Municipal Metrics Catalogue

Version 1.0

November 2018

Level of Service (LOS) Working Group

Municipal Metrics Catalogue

Version 1.0

Preface

This document is available to Municipal Councils and Staff across Ontario as a reference of measures and metrics commonly used to manage infrastructure and meet asset management-related standards and regulations.

There are thousands of measures and metrics used across many jurisdictions, agencies, and industries and are often used in different contexts. This document is not intended to be an exhaustive list of all known metrics and measures.

The intent of this catalog is to assist municipalities and regulators make informed decisions on their choices in Level of Service (LOS) metrics that best align with the organization's objectives. This document is also intended to support choices in the use of measures and metrics at management and operational levels that support and influence the chosen LOS metrics.

The catalog includes measures and metrics that have been historically adopted, and continue to be used and have varying degrees of suitability as LOS metrics for the reasons explained within this document.

The content of this document is expected to evolve through future revisions but remain limited to those most commonly referenced by municipalities and agencies providing public services.

Revision	Date	Notes
V1.0	November 2018	Initial Release

Definitions

Measures and Metrics

KPI, LOS, measure, and metric are terms that are used throughout the industry and are often used interchangeably. The following provides a very brief description of each term and should be considered when choosing to make use of them.

Measure: A value derived from something that can be directly observed and recorded. This may be monetary, a reading from some sort of gauge, an area on a map, or anything that can be describe through direct observation. It may be a numeric value with a qualifying standard unit descriptor or simply a qualitative description of something. Values that are subjectively assigned based on an interpreted set of conditions could be considered a measure.

Metric: A value derived or calculated from one or more measures. It is typically presented as a numeric value having some combination of units of measure that qualify the metric based on the underlying measures. It may be presented as an abstract calculated value without qualifying units.

Key Performance Indicator (KPI): A metric that is used in alignment with a business objective of some form. It is often used as a comparator with a range of thresholds that identify a desirable or undesirable state. KPIs can only be used effectively as comparators if the underlying measures are derived in the same way in the same context. This is often difficult to achieve and must be considered before choosing to compare a KPI from one jurisdiction to another or one business unit to another.

Level of Service (LOS): Perhaps the most challenging of all, a LOS may, in fact, be a measure, a metric, or a KPI. Depending on the context of which it is used. Fundamentally, it must be a value that represents a desired (or undesired) state of services being provided. In public sector, that can be a challenge as many services being provided are not actively consumed or recognized they exist by the public. However, they do all tend to share the trait of being noticed when not available and all but invisible when the service and supporting assets are performing well.

For the purpose of this document, the term metrics will be used throughout to represent the values in context of the catalogue and may be considered a KPI or LOS in the appropriate context.

Leading vs Lagging Metrics

The concept of Leading and Lagging is often dismissed as theory. It can be difficult to apply this theory and put into appropriate context. However, it is an important to understand these terms and the relationship between them to make the best decisions possible on choosing which metrics will be used and in what context.

Leading A metric that identifies a condition that can be directly changed by decisions and actionably items to achieve a different future state or outcome.

As an example, if you would like your vehicle to move faster or slower you must choose to change the pressure on the accelerator pedal or the brake pedal. The direction of your vehicle will change only by choosing to turn the steering wheel one way or another. In both of these examples, choosing to press the brake, the accelerator pedal or turning the steering wheel are all actions (leading measures) that will result the desired outcome.

Lagging A metric that identifies an outcome or reflects an achieved state as a result of one or more decisions on related actionable items (i.e. leading metric). Lagging metrics are more commonly suited to be used as LOS and are more often a value that resonates with the users of the service.

As per the example above, if the desired outcome (lagging measure) is to be moving faster, or slower, or a different direction, those outcomes can ONLY be achieved by taking a specific action that can be described in a leading metric (pressure on gas pedal, brake, or torque on the steering wheel). It is not possible to achieve a different outcome directly without taking a specific action that has the ability to alter the outcome.

It is vital to understand what underlying leading measures and actions are related to the desired outcome (and to what degree) so that appropriate, meaningful, and effective actions are undertaken.

For example, turning up the volume on the radio in the vehicle will not make the vehicle go faster. Speaking louder or slower to someone in a language they don't understand will not improve their comprehension.

