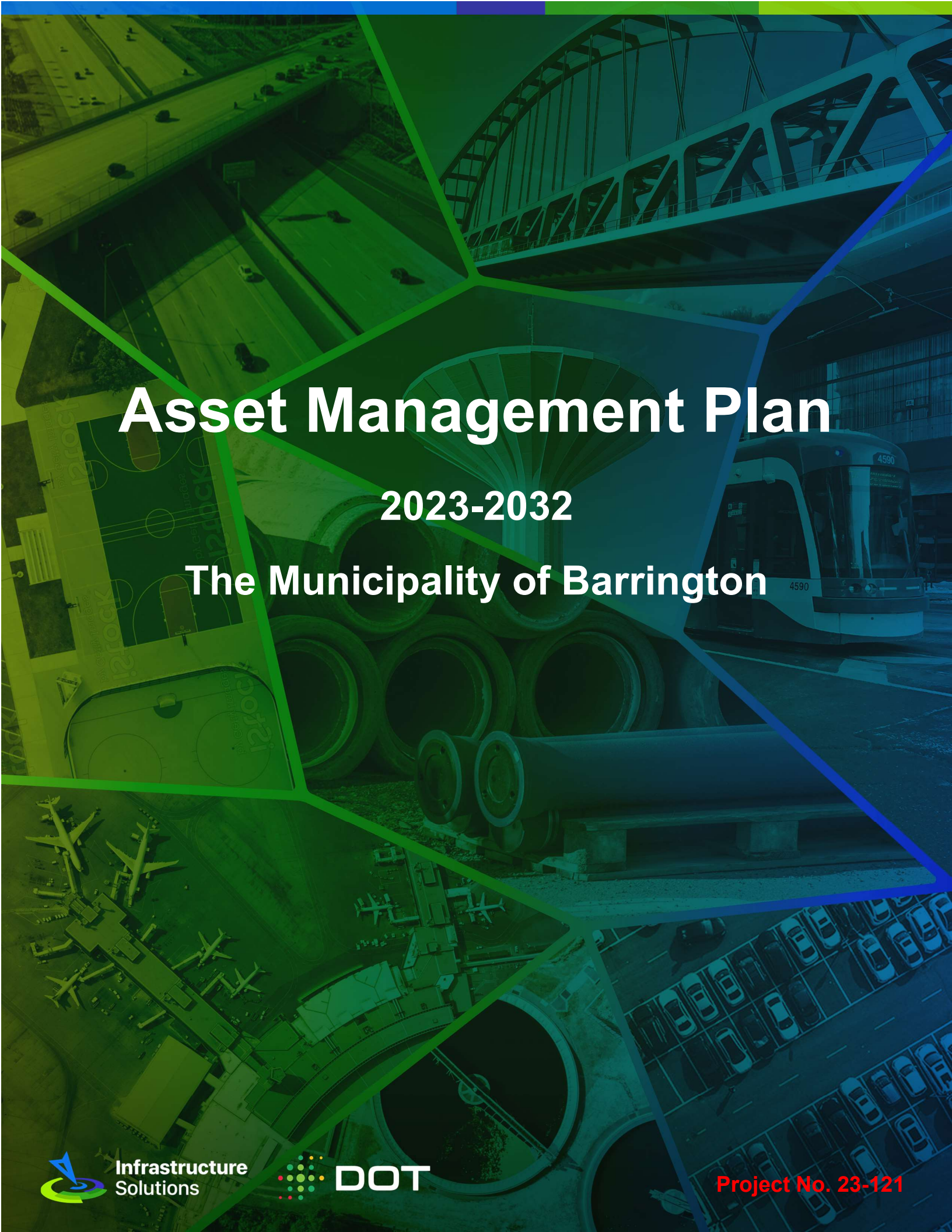

Asset Management Plan

2023-2032

The Municipality of Barrington

Infrastructure Solutions

DOT

Project No. 23-121

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The preparation of this project was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.

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1 EXECUTIVE SUMMARY

The Municipality of Barrington is undertaking a detailed evaluation of all its existing infrastructure in order to update their long-term Asset Management Plan, put the municipality in a position to receive the Federal Canada Community-Building Fund (formerly Gas Tax Fund) and other grants, and build a fully implementable program for its residents which aims to further strengthen municipal asset management practices.

Infrastructure Solutions (Software) Inc. was well supported by the Municipality of Barrington's Chief Administrative Officer to accumulate the geometric and condition assessment data, where available. We based the Asset Management Plan on all asset types and their current replacement costs. Asset lifespans, condition and project requirements were determined by engineering assessments and degradation curves. Where condition assessments were unavailable, ISI applied an age-based analysis. Our objective was to build a practical asset management plan based on optimizing the capital spend and taking corrective action to address the Municipality of Barrington's infrastructure deficit.

The Municipality's infrastructure deficit is defined as the added investment that would be required to maintain a Municipality's infrastructure at appropriate service levels and in a good state of repair today. Based on our calculations, the Municipality of Barrington 's infrastructure deficit is calculated to be $ 15,510,976. The Municipality of Barrington's infrastructure deficit is quite significant and eliminating it within a 10-year period will be challenging with the Municipality's current financial capability. We have analyzed the municipal assets in detail with the objective of optimizing how capital is expended.

We have reviewed the Municipality's current/projected capital contributions in relation to its current/projected needs. For all the assets considered in the current study, the Municipality currently has an operating deficit resulting in a total contribution of $518,621 per annum to its capital program with a contribution requirement of $1,653,693 per annum. Therefore, with an annual funding gap of about $1,135,072, the Municipality of Barrington does not have sufficient funds available to fully fund its operating expenditures, capital projects and to eliminate its deficit within the 10-year plan period.

Barrington is experiencing an increasing funding gap, possibly explained by a decline in population. Grants received in previous years, operating or capital, are not assumed to be recurring regularly, and are consequentially not included in the financial forecasting. The Municipality has been relying on Provincial and Federal grants to supplement the operational and capital funding requirements and will have to continue to do so unless it closes the funding gap by other means.

Roads, sidewalks. and the sewer pumping station are among the assets of Barrington covered in the analysis that are in excellent and good condition. The Sewerlines, vehicles, and buildings are in fair conditions. For most of the assets, the analysis is done based on an age-based analysis. To improve the accuracy of the capital plan, it is recommended to establish periodic condition assessments for as many asset types as is practical.

2 HISTORICAL OVERVIEW

Municipal infrastructure is the foundation that the daily life of Canadians is built upon. The strength of this foundation enables our communities and local businesses to grow, and it ensures that Canadians have a high quality of life. Municipalities own the core infrastructure assets that are critical to the quality of life of Canadians and the competitiveness of our country. Almost 60% of Canada's core public infrastructure is owned and maintained by municipal governments. According to survey results, the total value of core municipal infrastructure assets is estimated at $1.1 trillion dollars or about $80,000 per household.

The delivery of essential public services is reliant on a strong foundation of municipal infrastructure. This foundation enables our communities and local businesses to grow and ensures Canadians can lead safe and healthy lives. The Municipality of Barrington is not alone in dealing with an infrastructure deficit. According to the Canadian Infrastructure Report Card (CIRC), one-third of our Canadian municipal infrastructure is in fair, poor or very poor condition, increasing the risk of service disruption. Assets in fair, poor and very poor conditions represent a call for action. Survey results demonstrate that roads, municipal buildings, sport and recreation facilities and public transit are the asset classes most in need of attention. Figure 1 provides a summary of the physical condition ratings for all municipal asset categories across the country.

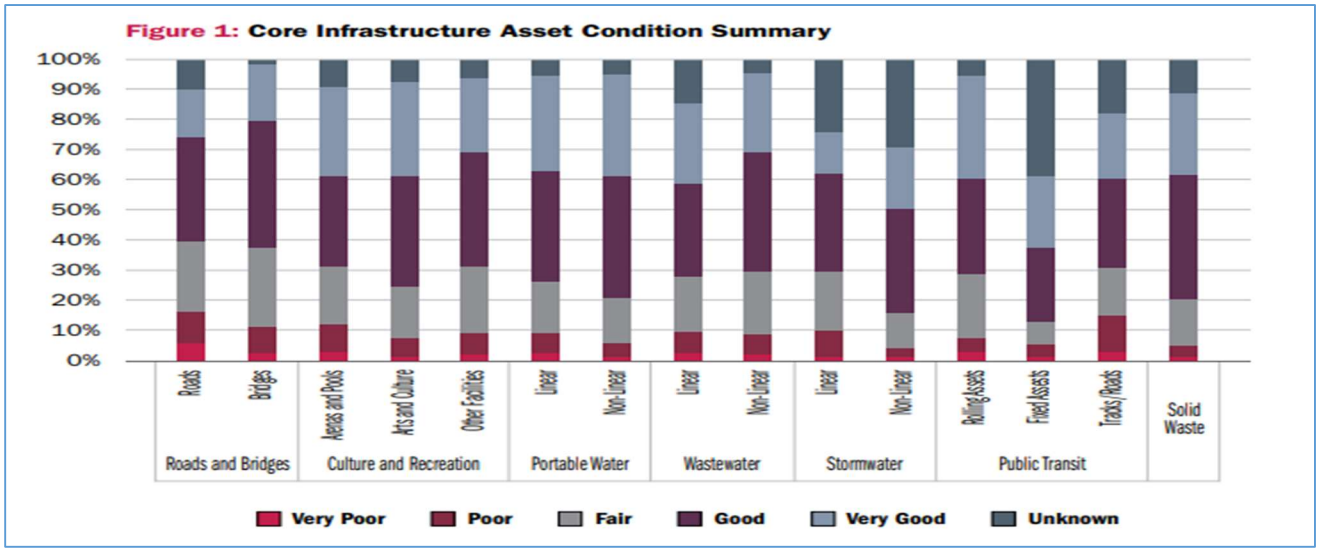


Figure 1: Physical Condition Ratings by Asset Category
Source: 2019 Canada Infrastructure Report Card

Increasing reinvestment rates will stop the deterioration of municipal infrastructure. The 2019 CIRC report found that rates of reinvestment are lower than targets recommended by asset management practitioners. The rate can vary based on factors such as the age of the infrastructure, the level of service and risk tolerance. The values provided are based on the experience of municipal asset management practitioners and are intended to be informative in nature. Roads and sidewalks, storm water, and sport and recreation infrastructure presented the largest gaps in terms of current and target rates of reinvestment. Figure 2 demonstrates the gap between current and target reinvestment levels. Continuing down this path will result in a gradual decline of physical condition levels that will impact municipal services. When contrasted with target reinvestment rates it becomes clear that current levels of reinvestment in municipal infrastructure are inadequate.

Target Reinvestment Rates vs Current Reinvestment Rate

Infrastructure	Lower Target Reinvestment Rate	Upper Target Reinvestment Rate	Current Reinvestment Rate
Potable Water (linear)	1.0%	1.5%	0.9%
Potable Water non-linear)	1.7%	2.5%	1.1%
Wastewater (linear)	1.0%	1.3%	0.7%
Wastewater (non-linear)	1.7%	2.5%	1.4%
Stormwater (linear)	1.0%	1.3%	0.3%
Stormwater (non-linear)	1.7%	2.0%	1.3%
Roads and Sidewalks	2.0%	3.0%	1.1%
Buildings	1.7%	2.5%	1.7%
Sport and Recreation	1.7%	2.5%	1.3%

Figure 2: Target Reinvestment Rates vs Current Reinvestment Rate
Source: 2016 Canada Infrastructure Report Card

3 SCOPE AND METHODOLOGY

The scope of this project is to undertake a detailed evaluation of some of the Municipality of Barrington's existing infrastructure in order to update the 10-year Asset Management Plan, give the municipality continued eligibility to receive the Federal Canada Community-Building Fund (formerly Gas Tax Fund) and other grants, and build a fully implementable program for its residents which aims to further strengthen municipal asset management practices.

Asset management planning requires that the most cost effective and realistic decisions are made regarding the building, operating, maintaining, renewing, replacing, and disposing of infrastructure assets. The prime goal of the Asset Management Plan is to maximize benefits, manage risk, and offer satisfactory, safe, and sustainable service levels to the public. Asset management planning requires that the Municipality of Barrington has an in-depth understanding of the characteristics and condition of infrastructure assets, as well as the service levels they are expected to meet. Asset management planning also involves strategic prioritization and optimization to obtain the best decision-making concerning the timing and utilization of investments, which includes a comprehensive and achievable financial strategy.

ISI and the Municipality of Barrington are using the DOT (Decision Optimization Technology) ™ software to assist in establishing that the most cost-effective and realistic decisions are made regarding the replacement, maintenance, rehabilitation, and reconstruction of The Municipality of Barrington's assets. DOT™ will give you a plan that is flexible, easy to update, credible, defensible, and implementable.

Using any software to build an Asset Management or Capital Plan is complex. Effective planning requires a balancing act which contemplates fluctuating annual budgets, shifting strategic priorities, service levels objectives and public expectations, risk and safety considerations, cross-departmental co-operation, and due consideration to political objectives. DOT™ helps with the analytical process, best utilizing your current budget to best meet your financial and socioeconomic objectives. It determines what your budget needs to be to manage your infrastructure deficit and reach your levels of service objectives. It provides concrete recommendations and an actionable plan to put your community on a solid path forward. It

generates a plan that well exceeds ISI 55000 standards and meets all Provincial and Federal regulations.

DOT™ is unique in the industry. Firstly, for the plan to be right, the civil engineering must be right. We have spent years in R&D working out degradation curves, lifecycle expectations, and factors like the impact of preventive maintenance. Secondly, prioritization and cost-benefit analysis methodologies do not have the analytical capability to manage a Strategic Asset Management Plan (SAMP) or Capital plan's complexity. Instead, DOT™ utilizes state-of-the-art, multiyear, multi-constraint optimization algorithms to create a range of scenarios to attain the best plan forward. Our flexible and comprehensive analytical processes give you the opportunity to attain your unique objectives for levels of service, socio-economic factors, and safety considerations. Finally, the plan you generate is only as good as your ability to gain support from your Council and community. DOT™ uses highly visual reports, presentation, and report ready, to simplify your communication task.

With DOT™ our objective is simple. We believe that the best plans are generated by local administrators, working in conjunction with their public works department (and external engineering companies when necessary), and interfacing with the community and Council to establish their political and level of service objectives. We will continue to expand the functionality of DOT™ as a world class municipal planning tool, built for Canadian governments by a Canadian company.

4 STATE OF THE INFRASTRUCTURE

4.1 ASSET INVENTORY

The Asset Repositories for all asset types have been assembled, using as much information as the Municipality had available. The following procedure was used to assemble the Asset Inventories for this plan:

a) All asset types, location and quantities.
b) Segmenting of linear assets into manageable sections.
c) Unique Asset IDs for each asset type.
d) Geometrics of the asset (dimensions and physical properties).
e) Current year financial accounting valuation using historical costs and depreciation assumptions and replacement cost calculation accounting for expected inflation, changes in technology and other factors.
f) Asset age distribution and asset age as proportion of expected useful life.
g) Identified needs for all asset types.
    i. identify deficiencies.
    ii. identify treatments and life cycle interventions currently used to address deficiencies, including maintenance.
    iii. determine cost of treatments and interventions.
    iv. develop list of all asset needs with a multi-year listing (10-year) projects assuming unlimited funding; and a year-by-year (10-year) listing of total costs and capital requirements.

This section will also be supported by:

a) An inventory database of infrastructure covered by the plan, which includes basic asset information.

b) Records of all assumptions.
c) A data verification policy and a condition assessment policy, consistent with provincial requirements, setting out when and how asset information will be verified and when and how assets will be assessed to determine their condition.

4.2 REPLACEMENT COST

Replacement Costs are calculated for each asset. The following hierarchy is used in calculating Replacement Costs, depending on data availability:

1. Replacement Costs provided by client, inflated to 2022.
2. Reconstruction unit costs where available, inflated to 2022.
3. Initial Cost, inflated to 2022.

The Municipality's Replacements costs by Asset Type is shown here:

Module	Replacement Cost	Percentage
Transportation	$40,552,811	53.17%
Water	$1,710,994	2.24%
Wastewater	$16,765,679	21.98%
Facilities	$13,499,536	17.70%
Fleet	$476,273	0.62%
Parks	$968,892	1.27%
Other	$2,299,630	3.01%
Total	**$76,273,814**	**100%**

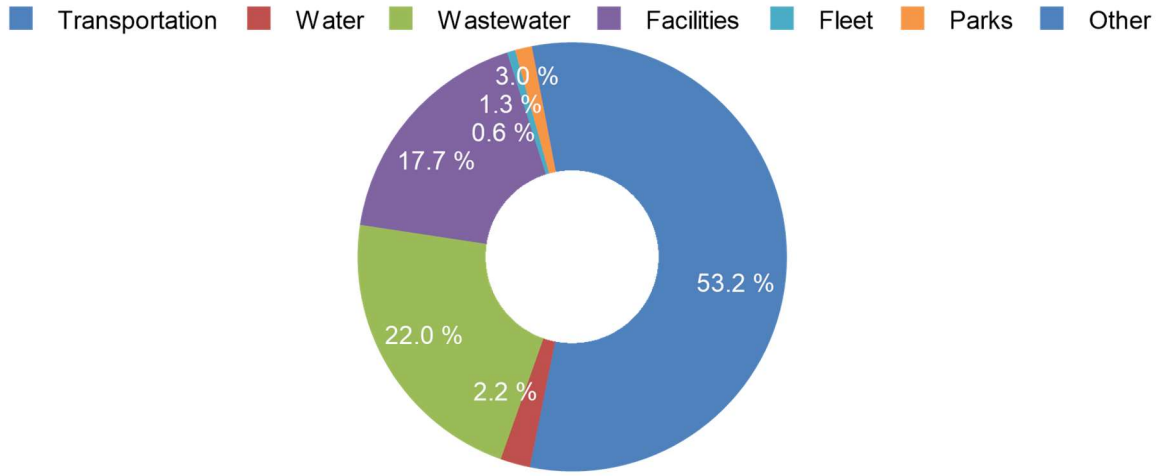


Figure 3: Asset Replacement Cost by Category

4.3 CONDITION ASSESSMENT APPROACH

Wherever condition assessments are available, they were utilized to determine asset conditions. When no condition data were available, an age-based condition rating of %RSL (% Remaining Service Life) was calculated based on the predicted service life for a given asset. The condition assessment approach used is stated for each Asset Type in Section 5.

4.4 LEVELS OF SERVICE

The plan will define potential Levels of Service (LOS) for community consideration through performance measures, targets, and timeframes to achieve them. This section provides an overview of the Level of Service methodology used and is supported by specifications for each asset type in Section 5, of which performance measures are associated with a given asset type, current performance and expected performance over the planning period, as well as any assumptions. We made recommendations, but significant input was provided by the Municipality to define their desired levels of service. These targets will be further refined with time.

4.4.1 OVERVIEW

Levels of Service (LOS) are statements of service performance delivery. LOS is established based on Council direction, the needs or wants of the community as well as legislative and regulatory requirements. This report includes Operating Performance Indicators (OPI's) for current levels of service. Through the ongoing Asset Management process, LOS will be further defined for the Municipality, its assets, and the community. They all are interconnected.

There is likely further effort required by the Municipality to address and formally define levels of service from a customer perspective. Asset management, at its root, is about balancing the full life cycle costs of various services and the levels of service being provided. It is about knowing what levels of service customers expect and what they are willing to pay. The level of service is a reflection of the quality, function, and capacity of the services being provided. As a Municipality, you might consider:

- The level of service you are currently providing to users.
- The annual cost to continue to provide the current level of service.
- How the level of service is expected to change in the future given current funding levels
- If you are meeting the level of service expectations of your users given the costs to provide current and desired levels of service

As a rough generalization, the higher the level of service provided, the higher the life cycle costs of providing that service. Levels of service drive the expected treatments in the management of infrastructure. Customer levels of service outline the overall quality, function, capacity, and safety of the service being provided. Technical levels of service outline the operating, maintenance, rehabilitation, renewal, and upgrade activities expected to occur within the Municipality. When practicing asset management, it is important to first document the current level of service being provided. As asset management becomes more established within your Municipality, levels of service may be set through consultation with the community. However, it is critical that prior to consulting with the public, the current levels of service along with associated life cycle costs are understood.

It is also important to discuss how various levels of service may have different risks associated with them. These risks may play an important role in determining if certain levels of service are acceptable. As with all economic analysis, a sensitivity analysis should be carried out on those parameters which are more likely to be beyond the control of the organization, such as market forces affecting the opportunity cost of capital, community expectations/perception on risk and factors in the long-term, health and safety effects, community economic effects, environmental and social effects, feasibility including public support and the Municipality's readiness.

4.4.2 LEVEL OF SERVICE APPROACH

The implementation of a formal Maintenance Management System (MMS), among many other items, measures the response time, lag time, total time to resolution, resources involved, and communication logs for all issues identified internally and by customers. Going forward, this type of information not only provides the basis for resource and program management decisions but is key information that will provide council and the public with the service level information in relation to the cost of service. Historically a significant portion of activities has been provided at a 'best we can do with what we have' basis. Through a review of design guidelines, and metrics being captured by the MMS, the Municipality of Barrington can re-orientate service delivery that is driven by service level expectations that incorporate Level of Service factors. To assist in better establishing Levels of Service, The Municipality of Barrington should also consider collecting technical performance measures needed to provide information on:

- the types of failure.
- the number of customers affected.
- the duration of the failure,
- the severity of the failure.

This kind of technical performance measurement and monitoring is undertaken to support decision-making by the asset managers within an organization. It addresses issues for consideration in the effective management of the assets, such as:

- Assessing the effectiveness of the operational, maintenance and capital works program.
- Review and refinement of maintenance and rehabilitation strategies and standards.
- Assistance in strategic decision-making through the definition of remaining life, based on the measure being assessed, e.g. capacity of a pipe versus demand.

Benchmarking and other comparison management techniques are used both internally and for external regulation and monitoring, to assess the performance of infrastructure groups and asset owners. Each Municipality needs to consider developing rating systems to judge the assets from both a Municipal perspective with the values that it brings to the organization, and also from a user's or regulator's perspective, in terms of the functionality, suitability, cost and service performance of the asset.

