



Asset Management Risk Strategy

Town of New Tecumseth

10 Wellington Street East, Alliston, ON



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Acronyms and Abbreviations

CAPEX	Capital expenditure
FMECA	Failure Mode Effects and Criticality Analysis
FMEA	Failure Modes and Effects Analysis
ETA	Event Tree Analysis
FTA	Fault Tree Analysis
HAZID	HAZard Identification
HAZOP	HAZard and Operability
HACCP	Hazard Analysis and Critical Control Points
LOS	Levels of Service
MMRA	Must-Manage Red or high Amber
OPEX	Operating expenditure
SIF	Strategic Importance Factors

Glossary

Consequence of failure:	A measure of the direct and indirect impacts on the Town if an asset failure was to occur.
Critical assets:	Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non-critical assets.
Incident:	Occurrence caused by either human action or natural phenomena that may harm and may require mitigation.
Probability (likelihood) of failure:	Probability is defined as the likelihood or chance that an event will occur within a specified time frame
Remaining life:	The period from the current point in time to the time an asset requires renewal.
Risk:	Risk refers to the uncertainty that surrounds future incidents and outcomes. It is a function of likelihood and consequence.
Risk cost:	The assessed annual cost or benefit relating to the consequence of an event. Risk cost equals the costs related to the event multiplied by the probability of the event occurring.
Risk management:	ISO 31000 defines risk management as “coordinated activities to direct and control an organization with regard to risk.
Triple Bottom Line:	The confluence of risks and opportunities associated with environmental, social, and economic performance has made sustainability a strategic priority. Measuring an organization’s environmental, social and economic performance is referred to as “Triple bottom line”. A sustainability report for an organization will help understand how well the reporting organization is doing on the triple bottom line.
Threat:	The presence of a hazard or vulnerability may be natural or human induced, either accidental or intentional to damage or destroy an

Asset Risk Strategy

asset. (E.g. Arson, Vandalism, Flooding, Heat wave, Storm surge, pandemic etc.)

Vulnerability:

A characteristic or attribute of an asset which renders it susceptible to effects of an incident

Infrastructure Asset:

Infrastructure asset consists of long-lived capital assets that can be preserved for a number of years than most capital assets. They can be linear or vertical.

Introduction

Asset management involves understanding and balancing performance, levels of service, costs, and risks associated with an asset. Risk management is an integral part of managing an Infrastructure Asset throughout its lifecycle. Any approach that an organization takes to engage and maintain its assets involves (by the nature of the asset or activity) the acceptance of risk. A risk arises from the



potential for events or failures to occur. It will vary depending on the location, operating scenario, age and condition of the asset. Events or failures are assessed on the probability of occurring, and the consequences for the

organization should they occur. For instance, the risks related to asset failures in the water services have a higher consequence than those related to parks. There can also be variation within a service area. For example, the risk of a closure to a recreation facility has a higher consequence than to a corporate facility. Utilizing a risk-based approach allows the Town of New Tecumseth to identify the importance of various assets supporting the delivery of services. It also provides the ability to consider the likelihood of asset failures and the associated consequences in terms of the impact on customers and the Town (e.g., reputation, health and safety, etc.).

The Asset Management department for the Town of New Tecumseth will:

- Develop a Risk Management Strategy for the town's assets
- Apply proven risk management practices in our decision-making process.
- Understand the criticality of the service and individual components of the asset base.

- Utilize objective methodologies based on the consequence and likelihood of an asset failure. By understanding the probability and impact of risks on each asset, the Town can adapt interventions accordingly.
- List strategic, tactical and operational risks into risk registers and develop risk mitigation strategies.
- Produce robust forecasts of changes to the asset risk over profile time. This will enable the Town to determine the optimum level of capital and operational investments needed to sustain the assets.

The Risk framework proposed by the Municipal Finance Officers Association (MFOA) was used by the Town of New Tecumseth to develop a risk profile of the assets. The consequence and likelihood tables illustrated in Figure 1.1 and 1.2 were used to categorize risks and determine which service is critical to the town.