Characteristics of Metrics

For each metric, the following characteristics have been identified and are included in the catalogue:

Category: A generalized attribute of the metric falling into one of the following values:

- *Financial* – metrics that are based on monetary values.
- *Technical* – metrics that are based on physical parameters.
- *Qualitative* – values that are assigned through observation that cannot be expressed effectively through a specific value. It may, however, include one or more values as part of the narrative.

Type: A characteristic of the metric falling into one of the following theoretical contexts:

- ***Leading*** - metrics that identify a value in an actionable item and can made by the Organization to achieve a different desired future state or outcome. (*see Definitions section of this document)*

- ***Lagging*** - metrics that are outcome-oriented and reflect an achieved state as a result of one or more related business decisions. Lagging metrics are more commonly suited to be used as a LOS are expected to be a value that resonates with the users of the service. *(see Definitions section of this document)*

Inputs: Outline of the inputs to the metric.

References: List of the regulations, standards, organizations (e.g., ISO, CSA, NWWBI, OMBI,etc..) that are known to reference the metric or some close variation to it.

Suitability as LOS: A rating High/Medium/Low in use of the metric as a LOS measure.

Customer Values: An indication of which common customer values are represented in the measure. Commonly they include: *Safety, Quality, Availability, Capacity, Reliability, Environmental Impact, Sustainability, Climate Impact, Social Impact.*

Interpretation: Information on the meaning of the metric.

Recommended Uses: Commentary that identifies best practice use of the metric and in what context it best applies.

Pros/Cons: Commentary and opinions of the authors of this document on the pros and cons of this particular metric.

Relationships to Other Measures: Identification about how the metric affects (or is affected by) other asset management metrics. This is not intended to be an exhaustive or comprehensive relationship map between metrics, it will provide some examples where there is a clear, well understood relationship between common metrics identified within this catalogue. *It is anticipated that future versions of this document will contain more relationships.*

Acknowledgements

The catalog is a compilation of information from many different sources and will include some content common with one or more publications, documents, and organizations as listed below:

- *Ontario Regulation 588/17* - Asset Management Planning for Municipal Infrastructure – Infrastructure for Jobs and Prosperity Act, 2015
- *Sustainable development of communities – Indicators for city services and quality of life* CAN/CSA – ISO 37120:15
- *2016 MBNCanada Performance Measurement Report* – Municipal Benchmarking Network Canada
- *2014 Performance Measurement Report* – Ontario Municipal CAO's Benchmarking Initiative (OMBI)
- *Alberta Municipal Benchmarking Initiative – Roadways* – 2017
- *Annual Report – Municipal Statistics* 2015-2016 – Province of Nova Scotia
- *Municipal Report Municipal Profile and Financial Condition Indicators Results* 2017 – Cape Breton Regional Municipality – Department of Municipal Affairs – Province of Nova Scotia
- *Manningham Road Benchmarking Report* – January 2016
- *Ontario Regulation 170* (Drinking Water Systems)
- National Water/Wastewater Benchmarking Initiative (NWWBI)
- City of Guelph
- City of London
- City of Cambridge
- Town of Halton Hills
- City of Kitchener

The authors of this document have provided direct reference where similar information has been found, however, there are many other publications and documents that have not been included in the research and have not been referenced.

This catalog is being developed by the Asset Management Ontario LOS Working Group who gratefully acknowledges the support of the following Municipalities who have contributed content and staff resources in the development of this publication:

- Huron County
- City of Cambridge
- City of Burlington
- Town of Oakville
- Region of Peel
- City of London
- Town of Halton Hills
- City of Brampton
- Norfolk County
- Town of Richmond Hill
- City of Kitchener
- City of Guelph
- Town of Owen Sound

Asset Management Ontario wishes to acknowledge the efforts of the members of the ***LOS Working Group*** who have provided support, research, and content to this publication:

- Mike Hausser, P.Eng – *(Chair and Lead Author)*
- Jason Winter
- Dharmen Dhaliah
- Chris Chen
- Sam Sadawi
- Matt Day
- Stephen Bacchus
- Jordon Sangers
- Dalibor Stancovici
- Khalid Shahata
- Johan Krijnen
- Daryush Esmalli
- Danah Ashcroft
- Kim Davenport
- Grace McLenaghan
- Marina Khinich – Kreynin
- Terry Ricketts

This publication is made possible by members of Asset Management Ontario, Ontario Ministry of Infrastructure, and Ontario Municipalities through a combination of direct funding and in-kind contributions.