4.4.3 LEVELS OF SERVICE PROCESS

Some Levels of Service (LOS) for the Municipality can be attained through documents developed in the industry and by internally focusing on technical requirements that meet generally expected levels of operation and safety:

- Provincial Minimum Maintenance Standards (MMS) for roads, street lighting, water and drainage
- Drinking Water Quality Management System (DWQMS)

- Engineering Standards Manuals

Operating Performance Indicators – These are the main activities within each operating budget cost center. These activities (OPI's) link directly to the level of service provided by the Municipality. The OPI's also include maintenance tasks that help extend asset life. A good balance between asset replacement through capital funding and ongoing maintenance provides the best cost efficiency and service productivity.

4.4.4 OPERATING PERFORMANCE INDICATOR EXAMPLE

ROADS				
Service	Operating Performance Indicators (OPI)	Current Performance	Target Performance	Timeframe
Examples for Roads below:				
Road Maintenance & Repairs	Complete approximately X work orders per year for service requests including pothole repair, minor asphalt patching, sightline improvement, MVA clean-up.	1500	500	3 Years
Brushing and Roadside Mowing	Complete approx.. X km's of brushing on roadsides annually.	N/A	50 km	2 Years
	Complete roadside mowing X times annually	2	3	3 years
Boulevard Maintenance	Twice per year cut every boulevard in the Municipality.	2	3	3 Years
	Annual weeding, cleaning, and caulking of X km of sidewalk and curb.	7	7	
	Maintain sight lines at intersections for vehicle and pedestrian safety.	14 Days	14 Days	Timeline Achieved
	Roads Recapped ____km's - Annual Average	8	30	2 Years
	Gravel Roads Surface Treated ___km's - Annual Average	3.5	20	2 Years
Curbing/Shoulders	Annual repair, by August, of all curbing damage in previous winter.	September	July	1 Year
Sidewalks & Walkways	Completed Inspections _____times per year	1	1	Timeline Achieved
	Sidewalks / Walkways swept _____ times per year	1	1	Timeline Achieved
Vandalism	Within X hours of notification, remove graffiti.	48	24	1 Year

Street Lighting	Service requests for street light repair completed within X hours.	5 days	48 hours	1 Year
Signs	Annual inspection and maintenance of all X stop signs.	1225	1225	Timeline Achieved
	Annual inspection of crosswalk, pedestrian, school and playground signs and beacons.	September	July	1 Year
	Annual Upgrade of X signs to diamond grade	12	25	1 Year
Snow and Ice Control	Major roads including emergency routes during winter events.	72 Hours	72 Hours	Timeline Achieved
	Residential areas – through roads first then cul-de-sacs and dead ends.	72 Hours	72 Hours	Timeline Achieved
	Residential areas will be plowed and maintained within 96 hours unless snow and icy conditions return crews back to major roads.	72 Hours	72 Hours	Timeline Achieved
VEHICLES – FLEET				
Service	Operating Performance Indicators (OPI)	Current Performance	Target Performance	Timeframe
Fleet Maintenance	Undertake preventative maintenance and repairs to meet industry standards for safety and operation.	Daily	Daily	Timeline Achieved
	Maintain fleet availability at X%.	80	100	3 Years
Small Equipment	Inventory, maintain and repair X pieces of small equipment for use by all departments.	40	40	Timeline Achieved
Preventative Maintenance Services	X units inspected every X months to maintain safety and fleet efficiency.	32 Units every 250 Hours	32 Units every 250 Hours	Timeline Achieved
WATER / WASTEWATER				

Service	Operating Performance Indicators (OPI)	Current Performance	Target Performance	Timeframe
Examples for Water/ Wastewater below:				
Valves & Air Valves	Exercise all line valves once per year with yearly reporting	1	1	present
Main Breaks	Upon notification emergency response and water shut down within 45 minutes.	45	45	present
	Repair completed and service re-instated within 2 hours.	2	2	present
	Currently experiencing 10 breaks per year on average	10	>8	present
Service Connection Renewals	30 renewals completed each year on average.	30	20	
	Service connections associated with Road Rehab Program and capital projects are checked and replaced as necessary.	at that time	at that time	present
Water Towers - Reservoirs	Weekly inspections	no	every 6 months	present
	1 year cycle - drain, inspect, clean and repair	every year	every 2 years	present
Pump Stations	Annual painting	no	yes	present
	Annual vegetation control	yes	yes	present
	20 year cycle – rebuild control valves.	as necessary	10 years	present
	20 year cycle – rebuild or replace pumps.	as necessary	15 years	present
	Weekly trouble shooting and repairs	yes	yes	present
	5 weekly visual inspections	5	5	present
Stations	Maintain all pressure reducing stations to operate without failure.	as necessary	every 5 years	present
	30 year cycle - complete replacement of each station	as necessary	as necessary	present
	10 year cycle - complete rebuild of system.	as necessary	every 10 years	present
	Annual painting and vegetation control.	n/a	n/a	n/a
Testing	100% of water samples contain no bacteriological contaminants.	100%	100%	present
	Monthly reporting	yes	yes	present
WPC Chlorination	Disinfects 100% of City supply.	100%	100%	present

	Daily data acquisition and inspection	yes	yes	present
	Daily water testing	yes	yes	present
	Monthly chlorine cylinder replacement.	as necessary	as necessary	present
	Semi-annual chlorination equipment replacement and repairs	n/a	n/a	n/a
	Annual painting and vegetation removal	yes	yes	present
	10 year cycle - replacement of small piping and control valves.	as necessary	every 10 years	present
Reservoir Chlorination	Disinfects 100% of City supply	100%	100%	present
Water Main Flushing	Twice Annually flush all supply lines.	Twice annual	Twice annual	present
Service Call-outs	Provide 24/7 on call coverage for emergency response.	yes	yes	present

STORM / DRAINAGE				
Service	**Operating Performance Indicators (OPI)**	**Current Performance**	**Target Performance**	**Timeframe**
Examples for Drainage below:				
Flushing	Annual flushing of 100 m of the 236 m storm system	50	100	present
Video Inspections	Annual video inspection of 10m of the storm system.	5	10	present
Manholes / Cleanouts	Install and repair manholes and cleanouts.	yearly	yearly	present
Catch Basins	Annual inspection and cleaning of all 793 catch basins	150	250	present
Detention Systems	Annual inspection of all X detention systems.	N/A		
Inlet / Outlet Structures	As needed Inspect and clean all critical inlet and outlet structures and service before, during and post-storm events.	yes	yes	present
	Annual inspection and maintenance of inlet and outlet structures.	yes	yes	present
Ditch Cleaning	Annual inspection of all ditches and clean as needed.	yes	yes	present

Culverts	Repair driveway and road crossing culverts as assigned through work orders.	yes	yes	present
Service Call-outs	Provide 24/7 on call coverage for sewer and drainage emergency response.	yes	yes	present

4.4.5 CURRENT LEVEL OF SERVICE

The Level of Service for each asset is defined either by its condition rating, or by an age-based rating, e.g., Percent of Remaining Service Life (%RSL). Generally, condition ratings are preferred to age-based ratings, and are used wherever they are available. Different condition rating Indices are used for different assets, for example PCI, PQI or PASER, etc. for roads, NCAP for pipes, BCI for bridges, etc. Municipalities are encouraged to have conditions assessed for as many assets as possible.

The overall Level of Service Rating is weighed in the most appropriate way, depending on the asset. For example, linear assets like roads and utility pipes are usually weighed be length, assets of similar cost like hydrants, park benches, etc. are weighed by Quantity or Count, and Equipment or Fleet assets with large cost variations would typically be weighed by Replacement Costs.

The Municipality of Barrington's State of the Infrastructure Report Card is shown here:

Asset Type	Network Size	No. of Assets	Network Condition	Condition State	Condition Distribution
Roads	27 Km	80	81	Excellent	58% 42%
Sidewalks	2486474 $	8	64	Good	14% 81% 6%
Sewerlines	16036755 $	230	27	Fair	58% 23% 16% 3%
Pumping Station (Sewer)	65951 $	20	93	Excellent	100%
Vehicles	458357 $	9	38	Fair	44% 21% 8% 28%
Buildings	12956005 $	255	31	Fair	41% 38% 12% 9%

Figure 4: State of the Infrastructure Report Card

4.4.6 LIFE CYCLE CONSIDERATION

The Life Cycle of an asset is the time span from when an asset is first put into service to when it is replaced or discarded. Various intervention options are available during the life on an asset. These are divided into Early-Life interventions, (preventive maintenance), Mid-Life interventions (minor rehabilitation) and End-of-Life interventions (major rehabilitation, reconstruction, replacement). In addition, there are operation or routine maintenance interventions. For each asset type the suitable life cycle interventions available to the municipality are identified with the corresponding costs. The DOT™ software, during its optimization analysis, will determine the best possible intervention strategy, applying the right treatment at the right time, to maximize the

life cycle of each asset at a minimum cost; in addition to, maximizing the asset performance throughout the asset's lifecycle, while simultaneously satisfying the Level of Service, risk tolerance and budget constraints.

4.4.7 RISK METHODOLGY

The Concept of Risk
In an ideal case, Risk can be determined using the formula below based on the Probability of Failure and the Consequence of Failure in monetary terms. Formulations can be more complex using concepts such as risk mitigation and vulnerability.

Risk = Pf × Cf
Pf = probability of failure
Cf = consequence of failure in monetary terms

Quantification of Pf and Cf, however, is not an easy task and requires major research and development in addition to data collection by experts at municipalities. In practice, a variation of the above formula is used to determine a Risk Index based on the combination of **Criticality** (instead of the monetized consequence of failure) and **Likelihood of Failure** (instead of detailed probability functions and values). Criticality is typically determined based on the properties of various assets. Physical attributes or Community Impact factors can contribute to the criticality level. As an example, a large size sewer pipe with potential environmental impact has a higher criticality as compared to a small residential pipe. Likelihood of failure is determined based on the condition assessment protocol and determination models. In the software, various functional relationships can be created between condition index and Likelihood of Failure as part of the CI settings.

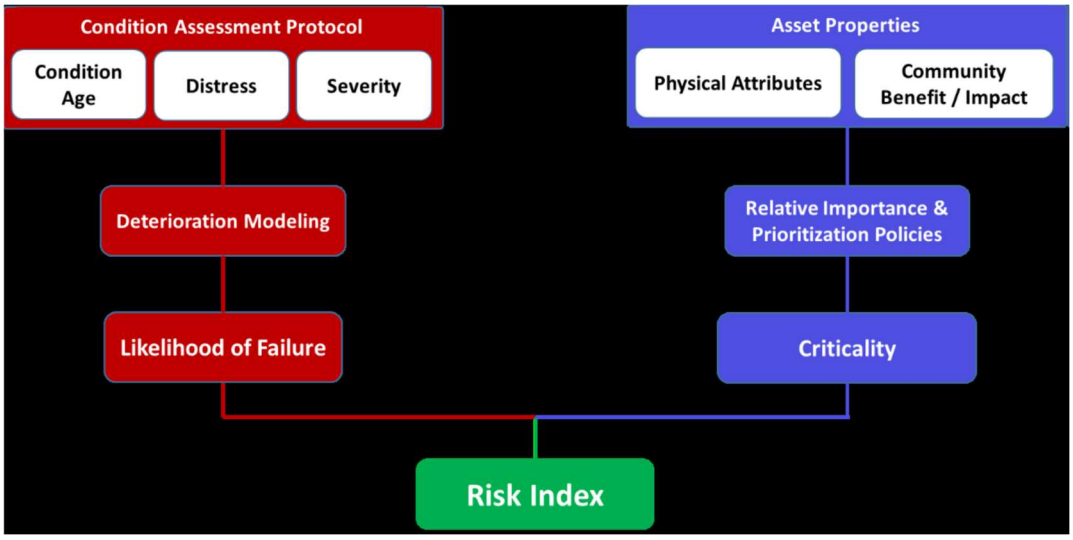


Figure 5: Concept of Risk

Risk Matrix Settings

Likelihood of Failure is calculated from the Level of Service for each asset. A typical relation of Asset Condition and Likelihood of Failure for a specific asset type is shown in Figure 6:

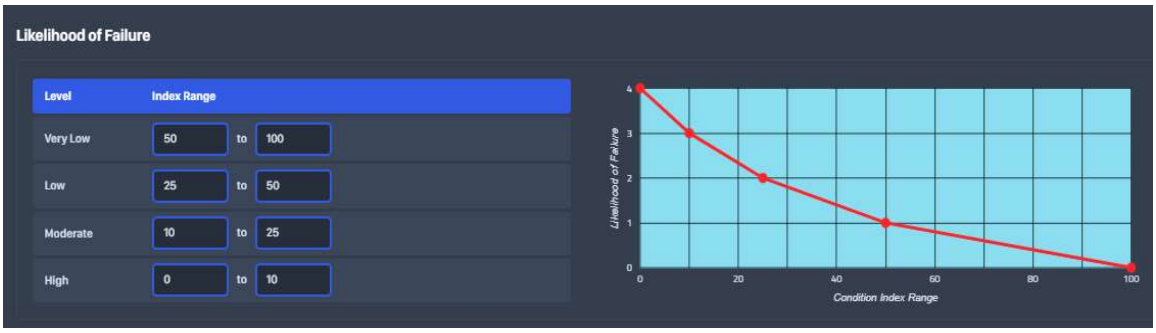


Figure 6: Likelihood of Failure Setting

Consequence of Failure is calculated from the Criticality value calculated for each asset. A typical relation of Criticality and Consequence of Failure is shown in Figure 7:

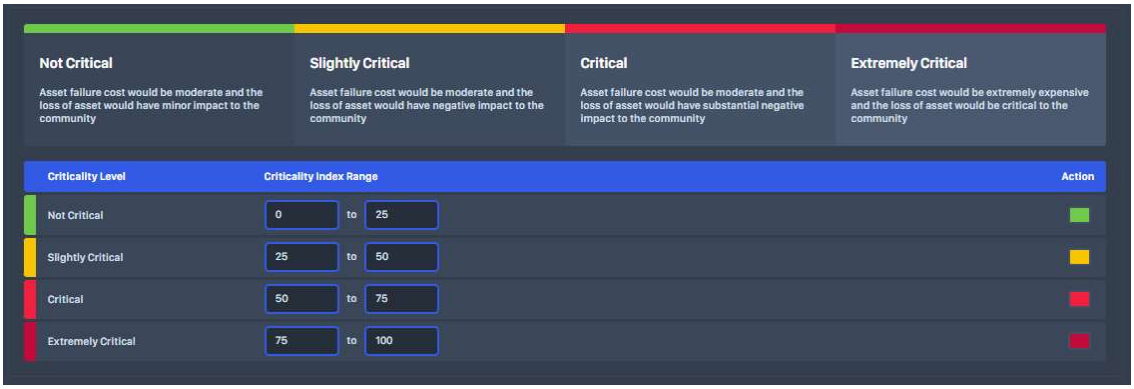


Figure 7: Consequence of Failure Setting

The combination of Criticality and Likelihood of Failure represents different risk levels. This combination is usually presented using a Risk Exposure Matrix and shown below.

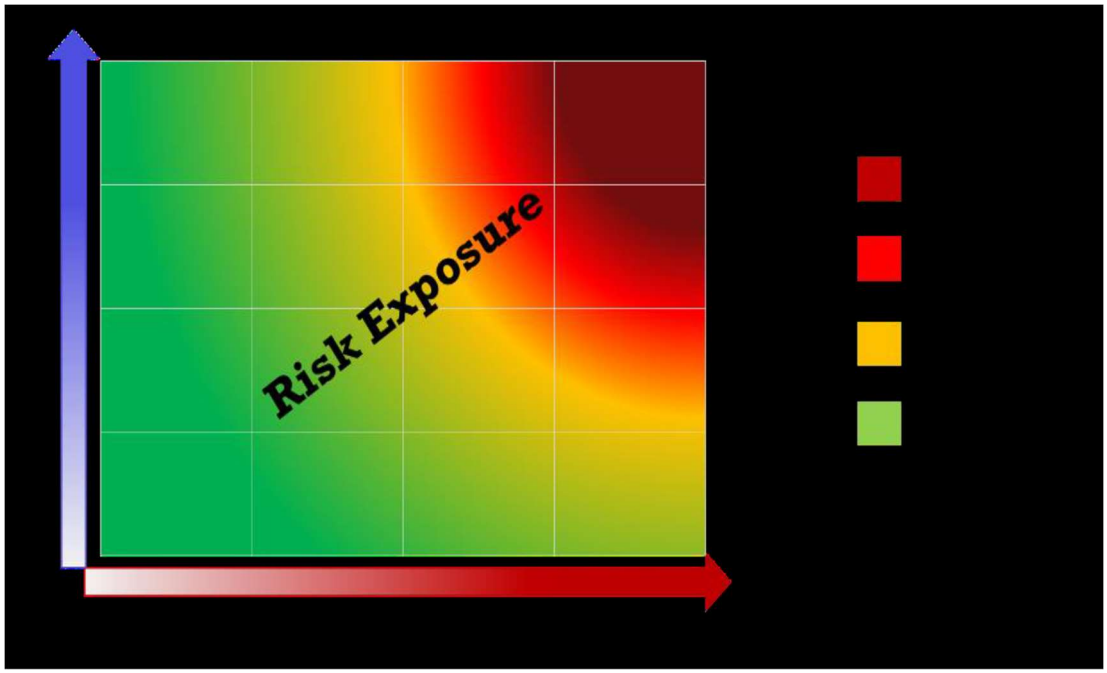


Figure 8: Risk Exposure Matrix

The DOT™ software utilizes your criticality and LoF settings to automatically calculate and produce Risk Matrix results to identify assets at different risk levels. Each point on the Risk Matrix below represents one asset such as a road segment or sewer pipe.

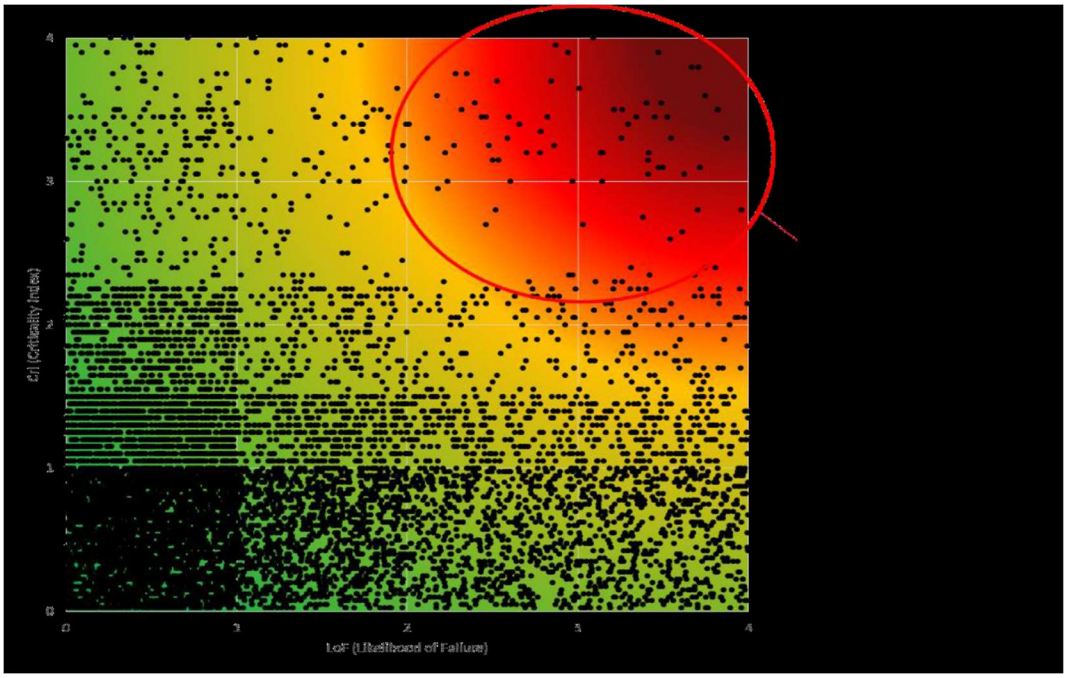


Figure 9: Risk Exposure Matrix of Assets

Risk matrix and risk level ranges can be set on the settings page of the software.

Figure 10: Risk Settings in DOT™

Risk Tolerance

As part of Level of Service settings, Risk Tolerance can be set to determine allowable risk thresholds for various Performance Classes and asset types. The following example shows a risked-based optimization scenario with the objective of maintaining the network risk level at low and moderate levels. In other words, the optimization process allocates available funding to eliminate all events exhibiting high and extreme risk levels over the planning horizon.

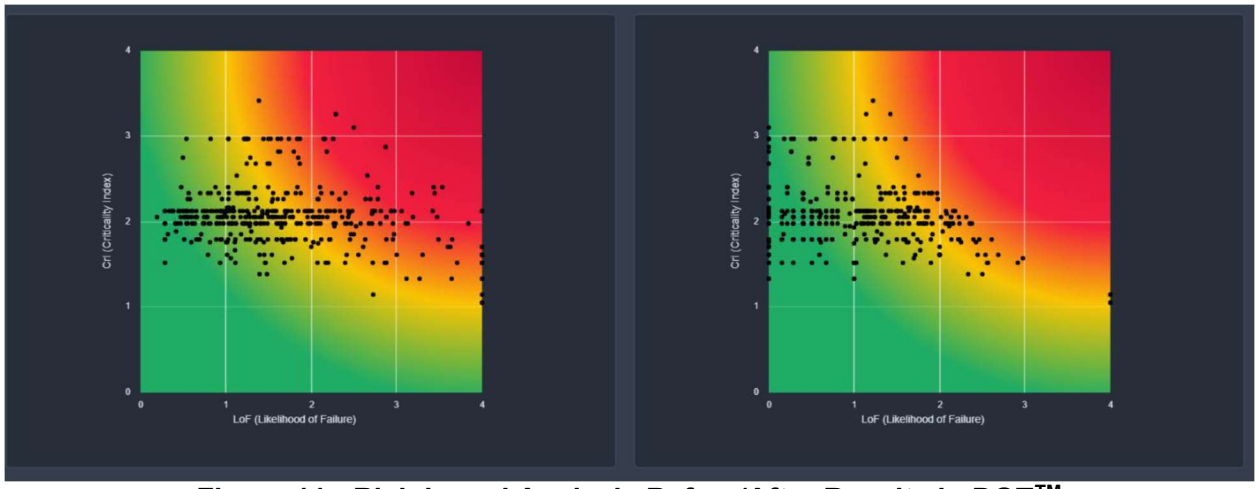


Figure 11: Risk-based Analysis Before/After Results in DOT™

5 COMPREHENSIVE ANALYSIS BY ASSET TYPE

Our DOT (Decision Optimization Technology)™ capital planning tool provides a robust decision-making process, identifies the best possible course of action, and considers both the short-term needs and the long-term goals of a municipality.