Figure 1.1 Consequence Table

Consequence Table							
Category	1	2	3	4	5	Weight	Notes
	Negligible	Low	Moderate	High	Catastrophic		
Strategic	No affect on Community well-being and Organization's Strategic Goals. No media exposure	Negligible impact on Community well-being and Organization's Strategic Goals. Minor local media exposure	Moderate impact on Community well-being and Organization's Strategic Goals. Moderate local media exposure lasting for several days	Significant impact on Community well-being and Organization's Strategic Goals. Intense local media exposure lasting several weeks and/or provincial	Major impact on Community well-being and Organization's Strategic Goals. Significant national exposure lasting several days or weeks.	0.10	
Environmental	Very negligible impact. Reversible within 1 week	Material damage of local importance. Minor, short-term (within 6 months) very isolated damage to the environment	Significant short term (less than 1 year) local damage to the environment	Significant long - term (greater than 1 year) widespread damage to the environment. GTA importance.	Major long - term (greater than 5 years) or permanent widespread damage to the environment. Some provincial importance	0.05	
Health and Safety	No obvious potential for injury or affects to health	Minor medical attention may be required	Potential for minor injury or affects to health of an individual. Full recovery is expected.	Hospitalization of some individuals may be required for a short period of time	Emergency and / or long term hospitalization required for one or more individuals	0.20	
Compliance	Breach of local standard operating procedures but not any mandatory policies or procedures	Ad hoc as opposed to systematic breaches of policies and procedures but not of laws or regulation	Breach of laws/ licenses, including a notifiable breach resulting in recommendations and active monitoring by regulator/ instances of breach of operational policies	Prosecution: Fines < 1M Show cause notice from regulator, enforceable undertaking: Significant and systematic breach of policy	Prosecution with potential for executives to be jailed. Fines > 1M. Loss of critical license/accreditation. Significant and systematic breach of governance policies	0.20	
Operational	Small number of customers experiencing service disruption No impact or reduced quality of service or service loss for few residents	Service disruption at a localized level Reduced quality of service or service loss for critical users for less than an hour An increase in complaints from the community (<10%)	Significant localized service disruption Service loss or major quality of service concern for critical users. An increase in complaints from the community (10%-25%)	Major service disruption Major service loss (less than a day and not able to maintain fire supply) A marked increase in complaints from the community (25%-50%)	Very major, widespread service disruption Disastrous service loss (for more than a day) Significant increase in complaints from the community (increase of 50% or more)	0.25	
Financial Impact	Less than \$5,000	\$5,000 - \$100,000	\$100,000 - \$250,000	\$250,000 - \$1M	Restoration is impossible or greater than \$1M	0.20	

Figure 1.2 Likelihood Table

Probability/ Likelihood Table					
	1	2	3	4	5
	Improbable	Unlikely	Possible	Likely	Almost Certain
Likelihood	Never happens under unusual circumstances	The failure of the asset might occur at rare time as there is few history of this event occurring. Probably never will except under exceptional circumstances	The failure of the asset might occur at some time as there is a history of this event occurring	There is strong possibility of the failure of the asset occurring as there is a frequent history of occurrence	Very likely. Asset failure expected to occur in most circumstances.

The Town’s 2013 Asset Management Plan focused primarily on the age of the asset to gauge it is overall condition. Assets at the end (or approaching the end) of their design lives were graded as Poor to Very poor. The asset profile had very limited condition information available, so using this method was the closest way

to gauge the overall health of the asset profile. However, it does not always address those assets in greatest need of attention. Two assets of the same age may be classified as the same condition, however their operating context, and working environment could impact the remaining lives of each asset. For example, fleet assets used by Public Works and those used by By-law will have varying deterioration and risks due to how often each is operated. A plow truck has major equipment attached for winter maintenance and driving conditions are generally poor and hence are more prone to operational risks, hazards, and service delivery disruptions. A light vehicle used by by-laws has a lower risk in terms of affecting service delivery in the town. They also function in a lower risk environment during operation.