Individuals who have comments and suggestions or wish to contribute to future revisions should contact info@amontario.ca

Disclaimer

The authors of this document have included content from a number of documents, publications, and organizations and acknowledge that many more references do exist on the subject and have not intentionally excluded any specific document, publication, or organization.

Information in this document is a compilation of many sources including knowledge of the authors that have contributed and have not knowingly infringed on any copyrighted material. References provided in this document have been provided in best efforts to acknowledge content found through research and that further and additional information is available through references provided and other existing information beyond the scope of this document.

This document is published by Asset Management Ontario (Legally registered as AMONTario Center of Excellence – A non-profit organization) as a free resource to organizations that provide and contribute to the delivery and support of public services.

Municipal Metric Index

Bridges

Generic

Roads

Roads

Sanitary Sewer

Sanitary Sewer

Storm Sewer

Water

Water

Municipal Metric Catalogue

Service Area: **Bridges**

Asset: **Bridge**

BCI

Bridge Condition Index

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Detailed inspection of bridge components.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values:
100 - New Structure with no defects found
0 - Structure has failed

Recommended Uses: Generalized indicator of overall condition of bridge structures.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS	CONS
Good method to identify overall relative condition and to direct efforts for follow-up detailed investigations.	Value is subjective and open to preferences of individual inspectors risk tolerance. The metric does not help in the decision of rehabilation or replacement options.

References: OSIM, Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Bridges**

Asset: **Bridge**

Description of images of the condition of bridges/culverts and how this would affect use of the bridges.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric:

Suitability as a LOS Metric: High

Interpretation of Metric Values:

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: Good general information to the public

PROS	CONS

References:

Municipal Metric Catalogue

Service Area: **Bridges**

Asset: **Bridge**

Percentage of Bridges with Clearance Restrictions

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Dimensions of structures (width and height) in comparison to physical dimensions of adjacent roads and industry standards.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A high percentage represents limitations in the movement of goods, machinery, public transportation into or through the community.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses:

PROS	CONS
Easily obtained metric	Restrictions may be by choice and have limited if any impact to the community.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Bridges**

Asset: **Bridge**

Percentage of Bridges with Load Restrictions

Description: Number of structures that have posted load limits over the number of structures that exist

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Canadian Highway Bridge Design Code, OSIM, Structural Engineering Assessment vs carrying capaicty of adjacent roads

Suitability as a LOS Metric: High

Interpretation of Metric Values: A higher percentage indicates limitations on the movement of goods, machinery, and some forms of public transportation. A higher value may also have an overall economic and social impact in the community.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Bridge Management Prioritization

PROS

Metric is easily obtained. Metric is a good indicator of overall investment levels of transportation networks.

CONS

Metric does not necessarily represent structures in poor condition as the load restriction may be applied on structures in good condition but do not have by design the carrying capacity of adjacent roadways.
Some structures may remain load restriction as a choice by the community as part of an overall transportation plan.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **Non-Specific**

# of days to repair defect

Description: A running average number of days between identification of defects and their resolution.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Time tracking of individual defects identified by inspectors (and/or public) and recording date of resolution.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A high number represents a longer period of time - however, that is only relavent in context of response expectations set by the organization, by regulation, or by service agreements.

Impact on Customer Values:

- ☑ Public Safety
- ☑ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Measure of ability to respond to defects. Best used when management has on ongoing practice of monitoring defects in terms of severity, response expectation compliance, and running total of identified defects.

PROS

A good way to monitor overall workload of resources as the number will slip quickly if workload is higher than available resources.

CONS

A difficult number to report and monitor unless a comprensive work order system has been implemented.
The number itself must be compared to organizational or regulatory expectations.
The metric is reported as an average - response to individual defects may be much higher and present a hidden risk.

References: Ontario Minimum Maintenance Standards (Roads & Sidewalks)

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **Non-Specific**

# of re-active maintenance/repair calls per 100km of system

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Annual number of calls for service resulting in a repair vs the length of linear system. Can be applied to any linear system (water, sewer, roads, gas, trails, electricity, etc..)