It includes an advanced decision-making process called optimization or prescriptive modeling, which is the most powerful and effective way of finding the best possible solution to a decision-making problem. A capital planning tool with true optimization capability can maximize the overall performance of a network in terms of physical condition (or any other criteria) over a multi-year analysis horizon and provides municipalities with the best possible course of action in terms of timing and selection of different maintenance, rehabilitation, or reconstruction treatments considering all municipal goals and constraints.

The improvements achieved through an optimized solution, which inevitably highlights the critical importance of preventive maintenance, can be translated into substantial savings, and increased socio-economic benefit (Figure 12).

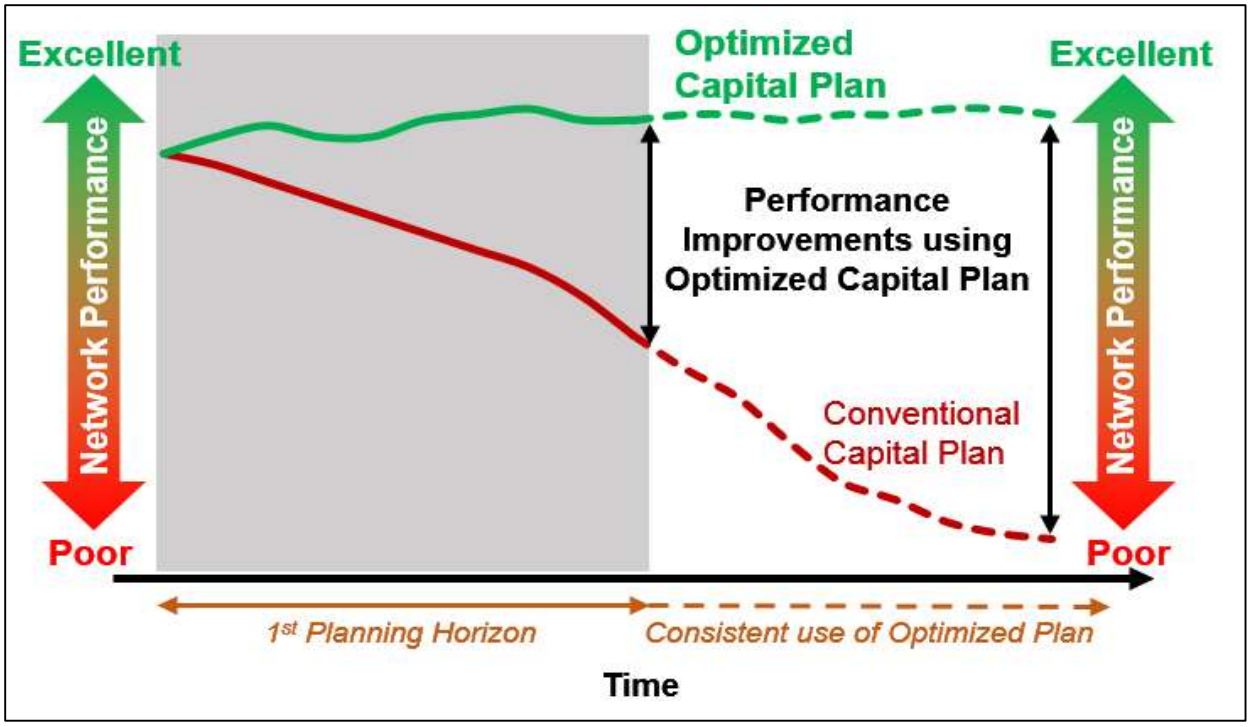


Figure 12: Optimized vs. Conventional Capital Planning

Combining advanced optimization capabilities with robust engineering models and socio-economic consideration provides municipalities with a fully implementable and defensible capital plan. The analytical models used in the system are flexible, able to adjust to regional variances and reflect the behavior of assets verified through a rigorous analysis.

5.1 ROAD NETWORK

The Municipality of Barrington has a total of 26.7 km of roads mainly with Hot Mix Asphalt surfaces.

5.1.1 ROAD GEOMETRICS AND ATTRIBUTES

The following summarizes the road surface types within the Municipality, weighed by length:

Surface Type	Length (km)	Percentage
Hot Mix Asphalt	26.7	100.0%

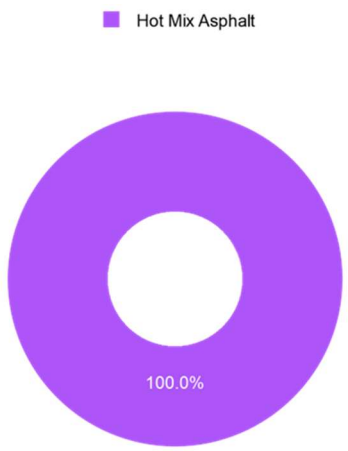


Figure 13: Roads by Surface Types

5.1.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for roads is determined through a condition based analysis. The four (4) Condition States are defined as follows:

State Name	ConditionAttribute Range		
Poor	0	to	50
Fair	50	to	65
Good	65	to	80
Excellent	80	to	100

Figure 14: Road Condition State Ranges

The DOTTM feature is used to calculate estimated current condition ratings by utilizing the installation year, and built-in degradation curves. Based on this methodology, the current 2022 Network Condition (PCI) of the paved roads is 81. This represents an overall "Excellent" condition state.

Title	Condition	Condition State
Est. 2022 Overall Network Condition	81	Excellent

The following summarizes the 2022 Network Pavement Condition, weighted by section length:

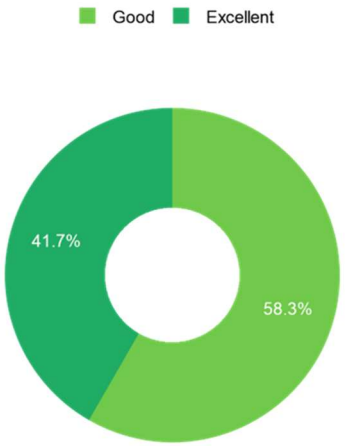


Figure 15: Road Network Condition States

The Condition States by Surface Type are shown in Figure 16:

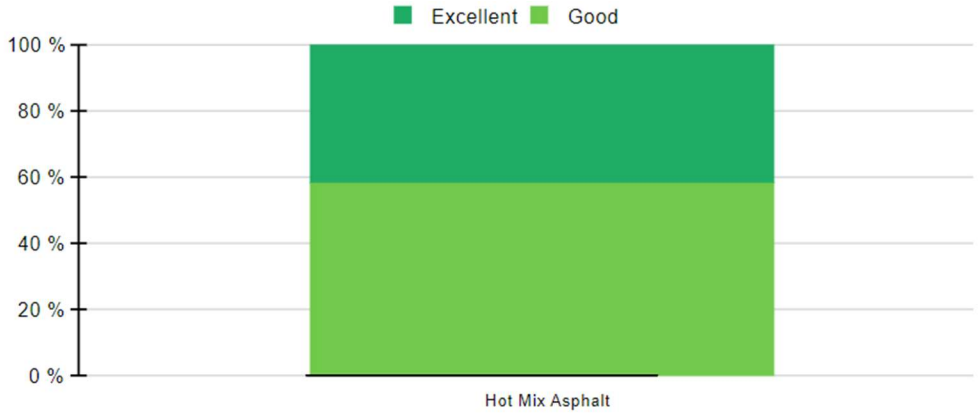


Figure 16: Road Network Condition by Surface Type

5.1.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status only.

Criticality Settings	
Functional Class	**0**
Collector	75
Freeway	100
Local	50
Major Arterial	100
Minor Arterial	90
Minimum Maintenance Standards	**0**

1	100
2	100
3	90
4	80
5	70
6	60
Roadside Environment	**0**
Rural	85
Semi-Urban	90
Urban	100
Service Type	**0**
Commercial	100
Industrial	100
Residential	90
Surface Type	**0**
Composite	100
Concrete	100
Earth	5
Gravel	20
Hot Mix Asphalt	90
Surface Treated	40
Brick	70
Paver Interlock	70
Asset Status	**10**
Abandoned	0
In-service	80
Removed	0
Unassumed	0

Risk
The Risk settings for Roads are done as described in Section 4. Due to the nature of the Roads assets, there are no risk targets set in the planning.

5.1.4 LEVEL OF SERVICE REQUIREMENTS

The Network PCI condition for Local Roads is assumed to be above 80 by the end of the 10-year plan period. The Level of Service Settings are as follow:

LOS Constraints					
Target Performance					
Acceptable Performance-Test	PC1-Local	%RSL	0.0% >= 80 by 2032	Soft	Extreme

5.1.5 LIFECYCLE MANAGEMENT STRATEGY

A number of treatment options are available for all surface types, including Routine Maintenance, Preventive Maintenance, Minor and Major Rehabilitation and Reconstruction treatments. The treatment costs are based on contractor costs for the region and cost data provided by the Municipality. The treatment options and their unit costs are summarized here:

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Brick - Reconstruction	Full Brick Reconstruction	183.20 $/m²	0.0%	2021
Paver Interlock-Recon	Full Paver Interlock Reconstruction	247.30 $/m²	0.0%	2021
Paver Interlock-Restore	Paver Interlock Restauration 5% of Surface Area every 9 years	12.50 $/m²	0.0%	2021
Brick - Restauration	Brick Restauration 15% of Surface Area every 20 years	13.70 $/m²	0.0%	2021
ST-Slurry	Slurry Seal	3.50 $/m²	0.0%	2020
ST-SST	Single Surface Treatment (Chip Seal)	4.00 $/m²	0.0%	2020
ST-DST	Double Surface Treatment (Chip Seal)	6.50 $/m²	0.0%	2020
ST-DST SAMI	Double Surface Treatment (Chip Seal) & SAMI	8.50 $/m²	0.0%	2020
ST-EnhSurf	Enhanced Thin Surfacings (Microsurfacing, Thin HMA Overlay)	4.00 $/m²	0.0%	2020
ST-Enh2Surf	Enhanced Double Thin Surfacings (Double Microsurfacing, Cape Seal)	6.50 $/m²	0.0%	2020
ST-Ovly	One Lift Overlay / Mill & One Lift Overlay	24.00 $/m²	0.0%	2020
ST-CCPR	Cold Central Plant Recycling (CCPR) plus ST/Thin Overlay	19.00 $/m²	0.0%	2020
ST-FDR & DST	Full Depth Reclamation (FDR) + Double Surface Treatment	10.00 $/m²	0.0%	2020
ST-FDR & DST & SAMI	Full Depth Reclamation (FDR) + Double Surface Treatment + SAMI	12.00 $/m²	0.0%	2020
ST-FDR & Ovly	Full Depth Reclamation (FDR) + One lift Overlay	27.50 $/m²	0.0%	2020
ST-FDR & 2Ovly	Full Depth Reclamation (FDR) + Two Lift Overlay	51.50 $/m²	0.0%	2020
ST-FDR & EAS & ST	FDR with Emulsion/Expanded Asphalt Stabilization + Single Surface Treatment	26.50 $/m²	0.0%	2020
ST-Recon & Ovly	Full Depth Reconstruction (350 Gran B, 150 Gran A, 90 HMA)	198.20 $/m²	0.0%	2020

ST-Recon &2 Ovly	Full Depth Reconstruction (350 Gran B, 150 Gran A, 140 HMA)	222.20 $/m²	0.0%	2020
HMA-Crack Seal	Crack Sealing	0.25 $/m²	0.0%	2020
HMA-Slurry	Slurry Seal	3.50 $/m²	0.0%	2020
HMA-ST	Single Surface Treatment (Chip Seal)	4.00 $/m²	0.0%	2020
HMA-DST	Double Surface Treatment (Chip Seal)	6.50 $/m²	0.0%	2020
HMA-DST SAMI	Double Surface Treatment with SAMI	8.50 $/m²	0.0%	2020
HMA-EnhSurf	Enhanced Thin Surfacings (Microsurfacing, Thin HMA Overlay)	4.00 $/m²	0.0%	2020
HMA-Enh2Surf	Enhanced Double Thin Surfacings (Cape Seal, Double Microsurfacing)	6.50 $/m²	0.0%	2020
HMA-Ovly	One Lift Overlay / Mill and One Lift Overlay	24.00 $/m²	0.0%	2020
HMA-2Ovly	Two Lift Overlay / Mill and Two Lift Overlay	48.00 $/m²	0.0%	2020
HMA-HIR & Ovly	HIR + One Lift Overlay / Mill and HIR + Two Lift Overlay	39.00 $/m²	0.0%	2020
HMA-CIR/CIREAM & Thin Ovly	CIR/CIREAM + Thin Overlay	34.20 $/m²	0.0%	2020
HMA-CIR/CIREAM & 1Ovly	CIR/CIREAM + One Lift Overlay	39.00 $/m²	0.0%	2020
HMA-CIR/CIREAM & 2Ovly	CIR/CIREAM + Two Lift Overlay	63.00 $/m²	0.0%	2020
HMA-FDR & 2Ovly	Full Depth Reclamation (FDR) + Two Lift Overlay	51.50 $/m²	0.0%	2020
HMA-FDR & EAS & DST	FDR with Emulsion/Expanded Asphalt Stabilization + Double Surface Treatment	26.50 $/m²	0.0%	2020
HMA-FDR & EAS & Ovly	FDR with Emulsion/Expanded Asphalt Stabilization + One Lift Overlay	44.00 $/m²	0.0%	2020
HMA-FDR & EAS & 2Ovly	FDR with Emulsion/Expanded Asphalt Stabilization + Two Lift Overlay	68.00 $/m²	0.0%	2020
HMA-FDARR & 2Ovly	Full depth asphalt removal and replacement (Two Lifts HMA)	53.00 $/m²	0.0%	2020
HMA-FDARR & 3Ovly	Full depth asphalt removal and replacement (Three Lifts HMA)	77.00 $/m²	0.0%	2020
HMA-Recon 90HMA	Full Depth Reconstruction (350 Gran B, 150 Gran A, 90 HMA)	198.20 $/m²	0.0%	2020
HMA-Recon 140HMA	Full Depth Reconstruction (350 Gran B, 150 Gran A, 140 HMA)	222.20 $/m²	0.0%	2020
PCC-CrackSeal	Crack Sealing	0.35 $/m²	0.0%	2020
PCC-HMAOvly	Asphalt Overlay	10.20 $/m²	0.0%	2020
PCC-PCCOvly	Bonded/Unbonded Concrete Overlay	15.00 $/m²	0.0%	2020
PCC-FullDepthRepair	Full-Depth Slab Repair/Replacement	130.00 $/m²	0.0%	2020
PCC-PrecastRplc	Precast Concrete Slab Repair	150.00 $/m²	0.0%	2020
COM-CrackSeal	Crack Sealing	0.25 $/m²	0.0%	2020
COM-EnhSurf	Enhanced Thin Surfacings (Microsurfacing, Thin HMA Overlay)	2.70 $/m²	0.0%	2020

COM-HMAOvly	Asphalt Overlay	10.20 $/m²	0.0%	2020
COM-DST	Double Surface Treatment (Chip Seal)	4.50 $/m²	0.0%	2020
COM-FullDepthRepair	Full-Depth Slab Repair/Replacement	130.00 $/m²	0.0%	2020
Re-Gravelling (50 mm or 2 in)	Re-Gravelling (50 mm or 2 in)	6400.00 $/Km	0.0%	2020
Re-Gravelling (100 mm or 4 in)	Re-Gravelling (100 mm or 4 in)	8200.00 $/Km	0.0%	2020
Rehabilitation	Rehabilitation	10000.00 $/Km	0.0%	2020
Grading	Grading	120.00 $/Km	0.0%	2020
Drainage Maintenance	Drainage Maintenance	1200.00 $/Km	0.0%	2020
Dust Control	Dust Control	1000.00 $/Km	0.0%	2020
Upgrade to ST	Upgrade to ST	31500.00 $/Km	0.0%	2020
Re-Gravelling HT (100 mm or 4 in)	Re-Gravelling in High Traffic (100 mm or 4 in)	8200.00 $/Km	0.0%	2020
Rehabilitation HT	Rehabilitation in High Traffic	10000.00 $/Km	0.0%	2020
Grading-2Times	Grading-2Times	240.00 $/Km	0.0%	2020
Grading-3Times	Grading-3Times	360.00 $/Km	0.0%	2020
Grading-4Times	Grading-4Times	480.00 $/Km	0.0%	2020

Utilization of Preventive Maintenance Treatments

In 2018 Infrastructure Solutions Inc. conducted the most comprehensive Canadian survey of municipal road maintenance practices ever undertaken. The 171 survey participants represented 45,000 km of paved road, 15% of Canada's population, and a wide range of municipalities by region and population. The survey was designed to identify the extent to which municipalities apply preventive maintenance treatments, to attain practical observations about treatment options and lifecycle gains and clarify user perceptions about what constitutes best road maintenance practices. The results are truly disturbing.

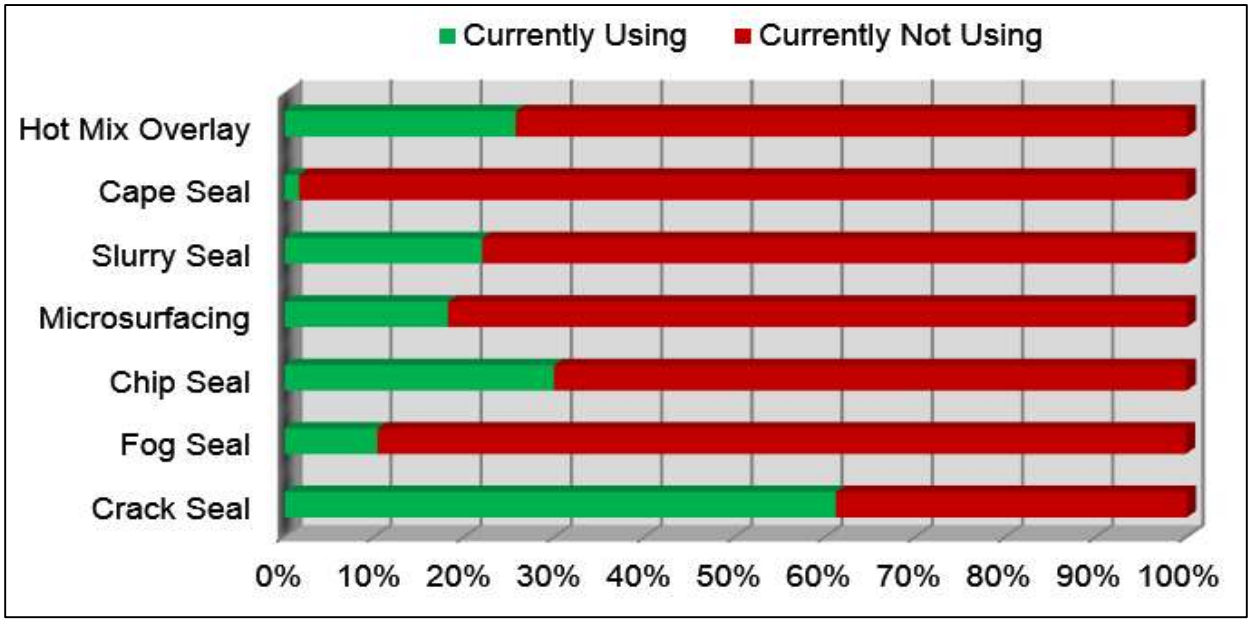


Figure 17: Current Application of Preventive Maintenance Across Canadian Municipalities

The survey established that 98% of respondents perceive preventive maintenance as an important and cost-effective approach to extend the service life of their pavements and to save the municipality significant capital investment in the long run. The survey further establishes that a majority of the municipalities do not apply preventive maintenance treatments (Figure 17) and have a widely varied understanding of when these treatments should be applied.

Respondents were asked what percentage of their municipality they believe is currently being maintained according to best practices. Figure 18 shows the survey's cumulative response on the application of chip seal, micro-surfacing, and slurry seal to paved roads. For every major surface treatment type, less than 20% of municipal road networks are maintained in accordance with what respondents believe to be best practice.

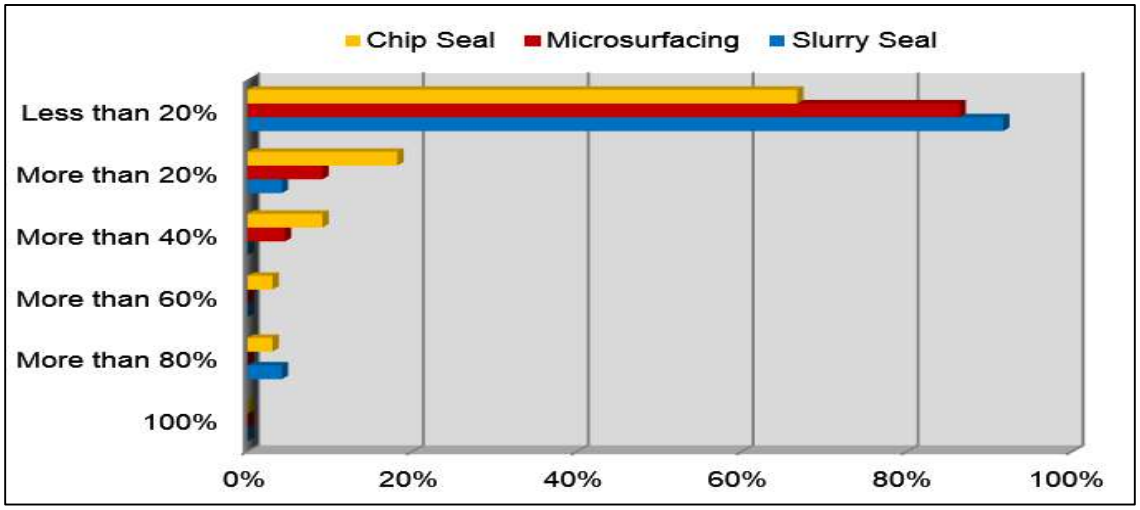


Figure 18: Application of Preventive Treatments According to Best Practices

This contradiction between the appreciated benefits of preventive maintenance and the inadequate application of preventive treatments in practice has deep roots. Municipalities may be overly reactive to community requests. Councils surely follow the advice of Roads Needs Studies, where engineering companies recommend repairing worst roads first for safety and other reasons, assuming an unlimited municipal budget. Deteriorated water or wastewater lines might necessitate road reconstruction for line replacement and take precedence over maintenance. Smaller municipalities often use Excel or simplistic pavement management programs which typically recommend projects based on a simple ranking process. Finally, many municipalities still operate on an ad hoc basis, arbitrarily selecting roads which need rehabilitation or reconstruction work without undertaking any analytical process whatsoever. Whatever the circumstance, tax dollars are being poured into potholes unnecessarily.