Assets could require replacement well before the end of their design life because of their operating context. As well, assets can continue to operate satisfactorily far beyond their original design lives. Condition based solely on age can skew an organization's view on investment requirements, leading to costs incurred from untimely replacements. For example, age-based-condition would not be a true picture of the assets overall condition if it is only used seasonally.

Assets support critical services to the town (water, fire etc.). Therefore, it is important to have a holistic view of risks to the service rather than an asset itself. Having a risk-based approach will prevent any skewing of investment decision. It also helps assess the relative priorities of individual assets for all services and will bring consistency across the town. Risks for individual assets (or children assets) can be rolled up to a system (or parent level) providing an overall risk. It should also be factored on all assets including the newly acquired assets. The Town will develop a consistent risk management framework across all service areas, while

recognising that framework needs to be appropriate for individual asset based within each of the Service Areas.

Risk Framework

There are several approaches to risk assessment. Choosing which methodology depends on several factors including, the number of assets, their value, and the available data for each of the asset groups.

The Town will identify risk by the following approaches:

- Understanding an asset's overall risk exposure – both within a Service Area and across the Town
- Identifying assets with the highest risk based on a combination of consequence and likelihood of failure. Those are the assets that are in greatest need of attention
- Identifying criticality on assets which have a high consequence of failure, but not necessarily a high likelihood of failure. This will assist in determining those assets that need enhanced operating or maintenance regimes and will form an input to the risk assessment process.
- Developing a plan to manage risk to acceptable levels – considering the cost of the mitigating actions and the funding available.

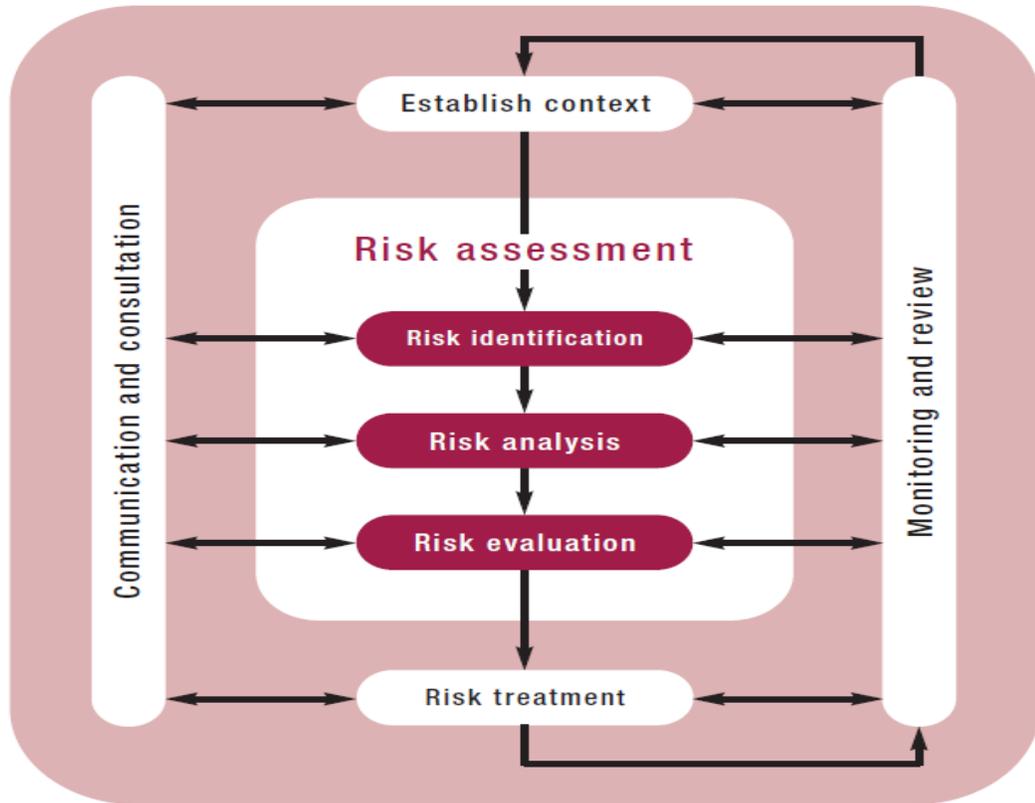
Risk-based approaches can be applied at different levels within the Town, from high level Town wide, to detailed assessments of individual assets. The purpose of this risk management framework is to ensure that:

- All significant risks are identified, including failure to deliver established levels of service.

- The type of risks and the magnitude of their consequence and likelihood are understood.
- Resilience is improved by identifying vulnerabilities and threats.
- Incident management is improved by developing mitigation approaches to prioritized risks.
- There is a reliable basis for decision making, planning, and determination of management priorities.
- There is improved stakeholder confidence and trust.
- Risks are incorporated into services that will be affected due to climate change.

ISO 31000 – Best Practices in Risk

Figure 3.2 Risk Management Framework of ISO 31000



Source: International Standards for Risk Management ISO 31000: 2009

Figure 3.2 is a representation of the Risk Management framework as prescribed in International standards for Risk Management ISO 31000. It provides principles and guidelines on risk management. It can be applied to both strategic and organizational levels to help make decisions and manage processes, operations, projects, services, and assets. The Town will follow the steps described in figure 3.2 to meet the risk strategy.

Step 1 Establish Context – Many asset failures are not related to asset condition but arise from the operational environment, maintenance practices or environmental reasons. Establishing the tendency towards failure requires

assessing a number of “Likelihood Indicators”, but also considers the maintenance and operational regimes for the key elements of the asset. These likelihood indicators are rated against factual statements about the asset failure which represent a scale from improbable to almost certain (1 to 5).

Step 2 Identify Risks –This involves defining a consequence profile for Level of Service failures. The consequence of failure typically considers the “triple bottom line” for a given asset failure. Typical consequence categories could include the following:

- **Strategic:** Impacts to Community well-being and the Organization’s Strategic Goals.
- **Environmental:** Impacts to the environment which could be widespread and take years to reverse.
- **Health and Safety:** Impacts to human health and safety which could be minor injury, or major long-term hospitalizations.
- **Operational or Service Delivery:** Impacts to service quality which could be local or widespread.
- **Financial:** Financial impacts due to restoration efforts resulting from a failure

The first two steps are a group exercise that includes brainstorming risks; combining them by asset groups or service area; developing risk descriptions; and defining consequences should a risk occur. A clearly defined process for identifying risk ensures all Service Areas have the same understanding of how risk is determined and can be communicated to other stakeholders.

Step 3 Analyze Risks – The analysis and prioritization of risks is a repeatable

process. Initial prioritization is done by the service areas objectively. The scores are based on the risk matrix. The risk matrix as shown in Figure 3.1 was developed based on the product of likelihood and consequence of failure. The scores in the matrix is to a maximum of 25 and minimum of 1 and is color coded based on risk level. For example, risk levels of low (green), medium low (yellow), medium high (orange), high (red) and severe (dark red). Each risk is assigned an overall risk score which is a product of the likelihood and consequence scores. The Service Area records the risk score in their risk register and sorts the list in order of descending score. The prioritized registers for each Service Area are combined and reprioritized.

Figure 3.1 Risk Matrix

Ranking Matrix						
		Consequence				
		1	2	3	4	5
Likelihood	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Risk Levels:		
		▪ Risk is Severe for any thing 20 and above
		▪ Risk is High for any thing 15 and below 20
		▪ Risk is Medium High for anything above 8 but below 15
		▪ Risk is Medium Low for anything 4 and above but 8 and below
		▪ Risk is Low for anything below 4

Step 4 Evaluate Risks - Since a consistent risk framework is being adopted across the Town, the risk scores produced by this approach will enable a comparison within a Service Area or across all Service Areas. This supports decision-making by comparing the magnitude of the risk with its risk tolerance.