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Higher numbers are always less desirable. High numbers may be an indication of one or more conditions such as: a lack of capital investments, poor communications, operations management culture, operations resource shortage, deferred maintenance/inspections.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Best used in conjunction with GIS system to identify 'hot-spots' and compared to known and scheduled work to separate calls induced by planned activities vs those that are identified by the public as service issues.

PROS

Easy to measure if a maintenance management system and/or call system has been implemented and configured appropropriately.

CONS

Calls may be a result of planned repair/maintenance activities which may indicate a communications issue - not a system issue. The Maintenance Management System will need to be configured to appropriately incorporate root-cause reporting with each call in order to extract insight to what actionable items (leading metrics) will influence this lagging metric.

References: NWWBI

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **Non-Specific**

AGE

Age of asset

Description: Number of years an asset has been in service

Category: Technical

Type of Metric: Lagging

Inputs to Metric: In service date vs current date

Suitability as a LOS Metric: Low

Interpretation of Metric Values: Only useful in context with overal life expectancy, however, not necessarily representative of need of individual asset.

Recommended Uses: Best used to qualify other metrics in terms of condition and need of an asset. Also best used for aggregate statistics (i.e. avg age of assets in this class).

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Easiest measure available	Poorest representation of the ability of asset to meet current and future service levels. It is an indicator but, not a directly useful measure for many long lived assets as assets that are well taken care of may be in exceeding good state.

References: Common measure requested by various agencies and regulating bodies.

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **Non-Specific**

Defects per KM

Description: # of defects identified per km of infrastructure. May be applied to any linear system such as: Roads, sidewalks, trails, pipelines, etc..

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Visual inspection

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A very high number may indicate a backlog in capital renewal
A moderate number may represent a level maintenance needs.
A low number identifies infrastructure in good working order with minmal overall risk.

Recommended Uses: Overal monitoring of capital re-investment and/or deferred maintenance.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS	CONS
Number is reltively easy to obtain. Year over year monitoring of this metric can quantify backlog in capital renewal or deferred maintenance.	Metric is not comparable to other jurisdictions. Metric does not distinguish severity/risk of underlying defects - many defects may exist below threshold of need of repair and may or may not adequately represent a level of risk.

References: Ontario Regulation 588/17 (Sidewalks)

Service Area: **Generic** Asset: **Non-Specific**

Description, which may include maps, of the area service by a municipal service.

Description: This measure can apply to most public services and an individual metric should be created for each service provided by the municipality.

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Typically a map produced through GIS or other mapping technique using underlying infrastructure mapping information. For soft public services, maps may be best shown in terms of catchment area including the catchment area criteria/parameters.

Suitability as a LOS Metric: High

Interpretation of Metric Values: This measure is purely descriptive providing context for other LOS values.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses: General communication of the extent of the service being provided in the community

PROS

If done visually, it is an excellent means to communicate where and to what extend the service is currently being provided.

Good means to also communicate the planned LOS in future relative to current LOS.

CONS

References: Ontario Regulation 588/17 (water, wastewater, stormwater, etc..)

Service Area: **Generic** Asset: **Non-Specific**

RVP Percentage of Reactive vs Preventative or Scheduled Work

Description: A measure of reactive efforts (or costs) vs planned or scheduled efforts.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Hours or costs associated with re-active workorders vs scheduled workorders for each activity.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: Generally, a highly reactive value will indicate one or more of the following causes: a system that has surpassed its life expectancy, significant deferred maintenance, lack of inspections and monitoring, or simply a re-active operations culture in the organization.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses:

PROS

A good indicator of the overal state of the assets within the service or management practices. It can easily be reported IF and ONLY if the Maintenance Management System has been configured appropriately and information is being captured consistently by the organization.

CONS

The metric may be financial (dollars of cost or hours of labour), or technical in terms of accomplishment metrics. It needs to be captured at each activity level and rolled-up to the system level. The number itself does not identify the root cause and determining the appropriate level is difficult. A much greater analysis of the service, operations, assets, and capital program is required to understand what actions can be taken to change the value to an acceptable level and what that acceptable level should be for the organization.

References:

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **Non-Specific**

Reinvestment rate per year

Description: Value of funding being directed to capital expenditures and reserve contributions.