5.1.6 DOT GRAVEL ROAD MANAGEMENT SYSTEM

The municipality does not have any gravel road in their inventory, and if they want to have this in the future, they should follow the below management approach. DOT™ Transportation software being provided to the Municipality includes a GRMS (Gravel Road Management System). The Gravel Road Management System is fully integrated into the DOT™ Road's module, and the interventions are included in the capital planning results. The GRMS was designed to meet the following criteria:

- manage inventory, condition data, and maintenance history of the gravel roads in conjunction with the paved roads.
- establish refined priority policies using network-wide priority settings based on various physical attributes, such as traffic, functional class, roadside environment, in addition to socio-economic factors for individual road segments.
- specify detailed routine maintenance policies based on local knowledge or pre-set schedules.
- identify when gravel roads should be upgraded to a hard surface.
- compare the longer-term impacts of multiple scenarios with different policy and budget settings; and
- generate a 10-year capital plan with road lists, budgeted costs, annual schedules, and map visualizations.

Decision to Upgrade to Surface Treatment

A key component of the GRMS analysis module is to determine if surface treating (i.e., chip sealing, oiling or similar) a gravel road is a sensible option. A financial analysis (i.e., discounted cash flow analysis) can be performed based on the initial cost of upgrading and the cost of subsequent maintenance activities in both cases. Figure 19 shows an example of a financial analysis on two gravel road segments. The first segment is 476 m long with AADT of 250 and the other segment is 973 m long with AADT of 50. The analysis uses an inflation rate of 1.5% and a nominal discount rate of 3%. In the first case (AADT of 250), the cost of maintenance as a gravel road (i.e., the cost of re-gravelling, drainage maintenance, grading, and dust control) over the next 20 years in today's dollars is estimated at about $69,000. By surface treating this segment the 20-year maintenance costs are reduced to about $37,000 (i.e., the initial cost of a double chip seal with subsequent slurry seals and single chip seal treatments). It is, therefore, more cost effective to chip seal this segment. In the second case (AADT of 50), however, the cost of maintaining the segment with a gravel surface is around $22,000 less compared to surface treatment.

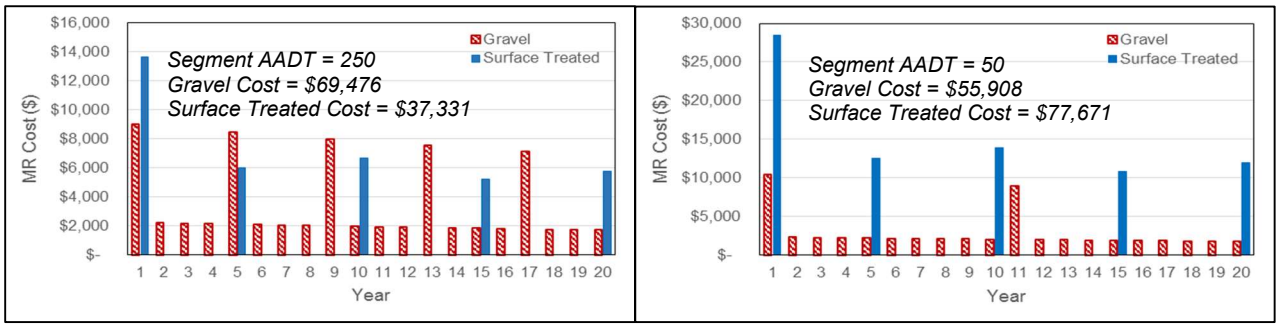


Figure 19: Financial analysis of upgrading gravel roads to surface treated

Performing financial analysis indicates that traffic is a major determinant of the time of upgrade for a gravel road. In addition to financial analysis, other considerations that should factor in the decision are described below:

- **Structural Capacity**: When a gravel road is upgraded, the surface treatment acts as a sealant and reduces moisture penetration. It also prevents surface gravel loss, eliminates dust generation, and increases user satisfaction by providing a smoother ride and better appearance. A surface treatment, however, does not improve the structural capacity of a gravel road. A gravel road with structural or subgrade defects needs to be structurally

enhanced or rehabilitated before upgrading to surface treatment. The cost of rehabilitation and stabilization should be added to the initial cost of surface treatment as part of the financial analysis. Upgrading a gravel road with structural defects can significantly reduce the service life of the surface treatment and result in poor performance.

- **Drainage**: Similar to structural capacity, adequate drainage provision of a surface treated road is imperative to achieving satisfactory long-term performance. Surface treated roads are less forgiving to frost damage than gravel surfaces. Poor drainage conditions will reduce the useful life of a surface treatment and make it expensive to maintain.
- **Traffic Characteristics**: Types of traffic can significantly affect the performance of surface treated roads. In some cases, a gravel road can be an agricultural or mining access road that experiences heavy or overloaded trucks on a regular basis. In general, if a gravel road serves heavy traffic, upgrading to surface treated can become an expensive decision since heavy trucks are more damaging to a surface treated road and the cost of rehabilitation is higher. In this case, it may be better to retain the gravel surface and upgrade to a superior load-bearing hot mix asphalt pavement when sufficient funds are available.
- **Road Geometry**: When a gravel road is upgraded to surface treated, it encourages drivers to drive faster and therefore operational speed increases. It may also increase traffic volumes as more motorists decide to use it. Substandard geometric features such as horizontal and vertical alignments, sight distances, lane widths, shoulder widths, superelevation's, in addition to lack of signage, can result in safety hazards and a higher risk of accidents. It might be necessary to improve the geometric features of a road before upgrading to surface treatment and the cost of these improvements should be considered as part of a financial analysis.
- **Opinions of Local Residents**: While it is usually assumed that local residents will support an upgrade to surface treatment, this is not always the case. Local users may prefer to retain a gravel road rather than encouraging more traffic, higher speeds, and greater use of the route by commuters. It should also be noted that from a context sensitivity perspective, gravel surfacing may be more compatible with the road environment and community setting.

5.1.7 BUDGET CONSTRAINTS

The overall network condition for the current 2022 year is excellent. As a result, the Target Scenario was run to maintain the current Level of Service by the end of the 10-year plan.

Budget Constraints - Maintain current condition

Total Capital Budget Limit	Total Capital Budget	<= (Less than or equal to)	NA	
Total Routine Maintenance Budget Limit	Total Capital Budget	<= (Less than or equal to)	NA	

5.1.8 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Road network to produce a workable capital plan considering municipal constraints and objectives, while maximizing network overall performance to achieve the highest possible investment efficiency.

The Optimization Analysis Settings are as follows:

Scenario	
Name:	Maintain current condition
Description:	Maintain current condition at 2022
Year:	2023

Optimization Settings	
Optimization Mode	Target Optimization
Planning Horizon (Years)	10
Include Priorities	Yes
Asset Replacement Value	No
Intervention Coordination	No
Discount Rate	0.00%
Rollover	No
Estimate Current Condition	True
Operational Efficiency	No
Condition Variation	
Project Size Limit	

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Minimize Cost	Min	1	NA

Network Optimization Results

Figure 20 shows the network overall network performance throughout the plan period:

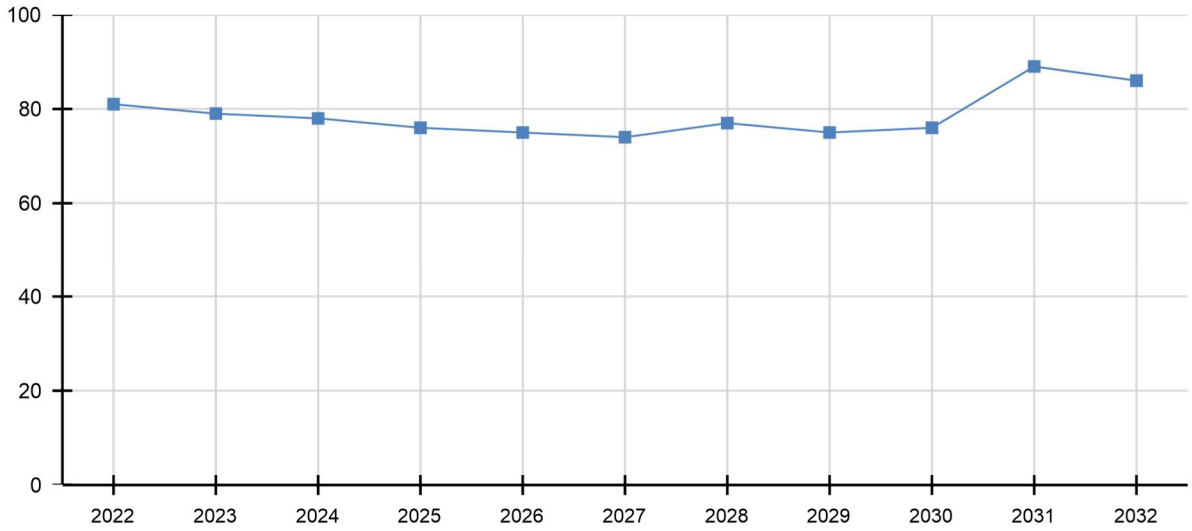


Figure 20: Overall Network Performance

The overall network performance improves from a PCI pavement condition of 81 to a PCI pavement condition of 86 during the plan period.

Figure 21 shows the condition status distribution of the road network at each year of the plan:

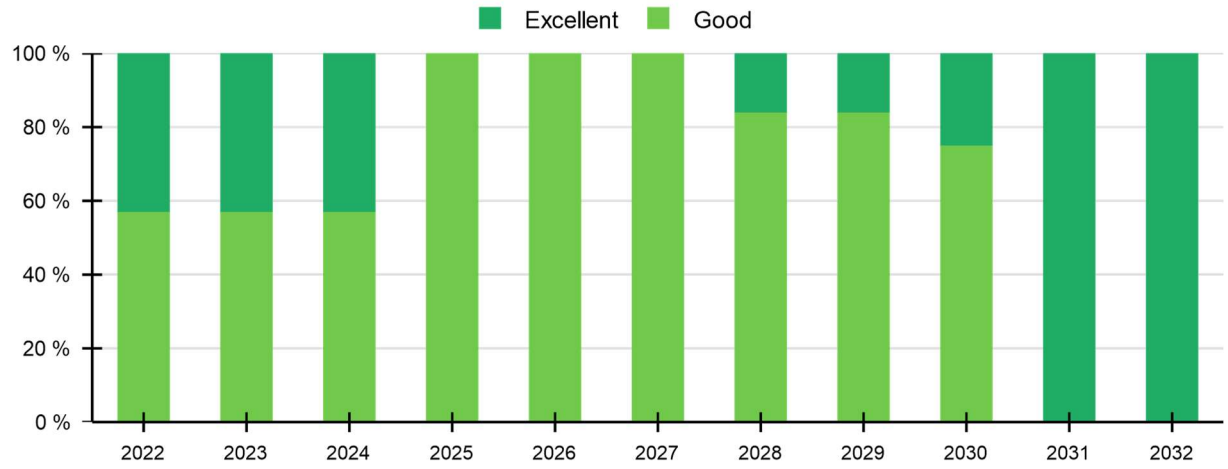


Figure 21: Annual Network Condition Status

As shown in this figure, at the beginning of the plan 43% and 57% of the roads are in excellent and good condition, respectively. At the end of the 10-year plan all the roads will be in excellent condition. This shows a significant improvement in the overall condition of the network. Furthermore, the optimization shows that there is no deficit for the entire period. The estimated Capital Expenditures and recommended routine maintenance budget are shown below in Figures 22 and 23:

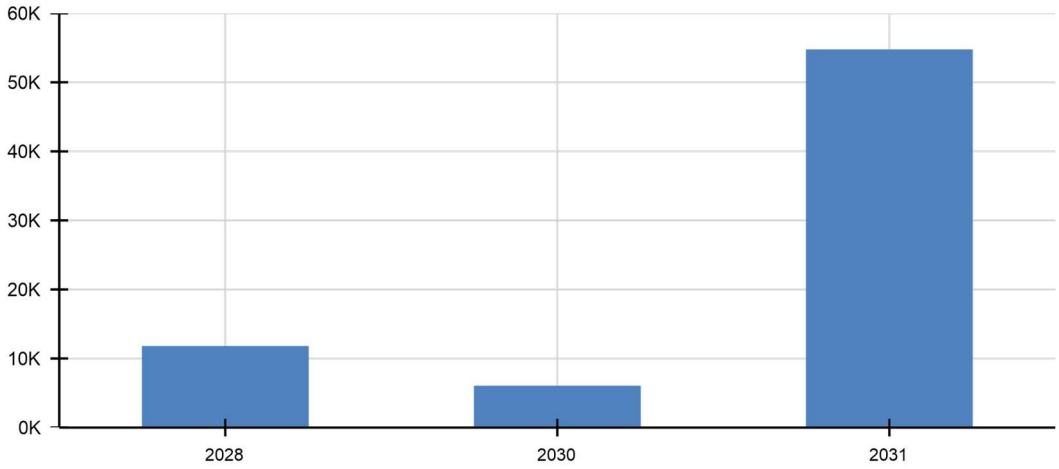


Figure 22: Capital Expenditures

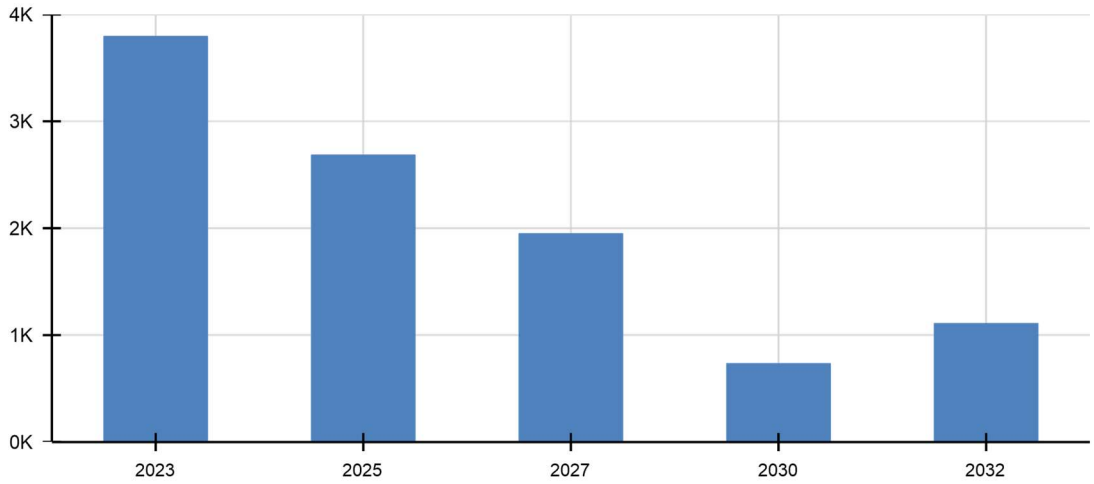


Figure 23: Routine Maintenance Expenditures

5.1.9 RECOMMENDED PROJECTS

An overview of the annual capital projects is shown in Figure 24. The road treatment costs are based on contractor costs for the region and cost data provided by the Municipality. The detailed capital Investment plan specifying which road section is scheduled for which suggested treatment, in which year, and at what budgeted cost is presented in Appendix A, the Capital Investment Plan the Municipality.

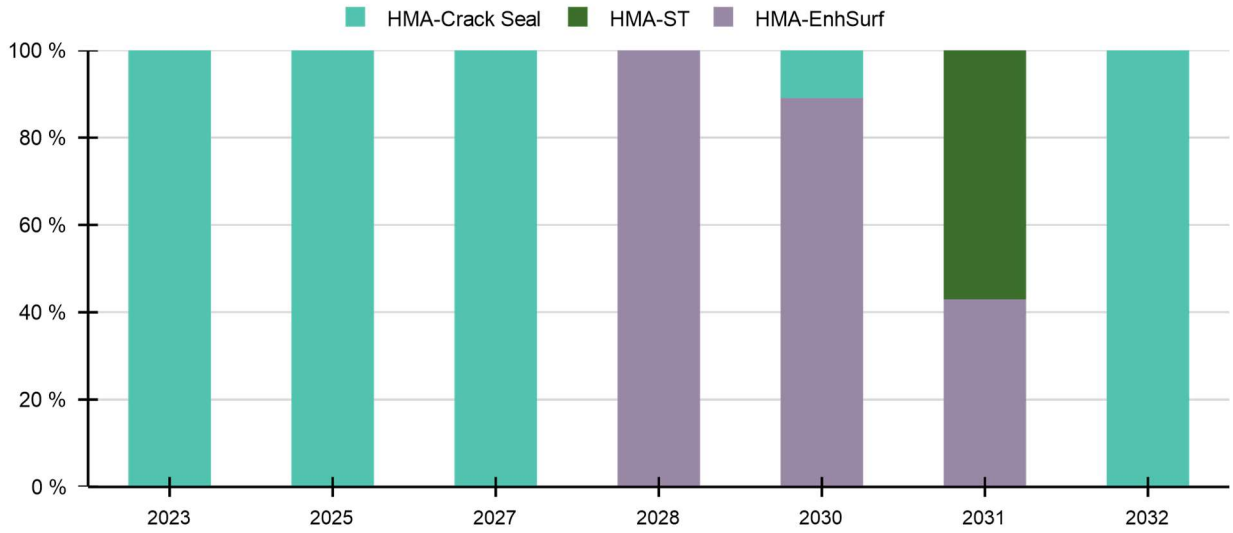


Figure 24: Capital Project Overview

Treatment	2023	2025	2027	2028	2030	2031	2032	Total
HMA-Crack Seal	$3,795	$2,685	$1,950	$0	$735	$0	$1,110	**$10,275**
HMA-ST	$0	$0	$0	$0	$0	$31,200	$0	**$31,200**
HMA-EnhSurf	$0	$0	$0	$11,760	$6,000	$23,520	$0	**$41,280**
Total	**$3,795**	**$2,685**	**$1,950**	**$11,760**	**$6,735**	**$54,720**	**$1,110**	**$82,755**

5.2 SIDEWALKS

The Municipality of Barrington has Sidewalks assets in the inventory that is worth $2,486,474.

5.2.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Sidewalks is determined through an age-based analysis. The five (5) Condition States are defined as follows:

Figure 25: Sidewalks Condition State Ranges

The age-based condition was calculated to the year 2022, and the current 2022 Network Condition (%RSL) is 64. This represents an overall “Good” condition state.

Title	Condition	Condition State
Network Overall Condition	64	Good

The Network Condition Status distribution, weighed by the replacement cost, is shown in Figure 26:

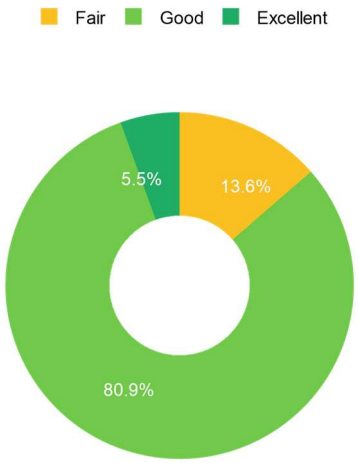


Figure 26: Sidewalk Condition State

5.2.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Sidewalks are done as described in Section 4. Due to the lack of data, there are no risk targets set in the plan.

5.2.3 LEVEL OF SERVICE REQUIREMENTS

The Municipality of Barrington targets to replace those Sidewalks before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.2.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Sidewalks, and it is a replacement treatment.

Treatment Methods				
Treatment	**Description**	**Unit Cost**	**Inflation Rate**	**Cost Estimation Year**
Replacement		100.00 %	0.0%	2021

5.2.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Sidewalks, and in this case, it is a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario	
Name:	AMP - End of life replacement
Description:	End of life replacement
Year:	2023

Optimization Settings	
Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Asset Replacement Value	No
Intervention Coordination	No
Discount Rate	0.00%
Rollover	No
Estimate Current Condition	True
Operational Efficiency	No
Condition Variation	
Project Size Limit	

Optimization Objective			
Type	**Min/Max**	**Weight (Sum = 1)**	**Performance Attribute**
Maximize Network Performance (Recommended)	Max	1	NA

Network Optimization Results

Figure 27 shows the Sidewalks overall network performance throughout the plan period:

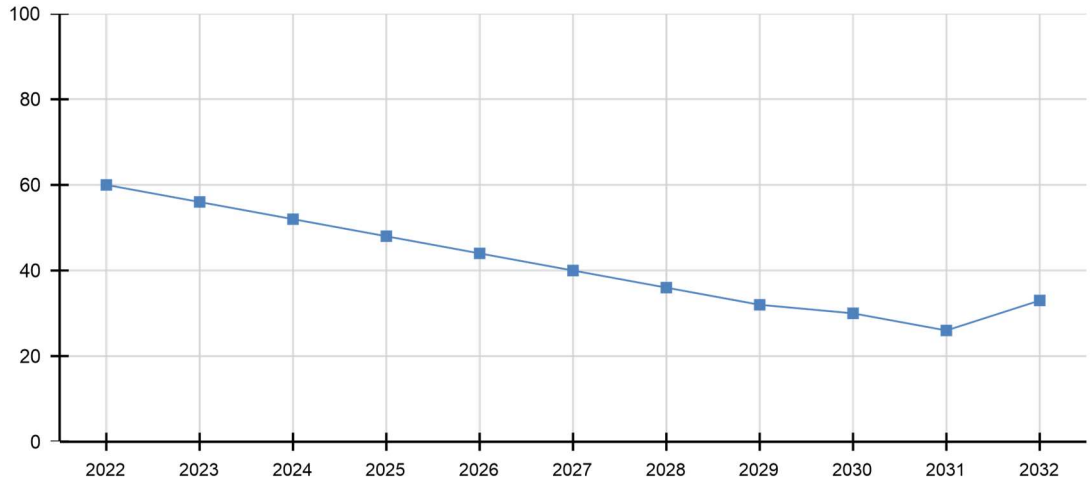


Figure 27: Overall Network Condition Status

Over the next 10 years the performance of the Sidewalks decreases from 60 to 33 at the end of plan.