Step 5 Treat Risks – Impact on Levels of Service due to risk is reflected in the risk register. The risk treatment identifies the current and possible mitigation actions used by the Town.

Recommended Approach

Currently there is no risk management in the Town. The Town of New Tecumseth will utilize a model proposed by MFOA (Municipal Finance Officers Association) to rank risk in terms of likelihood and consequence of failure. This approach weights individual consequence categories (Strategic, Environmental, Health & Safety etc.) which are multiplied together to produce an overall consequence score. The likelihood of failure score does not require weighting and focuses on ranking probability on a 1 to 5 scale. The likelihood of failure is based on the asset condition. The weighted consequence score multiplied by the likelihood score is the overall risk score. This approach provides a fair level of granularity in terms of assessing the asset condition, its failure rate and handling of consequences from business objective.

It is important to note, the impact of a consequence category will vary in level of importance to the Service Areas. Weighting scores for each category will be derived through discussion based. Each category is matched head-to-head (one-on-one) with the other categories in order to arrive at an overall ranking of categories. It is often difficult to attribute one risk score to an asset which may fail in a variety of ways with a variety of potential consequences. This can lead to opting for the “worst case” scenario thereby overestimating the true likelihood and/or consequences of an asset failure, skewing subsequent prioritization attempts. Therefore, adopting a summative approach to likelihood and consequence that is standard across all Service Areas will address this issue. The proposed town wide risk-based approach will be relevant and makes the best use of current practices .

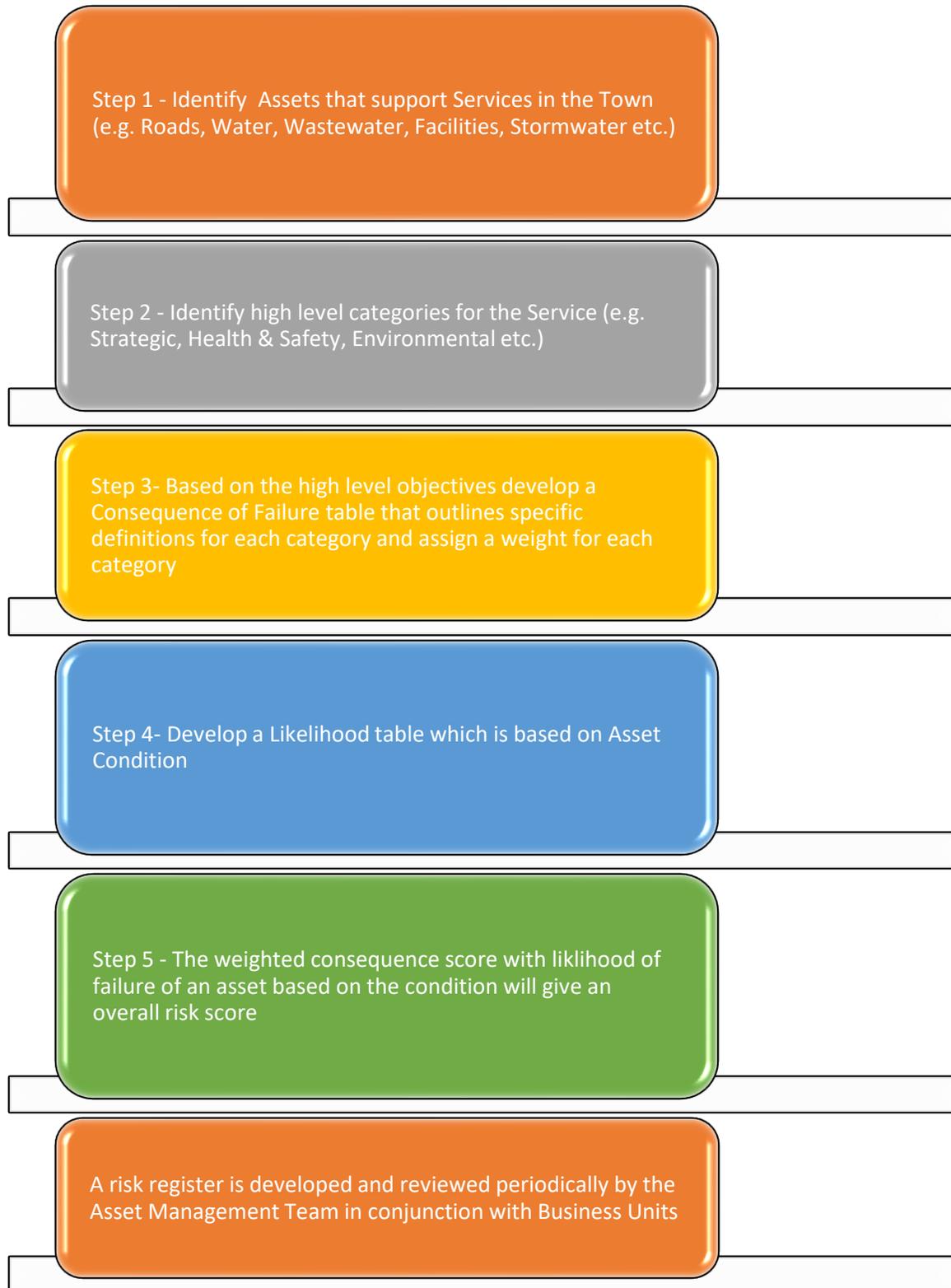
The proposed approach asks the following questions:

- In the event of a failure of an asset what will be the consequence to the Town from different category perspective. How does an asset failure have a consequence on service delivery and how severe is the impact to service delivery? The use of a consequence profile allows for the fact that the consequence could be catastrophic or severe but also acknowledges that it could be unlikely and therefore provides a more realistic assessment of consequences. The consequence table also investigates the overall impact to the Town from perspective of triple bottom line which is by measuring the Town's commitment to social and environmental factors in addition to financial and operational impacts.
- Are there any special factors that would inflate the impacts of a failure? (e.g., locational issues). This may be decided at a later stage when the asset management department can investigate area or location specific threats to the assets.

Risks identified in the framework should be reviewed, monitored and reported to senior management within the Service Area on a periodic basis. All risk registers will be of the same format, to enable roll up at the Corporate level.

The diagram in Figure 2.1 illustrates how the Town approached its risk framework

Figure 2.1: Risk Assessment Steps from Town of New Tecumseth



Risk Mitigation Methodology

Assessing vulnerabilities through studies like the drainage master plan, the stormwater study, and the water masterplans will help with identifying risks and corresponding mitigation opportunities. Risks identified can be addressed through contingency plans, ongoing monitoring, inspections, preventative maintenance programs, as well as rehabilitation and replacement activities. The goal is to mitigate impacts a risk may have on the Levels of Service, Health and Safety, and Asset Reliability.

Monitoring and Review

Service Areas will need to identify how risks are likely to change over time. This will largely be dependent on where the Town assets are in their life cycle (i.e., how quickly are they deteriorating?). Therefore, risks will need to be reviewed on a fixed-time interval. This is typically every two years or resulting from external factors or unforeseen events. A recent example would be impacts on service delivery arising from pandemics such as SARS and COVID-19. Risks also should look at the economic impact to the town from a globalization perspective. And should consider subsequent impacts to employment, business and residents. More details for assessing and managing asset risks along with the timeframes for review should be documented in the Asset Management Plan.