Figure 28 shows the condition status distribution of the Sidewalks network at each year of the plan:

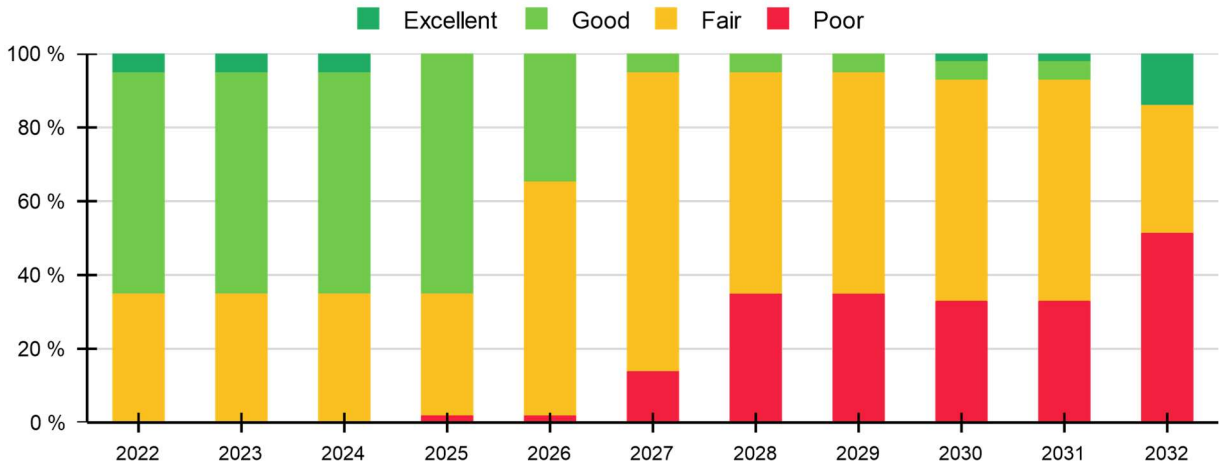


Figure 28: Annual Network Condition Status

As shown in this figure, at the beginning of the plan 5% is in excellent, 60% is in good and 35% in fair condition. At the end of the 10-year plan 14% is in excellent, 0% is in good, 35% is in fair, and 52% in poor condition. This indicates an overall deterioration in the sidewalk assets. Furthermore, the optimization shows that there is no deficit for the entire period. The estimated Capital Expenditures is shown below in Figures 29:

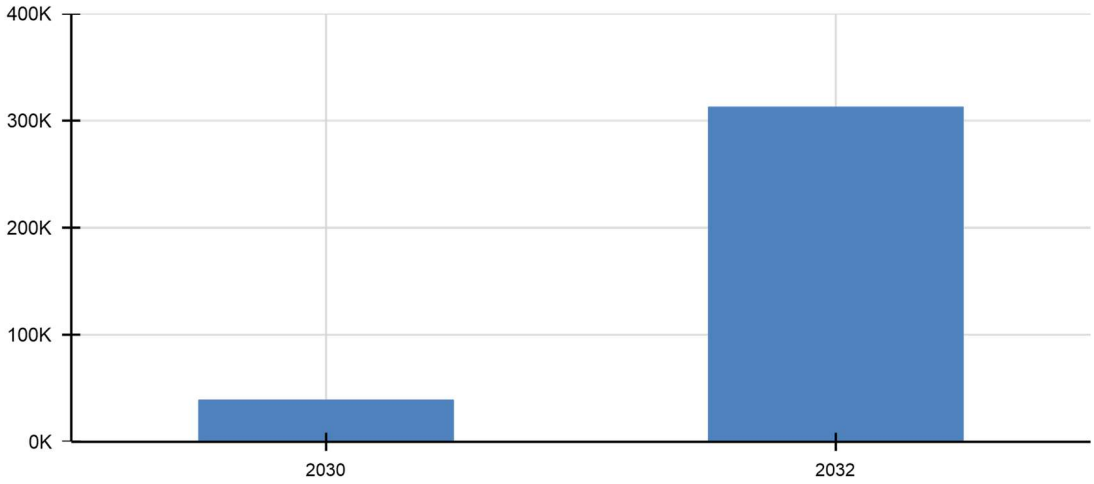


Figure 29: Capital Project Overview

5.3 SEWERLINES

The Municipality of Barrington has a total of 13.4 km of Sewerlines worth 16,036,754.8 dollars and all Gravity Mains.

5.3.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Sewerlines is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 30: Sewerline Condition State Ranges

The age-based condition was calculated to the year 2022, and the current Network Condition (%RSL) of the Sewerlines is 27. This represents an overall "Fair" condition state.

Title	Condition	Condition State
Network Overall Condition	27	Fair

The following summarizes the 2021 Network Condition, weighted by section length:

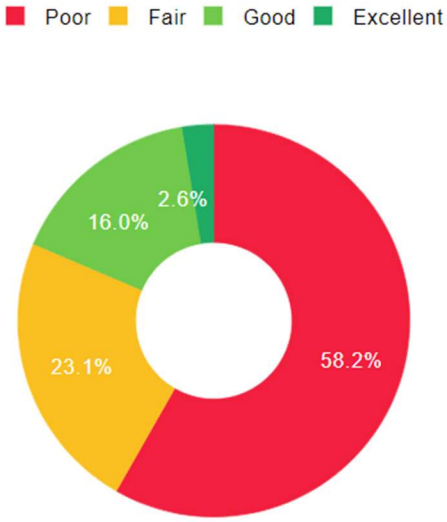


Figure 30: Sewerline Network Condition

5.3.2 CRITICALITY AND RISK CRITERIA

Criticality

Based on the data attributes available, the Criticality settings were applied based on Asset Status and pipe diameter. Socio-economic factors were not included.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	100
Removed	0
Unassumed	0
Diameter	**10**
0 - 125	30
125 - 250	60
250 and over	90

Risk
The Risk settings for Sewer lines are done as described in Section 4.

5.3.3 LEVEL OF SERVICE REQUIREMENTS

The Municipality of Barrington targets to replace sewer lines before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.3.4 LIFECYCLE MANAGEMENT STRATEGY

Treatments based on pipe material are available for Sewerlines, and they are open trench replacement treatments.

Treatment Methods				
Open Trench Replacement	Open Trench Replacement	100.00 %	0.0%	2020

5.3.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Sewerlines, on the basis of a straight end-of-life replacement. The Optimization Analysis Settings are as follows:

Scenario	
Name:	AMP - End of Life Replacement
Description:	End of life replacement
Year:	2023

Optimization Settings	
Optimization Mode	Standard

Planning Horizon (Years)	10
Include Priorities	Yes
Asset Replacement Value	No
Intervention Coordination	No
Discount Rate	0.00%
Rollover	No
Estimate Current Condition	True
Operational Efficiency	No
Condition Variation	
Project Size Limit	

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance (Recommended)	Max	1	NA

Network Optimization Results

Figure 31 shows the Sewerline overall network performance throughout the plan period:

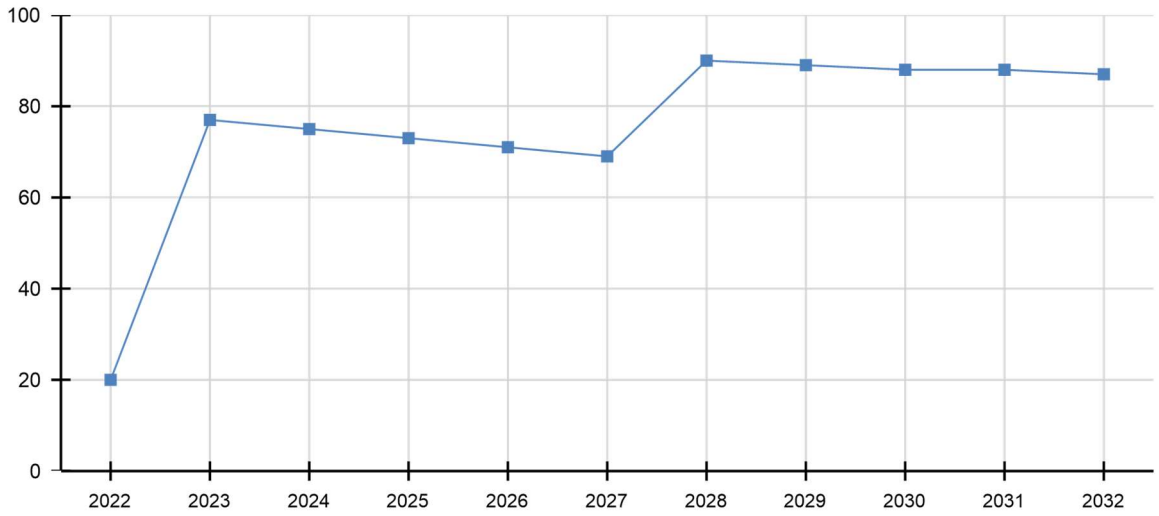


Figure 31: Sewerline Network Performance

Over the next 10 years, as the pipes age, the performance of the Sewerline network increases from 20 to 87 at the end of plan. Figure 32 shows the condition status distribution of the Sewerline network at each year of the plan:

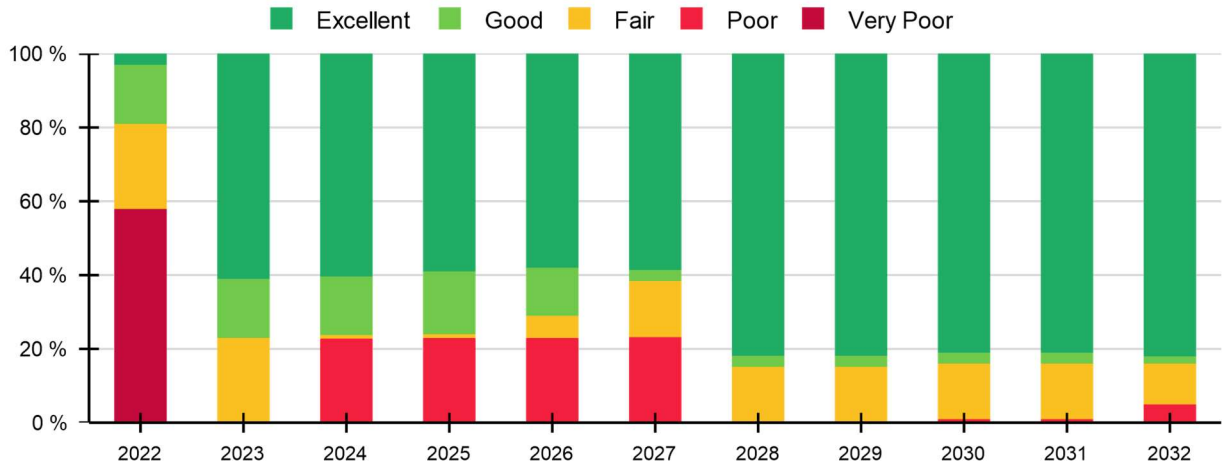


Figure 32: Annual Network Condition Status

As shown in figure 32, at the beginning of the plan 61% of sewer line assets is in excellent condition, 16% is in good, and 23% is in fair condition. At the end of the 10-year plan 82% of sewer line assets will be in excellent condition, 2% will be in good, 11% will be in fair and 5% will be in poor condition. The deficit projection of the Sewerline network is shown below in Figure 33. The estimated Capital Expenditures is shown below in Figures 34:

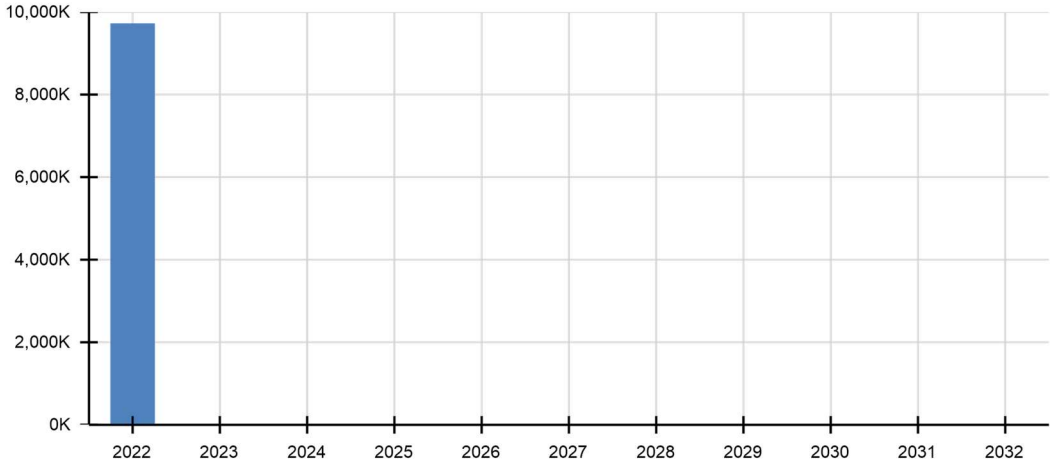


Figure 33: Sewerline Deficit Projections

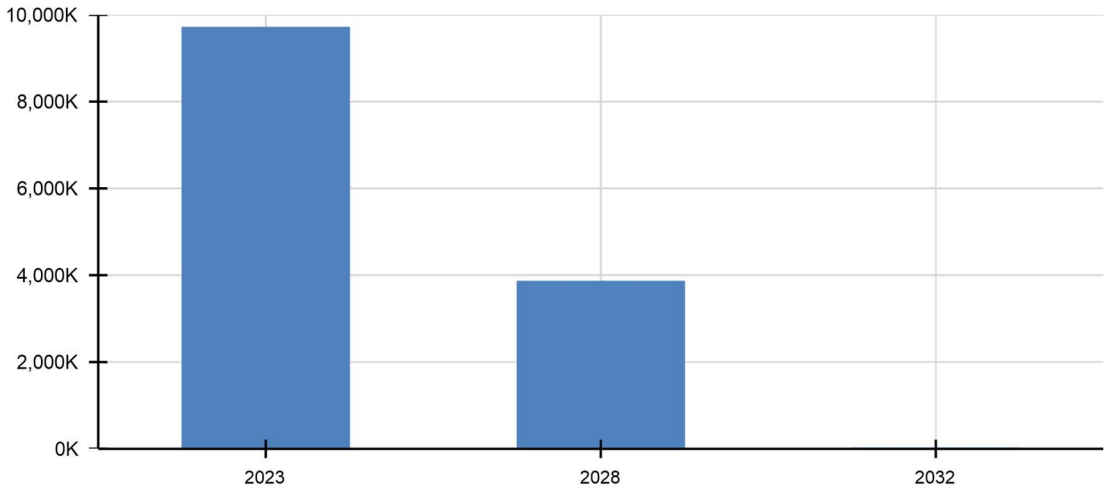


Figure 34: Capital Expenditures

5.4 PUMPING STATIONS (SEWER)

The Municipality has Pumping Stations valued at $65,950.70.

5.4.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Pumping Stations is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 97: Pumping Station Condition State Ranges

The age-based condition was calculated to the year 2022, and the current Network Condition (%RSL) of the Pumping Stations is 93. This represents an overall “Excellent” condition state.

Title	Condition	Condition State
Network Overall Condition	93	Excellent

5.4.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were based on Asset Status only. Socio-economic factors were not included.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Pumping Stations (Sewer) are done as described in Section 4. Due to the lack of data, there are no risk targets set in the planning.

5.4.3 LEVEL OF SERVICE REQUIREMENTS

The Municipality of Barrington targets to replace Pumping Stations (Sewer) before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.4.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Pumping Stations (Sewer), and it is a full replacement treatment.

Treatment Methods				
Treatment	**Description**	**Unit Cost**	**Inflation Rate**	**Cost Estimation Year**
Replacement	Replacement	100.00 %	0.0%	2020

5.4.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Pumping Stations, on the basis of a straight end-of-life replacement. The Optimization Analysis Settings are as follows:

Scenario	
Name:	AMP - End of Life Replacement
Description:	
Year:	2023

Optimization Settings	
Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Asset Replacement Value	No

Intervention Coordination	No
Discount Rate	0.00%
Rollover	No
Estimate Current Condition	True
Operational Efficiency	No
Condition Variation	
Project Size Limit	

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance (Recommended)	Max	1	NA

Network Optimization Results

Figure 35 shows the Pumping Stations overall network performance throughout the plan period:

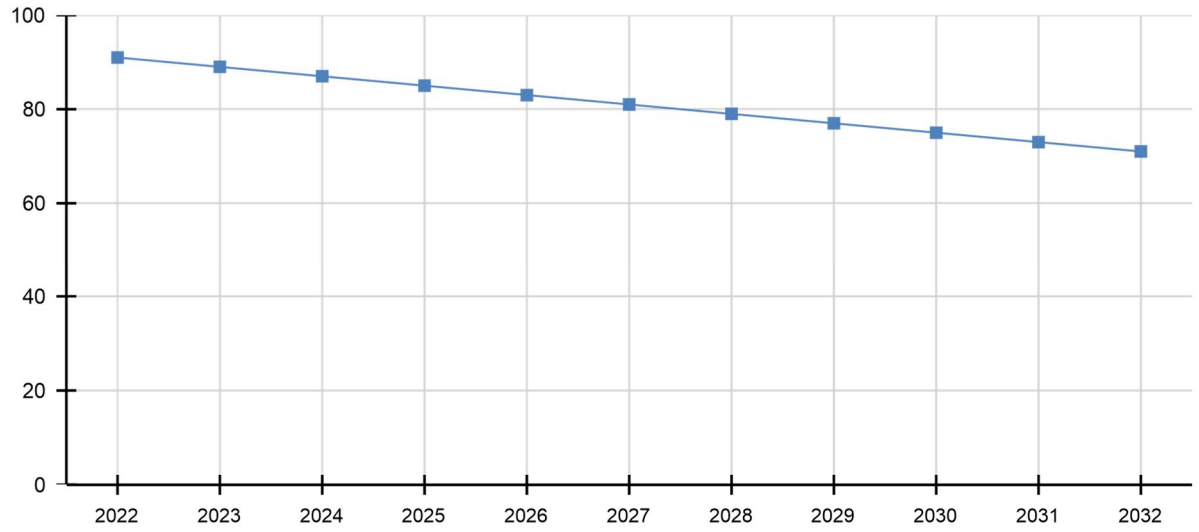


Figure 35: Pumping Station Network Performance

Over the next 10 years, as the Pumping Stations age, the network performance decreases from 91 to 71 at the end of plan. Figure 36 shows the condition status distribution of the Pumping Station network at each year of the plan:

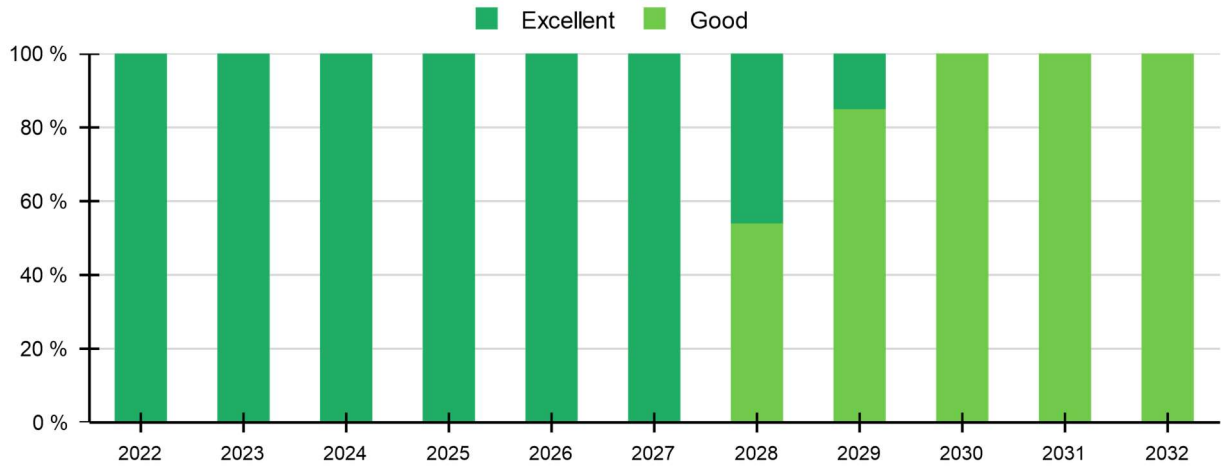


Figure 36: Annual Network Condition Status

As shown in this figure, at the beginning of the plan 100% is in excellent condition. At the end of the 10-year plan 100% will be in good condition. Furthermore, the optimization shows that there is no deficit and Capital Expenditures for the entire period.

5.5 BUILDINGS

The Municipality of Barrington has Building Assets worth $12,956,005. No data for Building Elements/Components was available, so the Buildings wemare analyzed as a whole.

5.5.1 BUILDING ATTRIBUTES

The following summarizes the Buildings by Department, weighed on Replacement Cost:

Department	Replacement Cost ($)	Percentage
General Government	5,875,386.0	45.3%
Recreation Facilities	181,168.9	1.4%
Fire Protection	244,500.0	1.9%
Library	1,180,099.0	9.1%
Other	5,474,851.2	42.3%

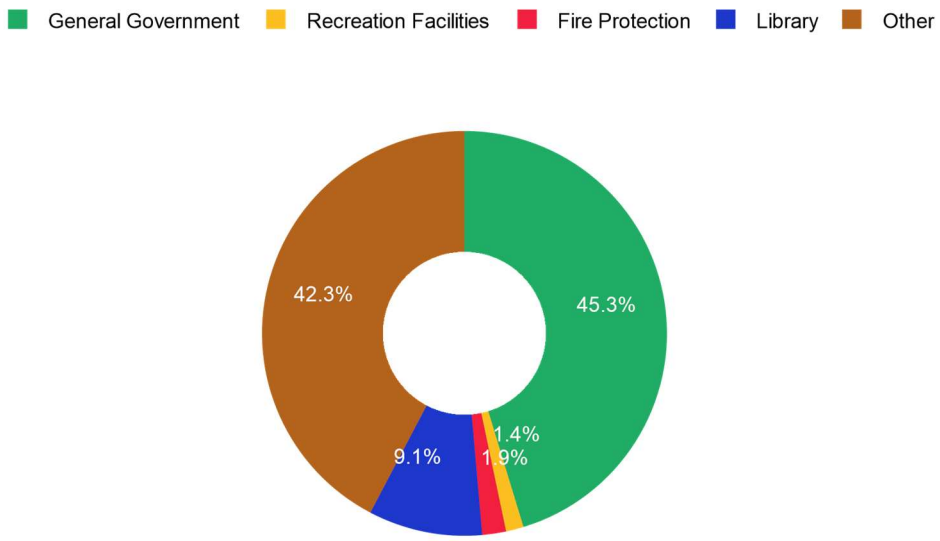


Figure 37: Buildings by Department

5.5.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Buildings is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

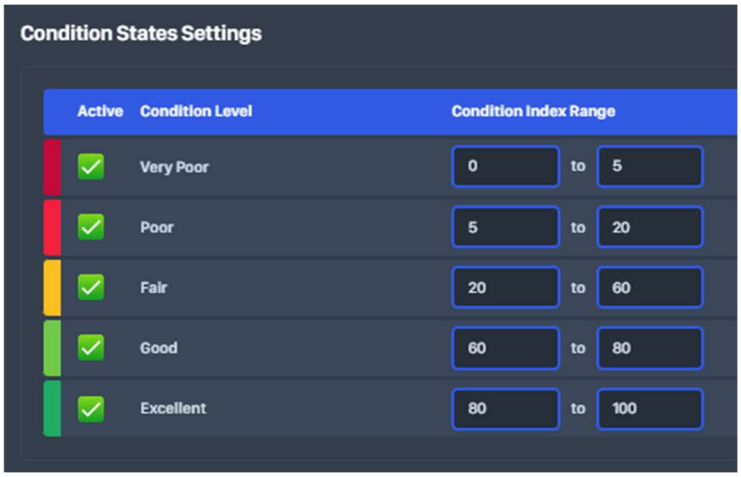


Figure 38: Building Condition State Ranges

The age-based condition was calculated to the year 2022, and the current Overall Network Condition (%RSL) of the buildings is 31. This represents an overall “Fair” condition state.

Title	Condition	Condition State
Network Overall Condition	31	Fair

The following summarizes the 2022 Network Condition states:

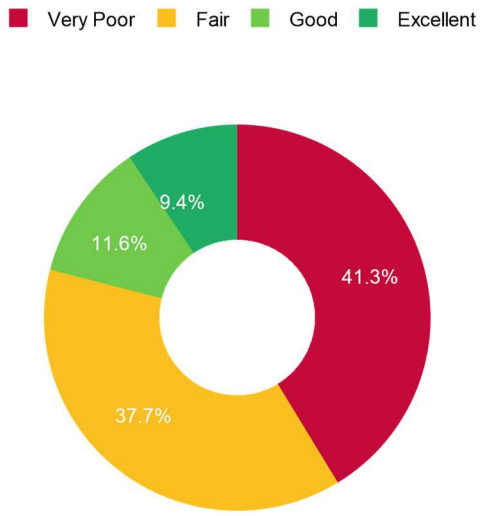


Figure 39: Building Network Condition

The Condition States by Department are shown in Figure 40:

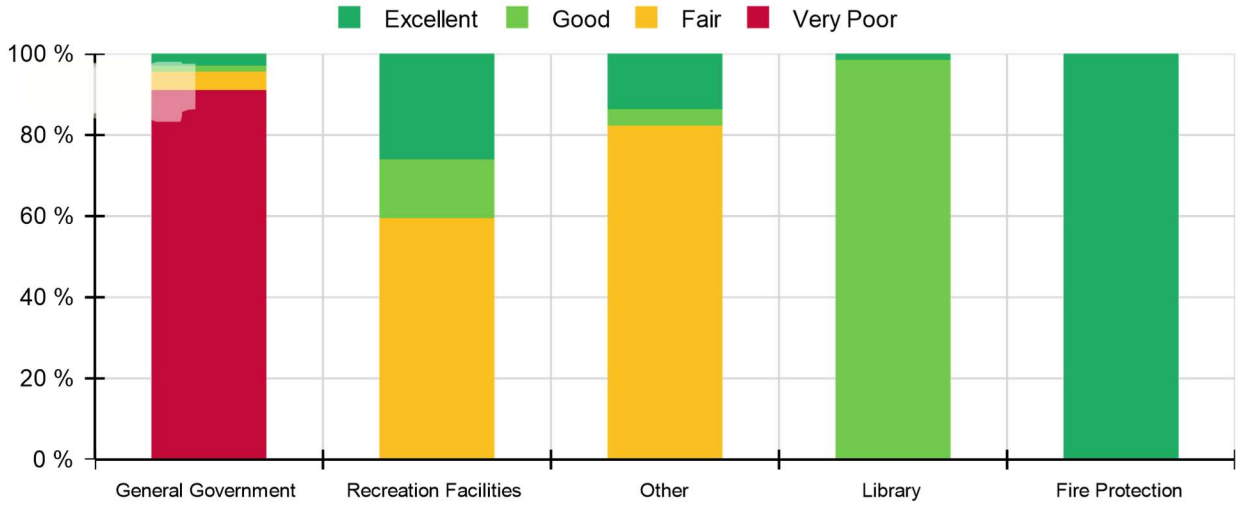


Figure 40: Building Network Condition by Department

5.5.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were based on Asset Status only.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	100
Removed	0

Risk
The Risk settings for Buildings are done as described in Section 4. Due to the lack of data, there are no risk targets set in the planning.

5.5.4 LEVEL OF SERVICE REQUIREMENTS

The Municipality of Barrington targets to do all required repairs to Buildings as per Building Inspection report. The analysis was done based on required repairs, with no budget constraint.

5.5.5 LIFECYCLE MANAGEMENT STRATEGY

The only treatment considered for Buildings is a full replacement.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.5.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the buildings, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	AMP - End of life replacement
Description:	
Year:	2023

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Asset Replacement Value	No
Intervention Coordination	No
Discount Rate	0.00%
Rollover	No
Estimate Current Condition	True
Operational Efficiency	No
Condition Variation	
Project Size Limit	

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance (Recommended)	Max	1	NA

Network Optimization Results

Figure 41 shows the buildings overall network performance throughout the plan period:

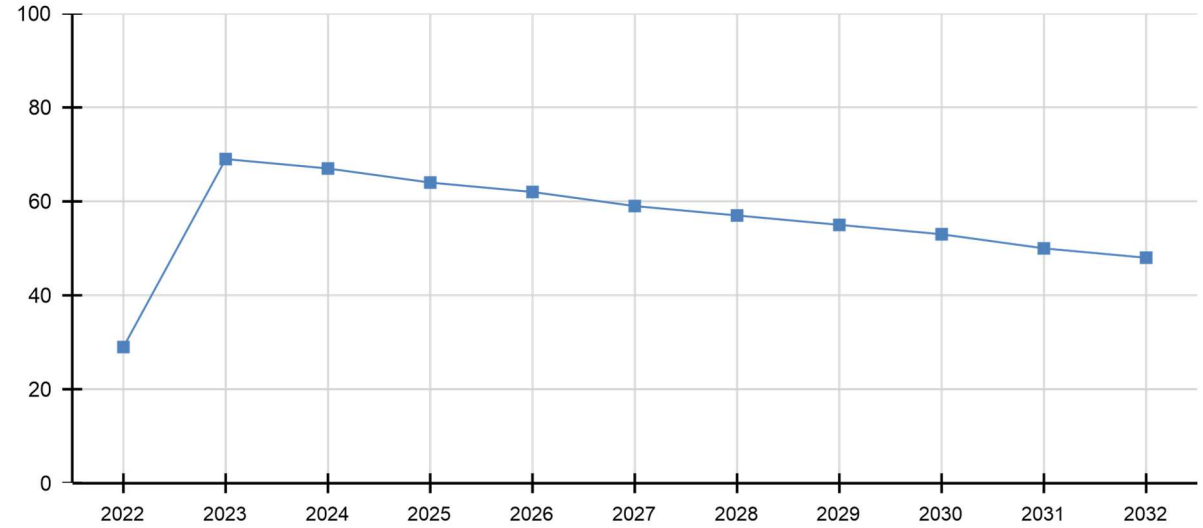


Figure 41: Buildings Network Performance

Over the next 10 years, the performance of the building network decreases from 69 to 48 at the end of the plan. Figure 42 shows the condition status distribution of the buildings network at each year of the plan:

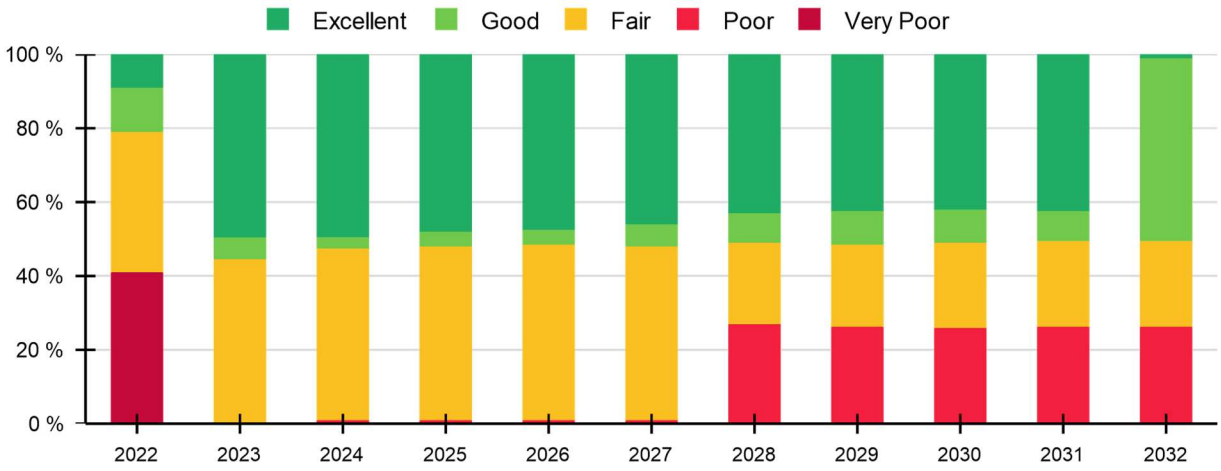


Figure 42: Annual Network Condition Status

As shown in figure 42, at the beginning of the plan 50% of building assets is in excellent condition, 6% is in good, and 45% in fair condition. At the end of the 10-year plan 1% of the building assets

will be in excellent condition, 49% will be in good, 23% will be in fair, and 26% will be in poor condition. The deficit projection of the building network is shown below:

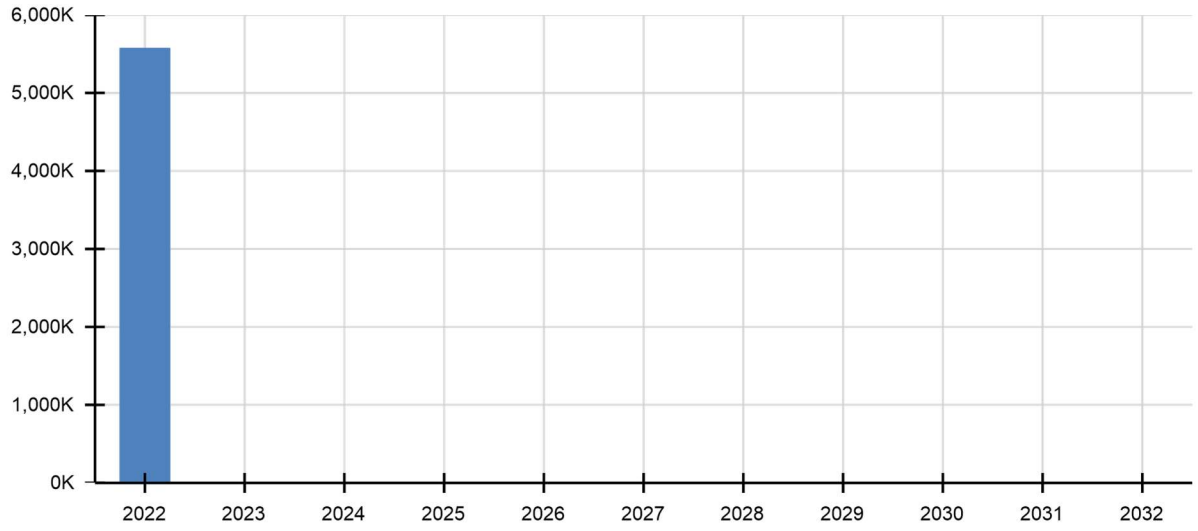


Figure 43: Projected Deficits

Capital expenditures in the amount of $5,573,341 and $133,977 are scheduled in 2023 and 2029, respectively.

5.6 VEHICLES

The Municipality of Barrington has a total of 9 Vehicles. Due to the large variation in cost the Vehicles are weighed by Replacement Cost.

5.6.1 VEHICLES ATTRIBUTES

The following summarizes the Vehicle Class within the Municipality, by replacement cost:

Vehicle Class	Replacement Cost ($)	Percentage
Heavy Commercial	50,783.6	11.1%
Light Commercial	350,980.0	76.6%
Trailer	56,593.0	12.3%

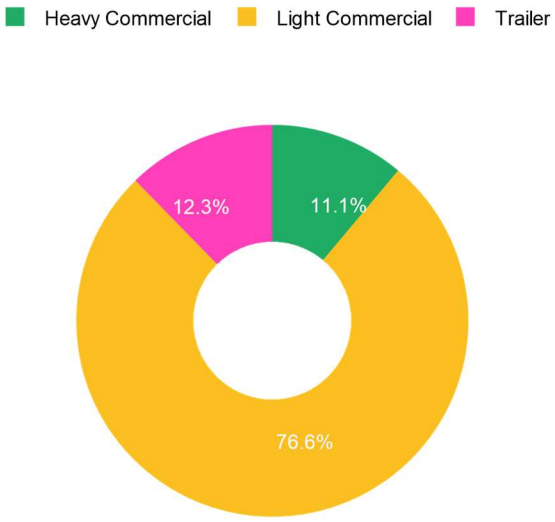


Figure 44: Vehicle Class by Replacement Cost

5.6.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Vehicles is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

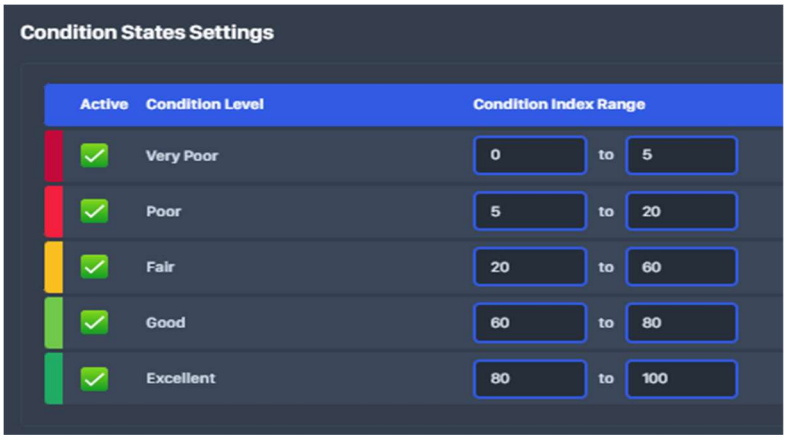


Figure 45: Vehicle Condition State Ranges

The age-based condition was calculated to the year 2022, and the current Network Condition (%RSL) of the Vehicles is 38. This represents an overall “Fair” condition state.

Title	Condition	Condition State
Network Overall Condition	38	Fair

The following summarizes the 2022 Vehicle Fleet Condition, weighted by Replacement Cost:

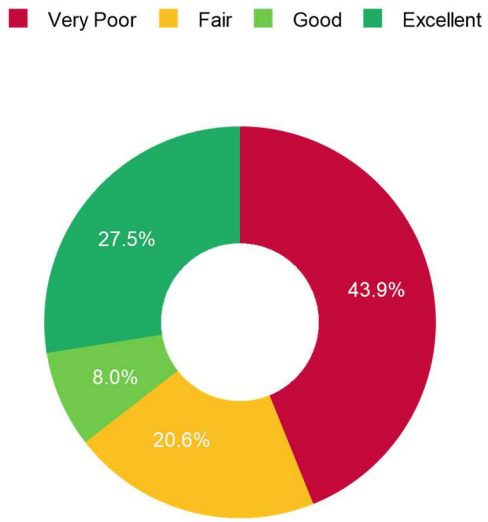


Figure 46: Vehicles Condition by Replacement Cost

The Condition States by Vehicles Class are shown in Figure 47:

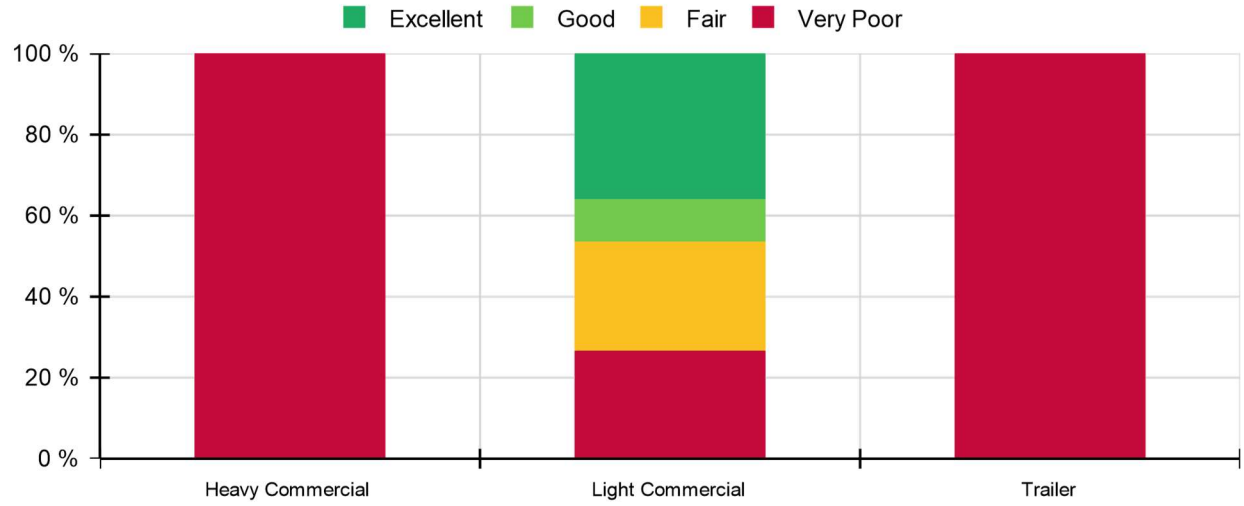


Figure 47: Vehicles Fleet Condition by Class

5.6.3 CRITICALITY AND RISK CRITERIA

Criticality

Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Vehicles are done as described in Section 4. Due to the lack of data, there are no risk targets set in the planning.

5.6.4 LEVEL OF SERVICE REQUIREMENTS

The Municipality of Barrington targets to replace Vehicles before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.6.5 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Vehicles, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.6.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Vehicles, on the basis of a straight end-of-life replacement. The Optimization Analysis Settings are as follows:

Scenario

Name:	AMP - End of life replacement
Description:	
Year:	2023

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Asset Replacement Value	No
Intervention Coordination	No
Discount Rate	0.00%
Rollover	No
Estimate Current Condition	True
Operational Efficiency	No
Condition Variation	
Project Size Limit	

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute

Maximize Network Performance (Recommended)	Max	1	NA

Network Optimization Results

Figure 48 shows the Vehicles overall fleet performance throughout the plan period:

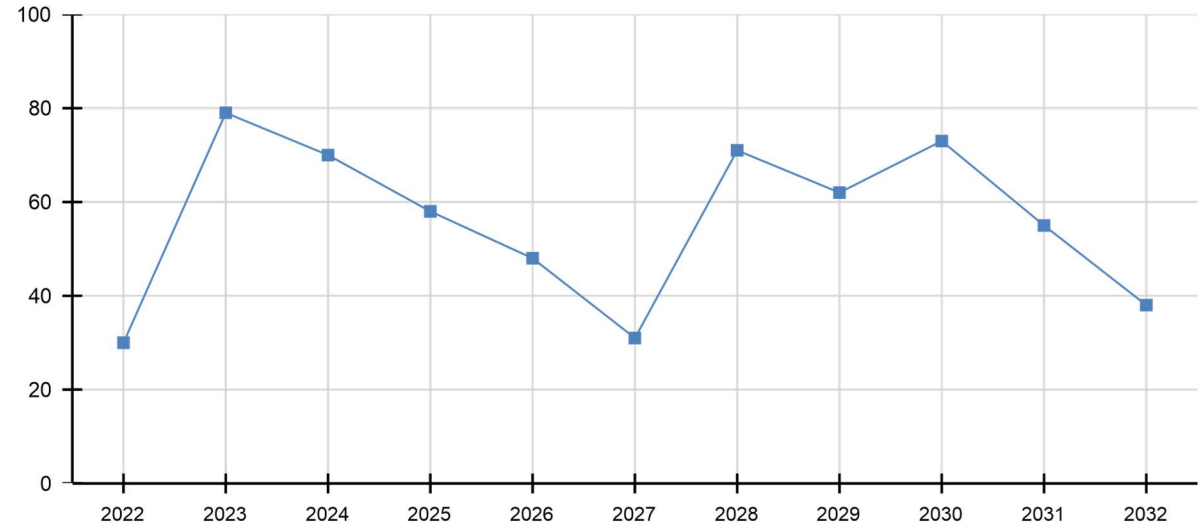


Figure 48: Vehicles Fleet Performance

Over the next 10 years, the performance of the Vehicles Fleet decreases from 79 to 38 at the end of plan. Figure 49 shows the condition status distribution of the Vehicles fleet at each year of the plan:

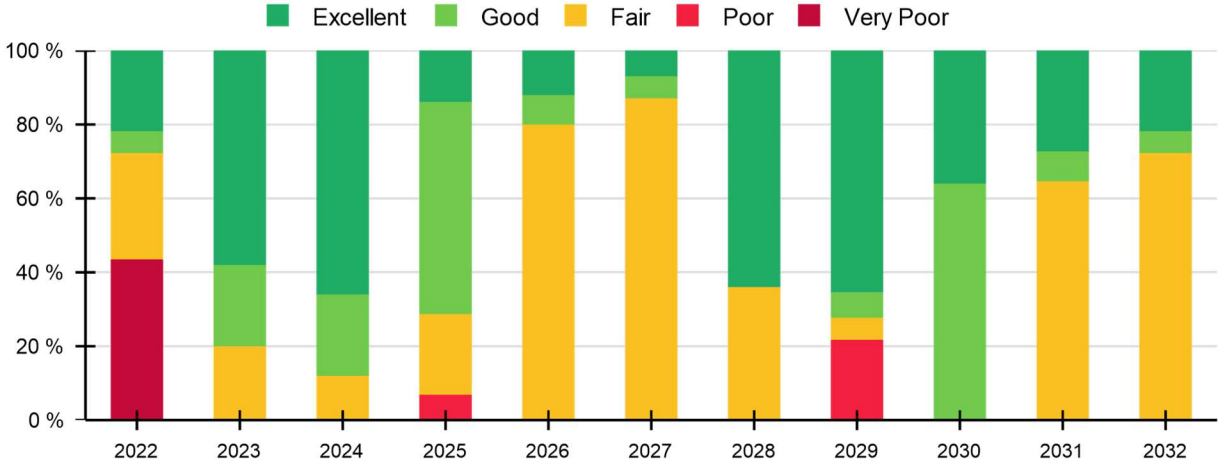


Figure 49: Annual Vehicles Fleet Condition Status

As shown in figure 49, at the beginning of the plan 58% of vehicles is in excellent condition, 22% is in good, and 20% in fair condition. At the end of the 10-year plan 22% will be in excellent condition, 6% will be in good, and 73% will be in fair condition, with the backlog having been cleared in the first year of the capital plan. The following capital expenditures for replacements are scheduled:

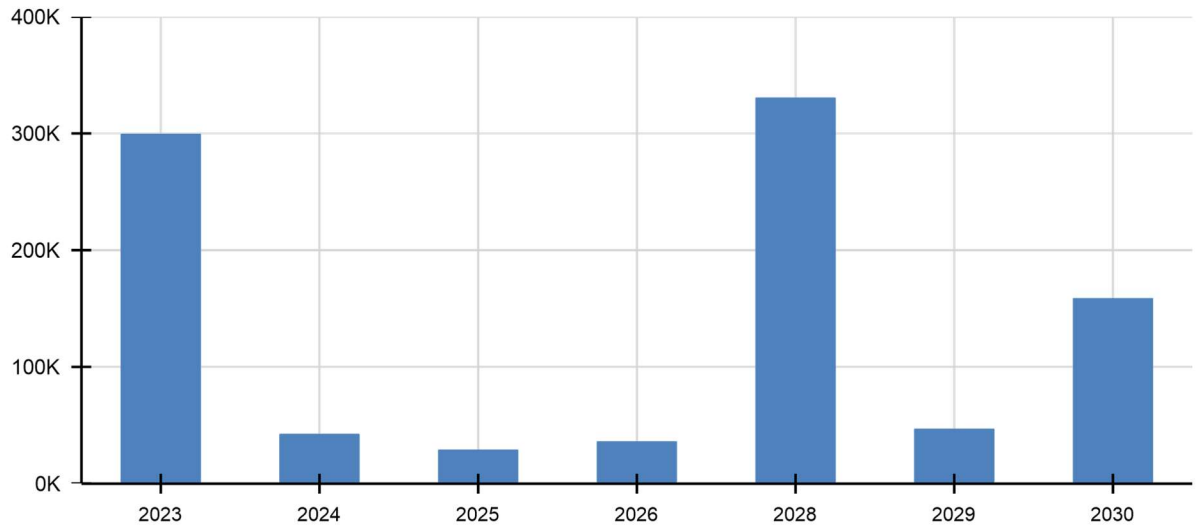


Figure 50: Capital Expenditures

6 CAPITAL INVESTMENT PLAN

6.1 BACKGROUND

Managing the Municipality's capital assets requires an assessment of the long-term capital project requirements and the establishment of the funding for high-priority projects in an efficient, timely and cost-effective manner. As a result of this analysis, the Municipality will be able to more effectively monitor, track and manage infrastructure assets, to ensure that policy makers obtain sufficient funding in order to maintain, at a minimum, and potentially enhance future service levels. Through capital planning, the Municipality of Barrington can plan the future operating budget expenses and reserve funds to manage the financial position over a long-term period. Capital planning also provides the core information needed for implementing the Council's planning and fiscal policies.

An Asset Management Plan provides many benefits including:

- A systematic evaluation of all potential projects at the same time.
- The ability to stabilize the debt and consolidate projects to reduce borrowing costs.
- To serve as a public relations and economic development tool.
- A focus on preserving a municipal government's infrastructure while ensuring the efficient use of public funds.
- An opportunity to foster cooperation among departments and the general public regarding the Municipality's priorities.

6.2 OVERVIEW

The Capital Plan, is an integral part of an Asset Management Plan, is a blueprint for planning a community's capital expenditure, and is one of the most important responsibilities of local government officials. It coordinates community planning, financial capacity, and physical development. It is a tool to assess the long-term capital project requirements of a Municipality and to establish funding of high-priority projects in a timely and cost-effective fashion. The development of a Capital Plan is intended to ensure that policy makers are responsible to residents and

businesses of the community with respect to the expenditure of public funds. It also promotes the provision of continuous efficient services.

The Capital Plan provides a detailed understanding of anticipated investments into tangible capital assets. These assets include basic facilities, services, and installations needed for the functioning of the community. The development of a CIP that will ensure sound fiscal and capital planning requires effective leadership and the involvement and cooperation of all municipal departments. A complete, properly developed CIP has the following benefits:

- Facilitates coordination between capital needs and the operating budgets.
- Enhances the community's credit rating, control of its tax rate, and avoids sudden changes in its debt service requirements.
- Identifies the most economical means of financing capital projects.
- Increases opportunities for obtaining federal and provincial aid.
- Relates public facilities to other public and private development and redevelopment policies and plans.
- Focuses attention on community objectives and fiscal capacity.
- Keeps the public informed about future needs and projects.
- Encourages careful project planning and design to avoid costly mistakes and help a community reach desired goals.

A municipal government must take care of two key responsibilities in managing its infrastructure:

- The first major responsibility is the maintenance and repair of existing infrastructure. Given the high cost to replace linear assets and the fact that they are essential to providing programs and services to the public, it is extremely important that regular maintenance and periodic refurbishments be done to keep facilities and other assets in good working condition for as long as possible.
- The second major responsibility that municipal governments have is to plan and construct new community infrastructure. This involves several steps including deciding what services are to be provided, identifying community needs, careful planning, determining priority investments, figuring out how to finance projects and good management to ensure projects are completed on time and on budget.

Although the Capital Plan is generally maintained separately from the operating budget, they do work in unison since the debt charges on funds borrowed for capital expenditures become expense items in the annual operating budget. In addition, operating and maintenance costs of capital assets have an impact on the operating budget. In order to have a realistic, workable Capital Plan, therefore, it is necessary to estimate the effect that debt service and operating costs will have on future tax rates. In this way, non-essential capital expenditures will not be undertaken at the expense of pending essential capital projects and the Municipality will thus be in a better position to control future debt levels.

6.3 METHODOLOGY

The Municipality of Barrington’s Capital Plan addresses infrastructure deficiencies and future capital expenditures. It includes existing service infrastructure not meeting engineering standards, the cost of renovation or replacement of infrastructure which has exceeded its service life and which consequently, is not meeting required service standards. Provision is required to renovate or replace previously constructed infrastructure when it reaches the end of its service life. These costs

do not include on-going operational and regular maintenance (which typically represent the greatest cost component of a facility's service life, for example). Unless informed by the Municipality of Barrington, requirements such as investments required to support industrial, commercial and residential development in accordance with the growth projections required to serve the community and social needs as well as supply the increasing population and to service to the boundaries of new subdivisions have not been analyzed.

The Municipality of Barrington's Capital Plan includes:

- Development of parameters for each asset class
- Development of rehabilitation and replacement unit costs
- Identifying the asset types to be included in the Capital Plan and determining and confirming the components of each asset class.
- Identification of services to be provided and the capital expenditures to be incurred.
- Determination of the time periods over which the asset is to be constructed or acquired and the costs prorated accordingly.

The methodology used for building this Capital Plan was to:

1) Determine target Levels of Service for each Asset Type.
2) Identify The Municipality of Barrington 's current infrastructure deficit.
3) Determine The Municipality of Barrington 's future requirements to meet target Levels of Service.
4) Prepare a report detailing the capital required for each asset class based on current rehabilitation and replacement unit costs
5) Establish the cost of maintaining existing infrastructure while addressing the infrastructure deficit.

7 ASSET MANAGEMENT PLAN RESULTS

Like most other local governments in this province, the Municipality of Barrington is dealing with aging infrastructure and constrained budgets. Upon completion of the collection of all the pertinent data, the capital plan was generated and broken down by asset class for the years 2023 to 2032. Inflation will be incorporated in the financial analysis. The results are as follows:

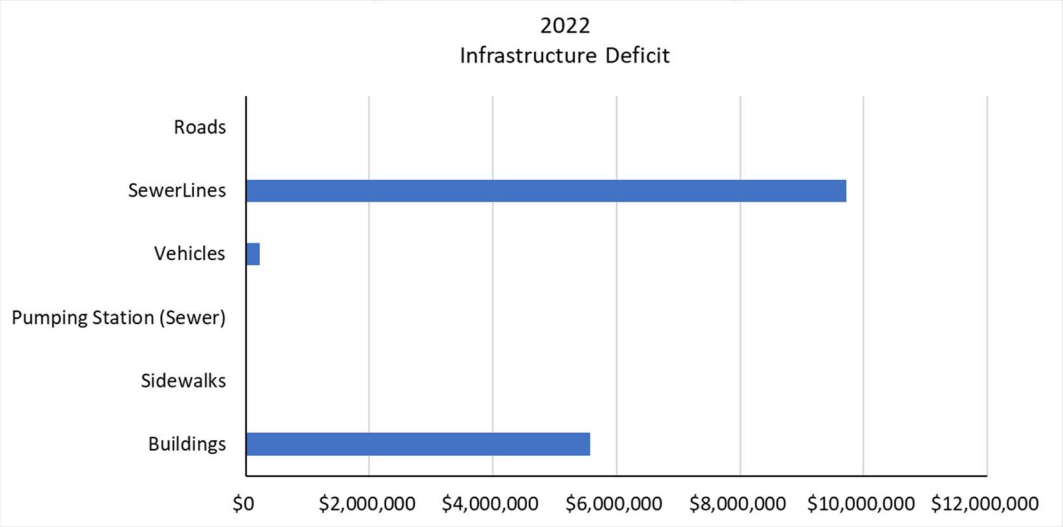


Figure 51: 2022 Infrastructure Deficit by Asset Category

The total Infrastructure deficit is $15.51 million, contributed primarily by Sewerlines ($9.71 million), Buildings ($5.57 million), and Vehicles ($222 thousand). The 10-year Capital Plan is summarized below:

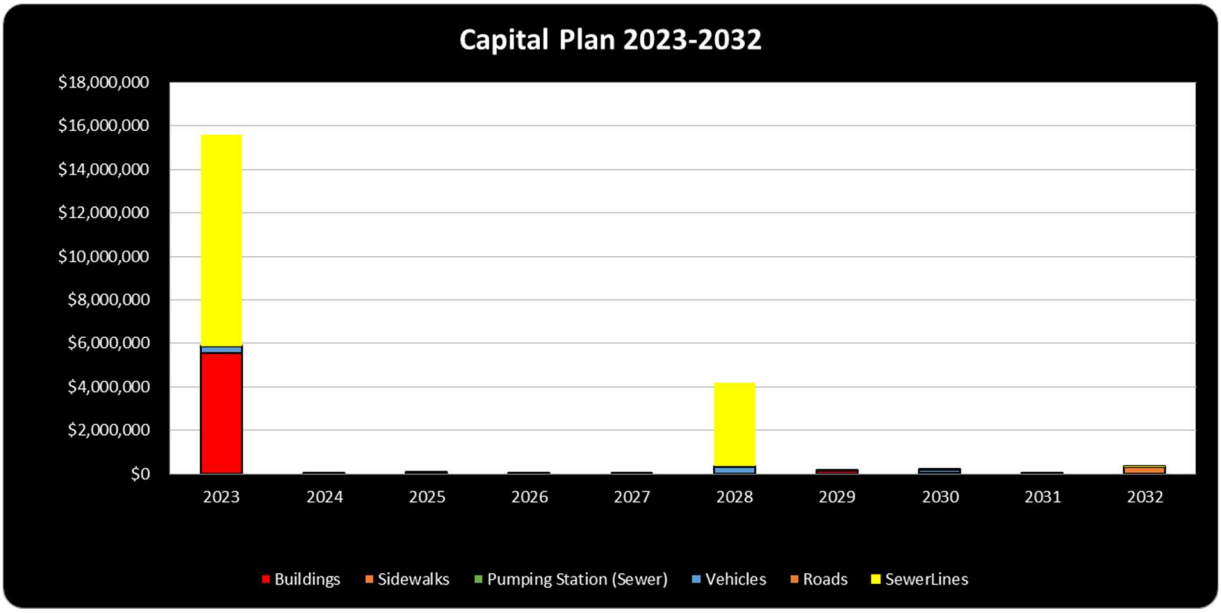


Figure 52: Summary of Capital Plan 2022-2032

Timeframe	Year	Capital Projects (Incl. HST)
Year 2022-2031	2022	$16,137,671
	2023	$45,342
	2024	$34,972
	2025	$41,226
	2026	$2,316
	2027	$5,167,382
	2028	$229,914
	2029	$269,179
	2030	$74,578
	2031	$473,219
Total		**$22,475,798**

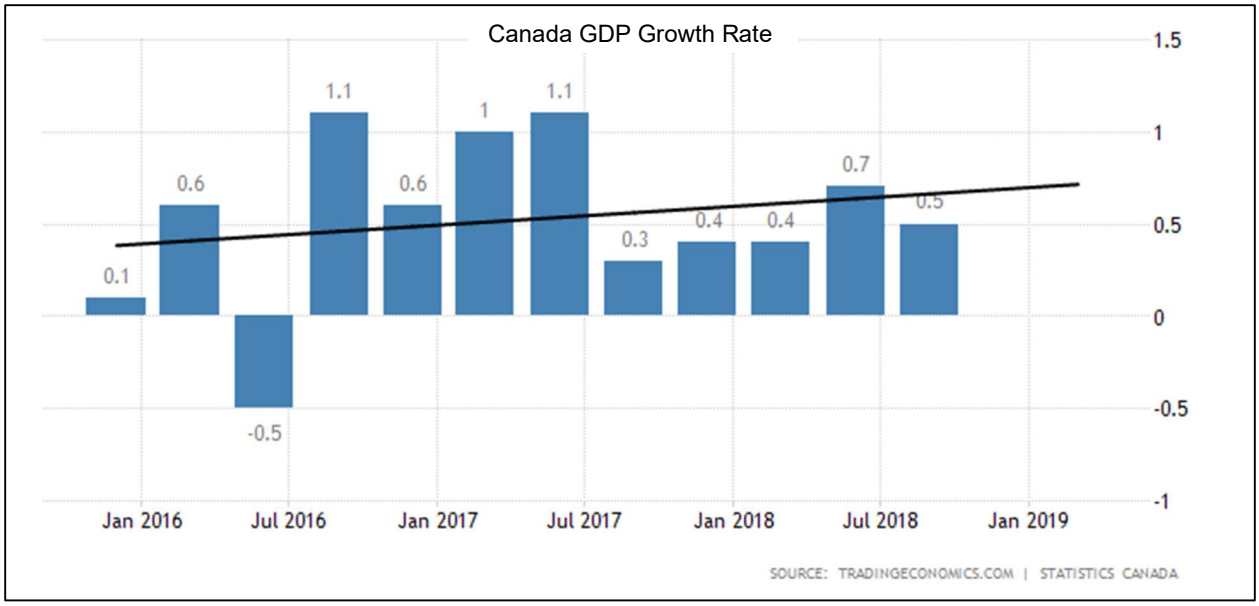
Timeframe	Year	Buildings	Sidewalks	Vehicles	SewerLines	Roads	Pumping Station (Sewer)
Year 2022-2031	2023	$5,573,341	$0	$299,301	$9,715,516	$3,795	$0
	2024	$0	$0	$42,327	$0	$0	$0
	2025	$0	$0	$28,858	$0	$2,685	$0
	2026	$0	$0	$35,926	$0	$0	$0
	2027	$0	$0	$0	$0	$1,950	$0
	2028	$0	$0	$330,452	$3,861,456	$11,760	$0
	2029	$133,977	$0	$46,733	$0	$0	$0
	2030	$0	$39,028	$158,655	$0	$6,735	$0
	2031	$0	$0	$0	$0	$54,720	$0
	2032	$0	$312,784	$0	$21,580	$1,110	$0

The most significant capital renewal projects are for Sewerlines, Buildings, Vehicles, and Sidewalks. For the Buildings, it is recommended to have an Element/Component assessment done to determine if a rehabilitation/renovation is feasible, rather than a full replacement/reconstruction. A detailed project-by-project breakdown of this Capital Plan and all proposed or consultant/study recommended projects are included in the capital project list in Appendix A.

8 FINANCIAL PROJECTIONS

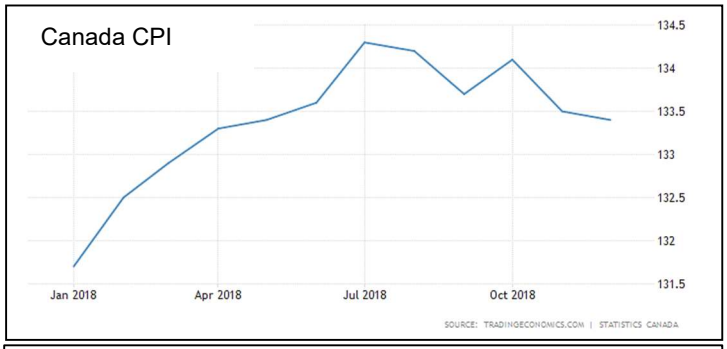
Our first steps in Financial Forecasting include compounding/inflating historical costs to Present Value (2022), and then further compounding/inflating these numbers to meet future requirements. Due to the volatility of inflationary factors, we were not able to determine a comprehensive regional "*Municipal Cost Index (MCI)*" that was reliable enough to have confidence in. We therefore used the CPI (Consumer Price Index) for the historic analysis. For financial forecasting beyond 2022, we assumed an inflation rate of 3.5%. In recent years inflation has been in the 2% range but has recently gone up to as much as 5%. We therefore believe that a 3.5% inflation rate is a reasonable assumption for long-range financial planning.

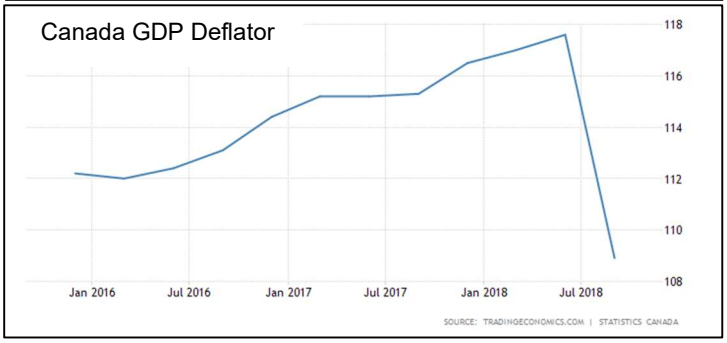
Our basic assumptions and calculations, included within this document, are key to the planning process and serve as the base for the forecasting and predicting your future budgetary requirements and needs.



8.1 CONSUMER PRICE INDEX: OUR PERSPECTIVE

A price index measures the change in the costs of purchasing a fixed basket of goods and services in the current period, compared to a base period, typically month-over-month or year-over-year. The most widely applied measure of inflation/price index is the Consumer Price Index (CPI). Given its pervasive use in setting cost-of-living adjustments, it can be the appropriate metric when calculating the rate of consumer inflation at the national level. Major components of the CPI include housing, food, and transportation.





Extending the use of the CPI into discussions about the appropriate level of tax and fee rate increases becomes problematic, however, because a government's actual experience with inflation can differ greatly from the CPI. This is because the largest expenditures for governments are typically labor, materials, and contractual services — different factors than those found in the CPI. Spending patterns that are different than those of other economic sectors. A price index that does not reflect the municipal purchasing structure does not truly reflect changes in the cost experience, and thus the purchasing power, of local governments. For instance, the CPI reflects household spending patterns that focus on shelter (27.7 percent of the Statistics Canada CPI basket), transportation (19.5 percent), food (15.5 percent), and recreation (12.9 percent) — none of which registers as leading purchase categories for local governments.

There are two main parts to the MCI (Municipal Cost Index) calculation: the weightings of the expenditure categories (showing the relative importance of items in the index), and the inflation factor used for each component. The inflation factors for expected price changes are based on economic data from two main sources, the Conference Board of Canada (CBOC) and Statistics Canada. The key issue is to match an appropriate inflator from these external sources to the types of expenditures in each budget category. MCI can be used in the following ways:

- To measure the increase in overall municipal expenditures attributed to inflation;
- To allow managers to more closely monitor the increase in spending by expenditure category, thus making inflationary price increases or decreases more visible;
- To provide an indication of the historical, current, and future direction of prices relative to municipal expenditures;
- To explain increased expenditures attributed to inflation when submitting annual budgets.

As mentioned at the beginning of this section, we did not use MCI in the analysis due to the volatility of the inflationary factors in Alberta.

8.2 FINANCIAL STRATEGY ASSUMPTIONS

The following summarizes the key assumptions used in the preparation of the financial strategy for major assets:

- 3.5% annual operating income increase (property taxation).
- 3.5% annual increase in user fees and other revenues.
- 3.5% annual operating expenditure increase.
- 3.5% annual increase in capital replacement costs.
- 2022 Canada Community-Building Fund (formerly Gas Tax Fund) of **$354,424** as per Nova Scotia's 2021–22 Canada Community-Building Fund allocations and top-up amounts, extended beyond 2022 with no increases.
- Existing funding sources, as identified in the 2021 FIR or Financial Statements.
- No growth-related capital has been included in the analysis as the financial strategy. relates to the replacement of existing assets.
- Capital replacement needs as identified in the previous section of this report.

It is important to keep in mind that assumptions may significantly change over time. In addition, capital replacement cost estimates may vary from current projections. As such, there is a need to monitor the financial strategy over time.

8.3 FUNDING REQUIREMENTS

In our efforts to create the best plan moving forward for the Municipality, ISI decided to create two scenarios:

- Capital Plan including infrastructure deficit (backlog)
- Capital Plan (excluding infrastructure deficit)
- The financial analysis separates the primarily tax funded assets from the user fee funded water and wastewater assets, including all related revenues, capital, and operating expenditures.