Asset Investment Strategies

The following strategies will be employed by the town of New Tecumseth

- a) Preservation First
- b) Beyond Preservation

Strategy 1 – Preservation First

This is an investment strategy that prioritizes maximizing an asset's service life, over expansion or enhancement. For example, managing the road network through annual road resurfacing treatments is a low-cost preservation treatment. This strategy prioritizes managing conditions across the system by keeping assets in low-cost preservation cycle. This allows future savings to be applied to more deteriorated assets bringing them into a state of good repair using high-cost treatments. In another example, a building can be preserved through low-cost preservation tactics such as minor rehabs and rebuilds. However, changing the use of the building could also be a preservation strategy.

Strategy 2 – Beyond Preservation

This strategy addresses assets that have deteriorated to a state which no longer meets the Town's goals for economic development, resiliency, and sustainability. The asset is beyond preservation tactics and would require replacement, enhancement, or expansion. Examples of this strategy are the streetlight enhancement to LED, use of green energy in buildings, treatments not defined as preservation, sidewalk reconstruction, and fleet replacement.

Conclusion

The risk environment is not static and needs ongoing improvement and feedback. There are decisions surrounding rate but severe risks that require careful consideration as the legal, moral and social responsibilities may override the economic considerations. These low likelihoods, but high consequence risks are less likely to be on the radar than high likelihood, but low consequence risks. The recent COVID-19 is a clear example of a low likelihood, but high consequence event can affect the global economy. The Town should incorporate lessons learned and document risk events. This should be used to improve and revise operations, risk mitigation actions and other plans including monitoring and tracking the implementation. Careful consideration of any new equipment required or modifications to facilities, deficiencies in the response and identification of improvements to emergency response plans.

Appendix I – Risk Register

		Note: Scores are given between 1 and 5 (lowest to highest). Each category holds a weighting from 0 - 1.							Consequence	Likelihood Calculated Annually By Assetic	Risk Calculated Annually By Assetic
Asset	Consequences	Consequence - Notes	Strategic	Environmental	Health & Safety	Compliance	Operational	Financial	Weighted Consequence Score	Score	Risk Score
			0.1	0.05	0.20	0.20	0.25	0.20			
Recreation Facilities	Revenue loss	High use building	4	2	4	4	4	3	3.70	1	3.70
Library Facilities	Revenue loss	High use building	4	2	4	4	4	2	3.50	1	3.50
Admin Facilities	Revenue loss	High use building	4	2	4	4	4	3	3.70	2	7.40
Roads Depot	Moving of Staff to another facility	Medium/ Low use building	3	2	4	4	4	2	3.40	1	3.40
Fire Halls	Compliance consequence	Medium/ Low use building	4	2	4	4	4	3	3.70	1	3.70

Appendix 2 – Consequence of Failure Table

Consequence Table							
Category	1	2	3	4	5	Weight	Notes
	Negligible	Low	Moderate	High	Catastrophic		
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Operational	Small number of customers experiencing service disruption No impact or reduced quality of service or service loss for few residents	Service disruption at a localized level Reduced quality of service or service loss for critical users for less than an hour An increase in complaints from the community (<10%)	Significant localized service disruption Service loss or major quality of service concern for critical users. An increase in complaints from the community (10%-25%)	Major service disruption Major service loss (less than a day and not able to maintain fire supply) A marked increase in complaints from the community (25%-50%)	Very major, widespread service disruption Disastrous service loss (for more than a day) Significant increase in complaints from the community (increase of 50% or more)	0.25	
Financial Impact	Less than \$5,000	\$5,000 - \$100,000	\$100,000 - \$250,000	\$250,000 - \$1M	Restoration is impossible or greater than \$1M	0.20	

Appendix 3 – Likelihood of Failure Table and Risk Matrix

Probability/ Likelihood Table					
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Ranking Matrix

Likelihood	Consequence				
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Risk Levels:

	▪ Risk is Severe for any thing 20 and above
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	▪ Risk is Medium High for anything above 8 but below 15
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