The financial analysis is applied together for both the primarily tax funded assets and user fee funded water and wastewater assets, including all related revenues, capital, and operating expenditures. This section looks at all assets, including other than Environmental (Water, Wastewater and Solid Waste) that have their own dedicated User Fees. Overall, the tax revenues have not significantly increased, while the operating expenses have increased. The loss in tax revenue can be attributed to a decline in population. With a current annual Property Tax increase of 3.5%, a Capital Plan that will eliminate the deficit over the next 10 years requires the Municipality to make an average annual capital investment of $1,653,693 as compared to the current contribution of $518,621, resulting in an annual funding gap of approximately $1,135,072. The Municipality is not generating sufficient funds, not even to cover its operating expenses, and by our calculations would have to increase the property tax annually by 2.5% above the 3.5% base rate to 6.0% per year to cover its operating and projected capital expenditures during the 10-year plan period.

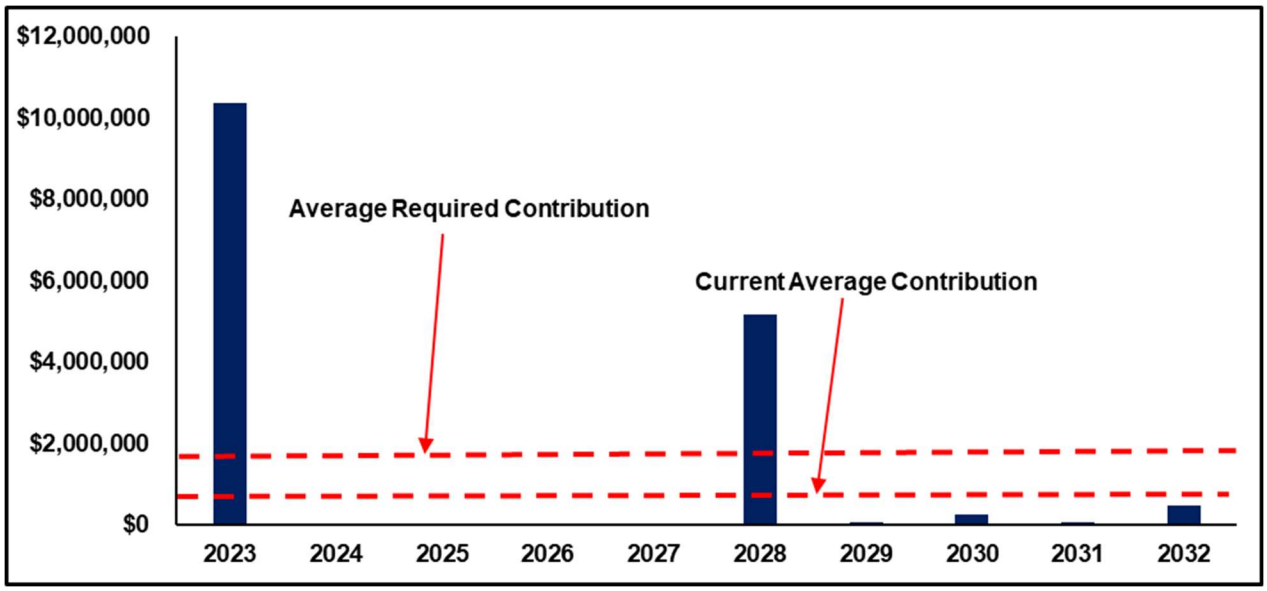


Figure 166: Tax Funded Capital Program Contributions (Required vs. Existing)

9 FINANCIAL STRATEGIES – THE INFRASTRUCTURE GAP

Financial sustainability requires that a Municipality ensures that there are sufficient resources to support the delivery of services for which the Municipality bears responsibility. Given the need and benefit for further infrastructure investment in order to protect, sustain, and maximize the use of The Municipality of Barrington's infrastructure assets, a number of options and strategies have been considered. Through the optimization software, for example, strategies are recommended which allow for an increased deficit on low volume rural Bridges, while directing capital to more critical non-transportation services. Deficit elimination is outside the financial capability of the Municipality, but much can be done to ensure non-priority items can be put on the backburner while critical services remain adequately funded.

9.1 STRATEGY 1: SPECIAL LEVY

One option to raise funds is to implement a 2.5% special infrastructure tax. By applying a special infrastructure tax levy of 2.5% annually, The Municipality of Barrington will increase the funds

available over the 10-year period by approximately $10.79 million. This reflects the significant power of compounding:

The following table is provided for illustrated purposes to help explain the significant potential through a modest levy increase to address an infrastructure gap:

2.5% Special Infrastructure Levy	
2022	$ 147,465
2023	$ 308,939
2024	$ 485,443
2025	$ 678,067
2026	$ 887,970
2027	$ 1,116,391
2028	$ 1,364,646
2029	$ 1,634,142
2030	$ 1,926,373
2031	$ 2,242,935
Total	***$ 10,792,372***
Average increase	***$ 1,079,237***

9.2 STRATEGY 2: RETHINKING INFRASTRUCTURE SERVICES

Optimization
The potential exists to reduce infrastructure costs by determining the most cost-effective options for all capital programs on new or rehabilitated infrastructure by pursuing life cycle cost analysis (discussed earlier in the report). The DOT (Decision Optimization Technology)™ capital planning software will be instrumental in assisting The Municipality of Barrington in focusing on preventive maintenance, and optimizing the allocation of the capital budget to determine highest return on investment.

Service Reduction
Recognizing the significance of the infrastructure deficit, the Municipality should consider a services review with the objective of re-evaluating the priorities of the community and cost of services provided with the objective of streamlining and potentially eliminating low priority services.

Long Range Planning
Many municipalities develop rehabilitation and replacement programs on a system-wide program basis versus annual project by project basis. This will allow for improved prioritization and coordination of required work.

Deferred Replacement
The infrastructure deficit can be viewed as hypothetical in some cases, applying conservative engineering lifecycle calculations that may be overly aggressive in comparison to real-life experience. For example, you might project the life of a building to be 50 years, but many fully functional buildings are more than 100 years old. Due to the limited funds available, some consideration should be given to where the replacement of some assets may be deferred.

9.3 STRATEGY 3: STRATEGIC USE OF DEBT

In some circumstances, it makes good sense to incur debt today rather than take the consequence and cost of allowing assets to deteriorate to a point where replacement or reconstruction would substantially increase cost to the community. The concepts involved with changing the oil in our cars and fixing the roof of our house also apply to preventive maintenance on road networks, for example. Keep a road in good shape with regular maintenance and you will never face a full reconstruction.

Due to the backlog in the tax-supported programs, there is a need to examine the cost/benefit of addressing these needs through the issuance of debt. Using debt strategically can provide capital funding flexibility by allowing certain infrastructure to be built and used before sufficient revenue has accumulated to offset the needed investment. Debt is frequently issued and considered a standard practice in Municipalities for capital projects that are long term in nature and that benefit future taxpayers, thereby spreading the costs across future years. As such, debt promotes inter-generational equity in that infrastructure is paid for by those who use it. With favourable interest rates and significant backlog, the Municipality may wish to consider the need to issue debt to expedite capital replacement.

A debt management policy improves the quality of decisions, identifies policy goals and demonstrates a commitment to long-term financial planning, including a multi-year plan. Adherence to a debt management plan signals to rating agencies and capital markets that the Municipality is well managed and is well positioned to meet its obligations in a timely manner. The Province regulates the amount of debt that Municipalities issue by setting an annual repayment limit for each Municipality (typically 25% of a Municipality's own source revenues). Based on our experience, Municipalities typically establish thresholds below the Provincial limit to take into consideration taxpayer affordability and to ensure flexibility.

In addition to debt guidelines, monitoring also becomes important when considering the idea of the increased use of debt as a funding source to ensure that it is being used in a fiscally responsible manner. Government Finance Officers Association recommends that Municipalities adopt policies that specify appropriate uses for debt.

The following strategies are recommended to determine the most appropriate time to issue debt.

- Debt will be proportionate to The Municipality of Barrington's tax base and will not put an excessive burden on operating expenditures.
- Outstanding and planned debt levels will not exceed an amount that can be supported by the existing and projected tax revenue base. Debt policies will focus on:
    - projected debt requirement
    - limits and benchmarks
    - term and structure of debt
    - use of reserves to offset debt issuance
- Long-term debt for the replacement and refurbishment of existing capital assets will be reduced and a planned process will be developed whereby an annual contribution will be made to meet lifecycle needs of all assets.

The following policies are recommended to manage debt within The Municipality of Barrington:

- Tax Debt Charges as a percentage of Tax Own Source Revenues will not exceed 10%.
- Long-term debt financing will be restricted to specific project types:
    - Increased/new services to residents for new initiatives
    - New, non-recurring infrastructure requirements

- Projects which are supported by a business plan that shows revenues will cover capital and interest costs
- Projects where the cost of deferring expenditures exceeds debt servicing costs
- Project costs not recovered from Development Charges
- Projects tied to third party matching funding

(Note: These restrictions may have to be phased in to meet short-term budget challenges.)

- The length of the term of debt will not exceed the useful life of the underlying asset.
- The Municipality of Barrington will monitor and report on all forms of debt annually.

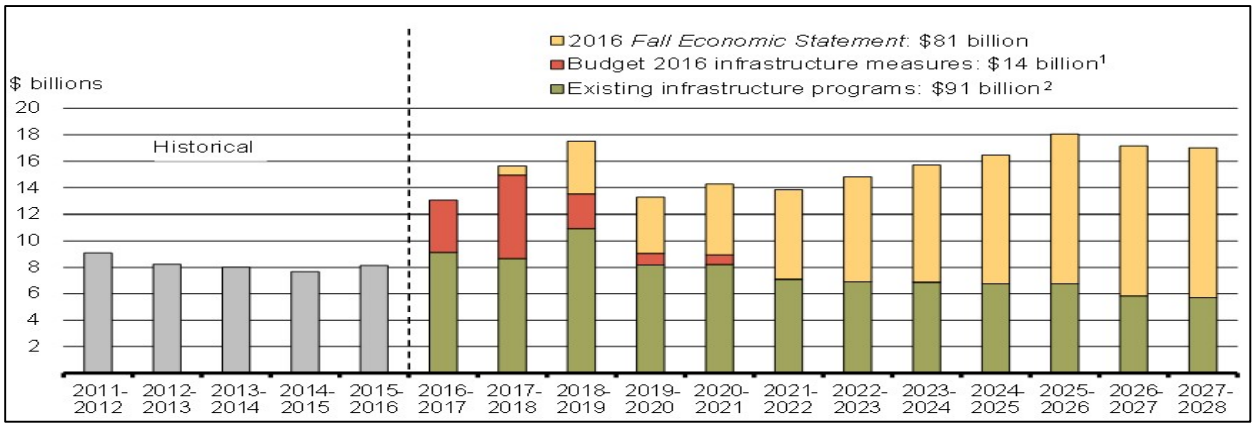
9.4 STRATEGY 4: USE OF GRANTS

It is well established that the condition of Canada's municipal infrastructure is one of the keys to underpinning, maintaining, and enhancing Canada's economic productivity and competitiveness. It is therefore clearly in the national and provincial interests for the federal and provincial government to institute permanent and sustainable infrastructure funding. Along with the strategic use of debt, the Municipality can also apply for the grants available from the Provincial and Federal governments. Some significant components of the infrastructure deficit can be dealt with through close monitoring of grant programs and a careful expression of interest to access these funds.

FEDERAL GOVERNMENT INVESTING IN CANADA

Across the country, people and communities are in need. The middle class and those working hard to join it need the opportunities that come with good, well-paying jobs, and communities need help to maintain, improve and expand the things that make Canada's Villages and cities great places to live.

Investing in Canada's infrastructure builds strong communities and helps to strengthen and grow the middle class, setting the stage for sustained economic growth in the future. In Budget 2016, the government made a down payment on future growth by making immediate investments of $11.9 billion in public transit, green infrastructure, and social infrastructure. This 2016 Fall Economic Statement strengthens the government's commitment to long-term growth for the middle class. It proposes an additional investment of $81 billion over 11 years, starting in 2017–18, in public transit, green infrastructure, social infrastructure, transportation that supports trade, Canada's rural and northern communities, and smart cities. The government will also establish a new Canada Infrastructure Bank to provide innovative financing for infrastructure projects, and help more projects get built in Canada, where public capital can be leveraged.



Considering existing infrastructure programs, new investments made in Budget 2016 and the additional investments contained in this Fall Economic Statement, the government will make a total investment in Canada's communities of more than $180 billion. This commitment is unprecedented in Canadian history.

The Municipality of Barrington can also apply for infrastructure funds to the different programs and funds available for the Province of Nova Scotia, including:

- Investing in Canada Infrastructure Program
- Canada Community-Building Fund
- Disaster Mitigation Adaptation Fund
- Smart Cities Challenge
- Other Infrastructure Canada Programs
- Programs Delivered by Federation of Canadian Municipalities
- Program Delivered by Community Foundations Canada
- Programs Delivered by Other Government Departments and Agencies

10 RECOMMENDATIONS

10.1 SOTI RECOMMENDATIONS

The SOTI/Capital Plan identifies a number of asset-specific recommendations. However, there are six recurring recommendations that should be addressed in future strategic asset management initiatives:

1. Develop, through more detailed analysis, a plan for allocating the additional funds to the operating and/or capital budgets, as required, in order to successfully develop, implement, and maintain an approved asset management plan;
2. Develop a policy and implement a strategy to reach long-term sustainable funding for each of the assets covered in this SOTI Report;
3. Implement a comprehensive budget structure along service delivery lines, so that service managers can adequately know what the true total cost of their service is (including asset management, operations, capital, and borrowing costs).
4. Review the selection and use of rehabilitation strategies on life-cycle costing and on a return-on-investment (ROI) basis.
5. Review operating and maintenance practices, balancing least life-cycle cost against level of service and risk exposure, on a business-case basis using InfraGuide Best Practices and other industry sources;
6. Provide regular updates to the SOTI Report Card and Analysis

10.2 CAPITAL PLAN RECOMMENDATIONS

1. Asset condition assessment of capital assets should be considered wherever feasible. The application of a standard life expectancy of an asset reflects a financial approach (PSAB 3150). Age-based condition assessment has the least level of confidence for building a capital plan.
2. The Municipality of Barrington needs to build a definitive policy with respect to it's infrastructure deficit.

3. The Municipality of Barrington should release its infrastructure policy, strategy, and intention as it pertains to the infrastructure deficit, including communications, to the general public in order to gain stakeholder support for tough decisions.
4. The Municipality of Barrington should proactively define organizational responsibilities to maintain the asset inventory including proposed and actual project cost information, updating the data as assets are acquired or betterments are added to existing assets and projects are started and completed. In this manner, the accuracy of future Capital Plans will increase over time.
5. The Municipality of Barrington should consider establishing as policy the following guiding principles, that it be:
    a) **Customer Focused:** To have clearly defined Levels of Service and applying asset management practices to maintain the confidence of residents in how The Municipality of Barrington assets are managed.
    b) **Forward Looking**: To make the appropriate decisions and provisions to better enable its assets to meet future challenges, including changing demographics and populations, customer expectations, legislative requirements, technological and environmental factors.
    c) **Integrated System Focused**: Evaluate an asset in terms of its role and value within the context of the greater system, as opposed to examining individual assets in isolation
    d) **Risk-based**: To manage the asset risk associated with attaining the agreed levels of service by focusing resources, expenditures, and priorities based upon risk assessments and the corresponding cost/benefit recognizing that public safety is the priority.
    e) **Value-Based/Affordable**: To choose practices, interventions, and operations that aim at reducing the life cycle cost of asset ownership, while satisfying agreed levels of service. Decisions are based on balancing service levels, risks, and costs.
    f) **Holistic**: To take a comprehensive approach that looks at the “big picture” and considers the combined impact of managing all aspects of the asset life cycle.
    g) **Sustainable**: The Municipality of Barrington will make the appropriate decisions and provisions to better enable its’ assets to meet future challenges, including population growth, people expectations, legislative requirements, technological and environmental factors, without compromising the ability of future generations to meet their own needs.
    h) **Optimal**: The Municipality of Barrington will make informed decisions between competing factors such as service delivery, asset quality & value, cost, and risk by determining which option will deliver the optimal lifecycle value.
6. To meet the goals and objectives of this policy, senior management could consider:
    a) The creation and maintenance of a Comprehensive Asset Management (CAM) governance structure to lead the development of AM tools and practices and to oversee their application across the organization.
    b) Adopt a Comprehensive Asset Management Strategy (AMS) to:
        - Establish, document and continually adhere to industry recognized asset management protocols;
        - Develop asset management knowledge and competencies aligned with recognized competency frameworks;
        - Entrench lifecycle costing when evaluating competing asset investment needs across the Municipality of Barrington assets;

- Monitor the performance of the assets and track the effectiveness of AM practices with a view to continuous improvement;

10.3 LEVEL OF SERVICE RECOMMENDATIONS

1. We recommend that the Municipality of Barrington incorporate a Level of Service to maximize the impact of their capital investments with the objective to:
    - Refine levels of service that balance customer expectations with risk, affordability and timing constraints as it pertains to the Municipality of Barrington 's unique requirements.
    - Adopt risk-based decision-making processes that consider the likelihood of asset failure and the consequence of a failure with regards to impacts on safety and levels of service.
2. To assist in better establishing Levels of Service, the Municipality of Barrington should consider collecting technical performance measures required to provide information on:
    - the types of failure.
    - the number of customers affected.
    - the duration of the failure.
    - the severity of the failure.
3. To support decision-making for effective management of the assets, the Municipality of Barrington should consider technical performance measurement and monitoring, undertaken by the Municipality of Barrington such as:
    - Assessing the effectiveness of the operational, maintenance and capital works program.
    - Review and refinement of maintenance and rehabilitation strategies and standards.
    - Assistance in strategic decision-making through definition of remaining life, based on the measure being assessed.

10.4 FINANCIAL STRATEGY RECOMMENDATIONS

A financial strategy to support the asset management plan is a dynamic document that should be updated and re-evaluated on an ongoing basis. The Municipality of Barrington should give due consideration to the following points:

1. The Municipality of Barrington has insufficient funds from existing sources to proactively manage its infrastructure and will need to prioritize its requirements to maximize the impact of existing financial resources.
2. The Municipality of Barrington has a growing infrastructure deficit which is serious considering its population and tax base. A special infrastructure levy will help the Municipality to reduce the gap over time and should be taken into consideration.
3. In the event that the Municipality of Barrington implements an infrastructure levy, the excess funds should be transferred into a reserve so that the Municipality of Barrington has some flexibility to prioritize and sustain future infrastructure and service level requirements and have the ability to match funds with grant programs.
4. The Municipality of Barrington needs to be proactive in reviewing and capitalizing on the upcoming Provincial and Federal programs, as the Municipality of Barrington will need financial assistance to close its infrastructure deficit. It should seek government grants to be able to undertake the capital projects outlined in this Asset Management Plan.

5. The Municipality of Barrington needs to be proactive in reviewing funding options including Infrastructure Nova Scotia Lending Policies, Private Public Partnerships, user fees and other funding options to have an understanding of financing options.
6. The Municipality of Barrington needs to embrace the principles of Asset Management to formulate assumptions, projections, and strategies going forward. The Plan should be modified and updated on an ongoing basis.
7. The Municipality of Barrington should track and build awareness of the results of its projections on current operating and capital spending and funding levels with the objective of fine-tuning the forecasting process.
8. The Municipality of Barrington should continue the analysis and examination of key financial goals and strategies that guide future priorities and expenditures.

11 CONCLUSIONS

The vast majority of rural Canadian municipalities do not currently have a sufficient tax base to gain control over their infrastructure deficit. Without corrective action over the next 10 years, these communities will see a significant deterioration in the level of service being offered to their residents. Increased taxes and/or deteriorating levels of services will trigger a migration to larger municipalities, further undermining the smaller community's tax base. Although Provincial and Federal governments are now committing to substantially increased investment in infrastructure, much of it ends up in major urban centers where the greatest number of citizens are served.

ISI worked with the Municipality of Barrington's Chief Administrative Officer Chris Frotten, who was responsive in providing ISI with information. As highlighted in the Report Card, the current state of the infrastructure, based on available data, condition rating and age analysis, presents a picture of the Municipality's assets in need of work. The Municipality should continue to be proactive in their strategies, to extend asset useful life and avoid major rehabilitation/reconstruction or replacement costs. The plan should also be updated as new data and information becomes available.

It is highly recommended that the Municipality of Barrington embrace the principles of Asset Management. Managing existing infrastructure at the right time, involves knowing and doing the most cost-effective maintenance, repair, rehabilitation or replacement activity at the right time throughout the entire lifecycle of the asset. Beyond cost savings, assets need to be viewed in terms of their ability to enhance the quality, function, capacity, and safety of the service being provided.

The process of implementing Asset Management is rife with challenges. It requires clear direction from the Council, significant cross-departmental cooperation, the allocating of time, energy, and resources to assume new responsibilities, consultation with the community and working with constrained budgets to balance priorities. Since infrastructure management deals with assets that have long lifespans, it may take years before a substantial financial return on investment (ROI) becomes apparent. Still, managing existing, capital-intensive, public-sector infrastructure assets could provide very significant benefits (i.e. 20 – 40% reductions in life cycle costs).

Smaller municipalities need to build a strategy for self-sufficiency. Better capital planning should be high on that priority list. As it pertains to road networks, a municipal council's first order of business is to capitalize on the significant cost savings and lifecycle gain associated with road preventive maintenance. A second initiative would be to use advanced analytical tools to attain the highest possible return, both from a financial and socio-economic perspective, on road capital

expenditures. Only by stakeholder buy-in on a practical and implementable capital plan can communities stem their infrastructure deficit, maintain a quality of life, and plot a course for the future with confidence.

Finally, the Municipality may be faced with difficult decisions over the next years to manage its infrastructure without increasing its deficit and while meeting the level of service that the community expects. The Council should put together a public communication program to engage the community in discussing the true cost of services and the assets required to provide those services. Community and stakeholder buy-in for an implementable asset management plan and service levels in line with public expectations and willingness to pay are critical to the success of the program.

12 APPENDIX A – DETAILED LIST OF CAPITAL PROJECTS

A detailed list of capital projects for each asset type is provided under a separate cover.