Category: Financial

Type of Metric: Leading

Inputs to Metric: Capital expenditure directed to capital replacement, renewal, or life-extension projects plus contributions (if any) to reserves for future infrastructure work.

Suitability as a LOS Metric: High

Interpretation of Metric Values: Value must be used in context with long range financial plan and the associated sustainable funding level.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: A good value to report and monitor in comparison to sustainable funding level requirements identified in long range financial plans contained within the Asset Management Plan. Best used in context of resultant remaining service life years of assets.

PROS	CONS
Provides a direct and easily understood measure of the degree in which the municipality is achieving (or not) financial sustainability.	Often confused with depreciation dollars contributed to a reserve or spent which is not representative of sustainable costs for long-lived assets.

References:

Service Area: **Generic** Asset: **Non-Specific**

RSL Remaining Service Life

Description: # of years the asset is projected to provide adequate service based on current condition, capacity, reliability, and performance.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Subjectively assigned by professional and operational staff based on direct knowledge of asset, its current condition, operational capacity, and level of maintenance efforts to keep in service.

Suitability as a LOS Metric: High

Interpretation of Metric Values: Low # of years indicates a priority need for funding, planning, and coordination of replacement or renewal.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Life cycle planning both from a financial funding need and a logistics in asset renewal/replacement planning. Ideally used to qualify the urgency of individual assets, but, also collective need in comparison to financial resources.
When used in combination with Financial Plans, this can be used as input to Risk to make decisions on funding allocations.

PROS

Metric has a wide range of inputs that, in the right context, be instrumental in decision making as provides a direct timeline to when service levels are expected to no longer be met.

CONS

It is a subjectively assigned value OR a modelled projection based on defined inputs which may not fully consider all aspects and/or depend on other metrics (i.e. future growth) that are often difficult to predict.

Often confused with TCA remaining life which is solely a measure of remaining years before book value reaches zero.

References:

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **Non-Specific**

Reserves vs AM Funding Needs

Description: Value of reserve funds in comparison to planned future needs.

Category: Financial

Type of Metric: Lagging

Inputs to Metric: Reserve levels and asset life-cycle renewal plan.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: A low value may indicate a vunerability to unexpected losses or unexpected increases in expenses.

Recommended Uses: Measure of fiscal resiliency of the organization. Best used in conjunction with other metrics that identify levels of funding for operational needs.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS

May be a comparable metric between jurisdictions as an indicator of overall financial resiliency. Metric is easily obtained once an AM Plan is completed.

CONS

A high level indicator. Is highly sensitive to the degree of effort spent on life-cycle-planning and cost estimates of underlying assets and other factors such as assumed inflationary rates.
Metric does not reflect whole-life-costing needs - only the capital renewal portion.

References:

Service Area: **Generic**

Asset: **Non-Specific**

System Failure Reinstatement Hours

Description: This metric can apply to any system or component and is representative of the commitment of the organization to provide a reliable service.

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric:

Suitability as a LOS Metric: High

Interpretation of Metric Values: A lower number indicates one or more of the following:
- System has been designed to be fault tolerant
- Resources and response has been made a priority by the organization
- The system is well maintained
- There is a focus on pro-active inspection and maintenance

Recommended Uses: Measure of ability to recover from a system failure/fault.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Metric that likely resonates well with customers.	Metric is truly a lagging measure and is dependant on monitoring many other technical measures and maintaining/implementing strategic efforts that contribute to reducing or increasing this metric.

References:

Municipal Metric Catalogue

Service Area: **Generic**

Asset: **System**

% of AM Investment Plan funded in Capital Budget

Description:

Category: Financial

Type of Metric: Leading

Inputs to Metric: Year by year asset management funding plan in comparison to the year by year capital budget.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Represents the degree of alignment of the budget and financial processes in the organization with the Asset Management Efforts.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Ongoing reporting to provide a quick perspective of the degree the AM plan is being funded. This metric should be used in conjunction with other metrics showing operational funding levels and needs to provide a complete whole-life-costing perspective.

PROS

Provides insight to the overal effectiveness of the AM Program and the extent of the shortfall to meet sustainability.

CONS

Municipalities, at this point, are not required to have long range financial plans.
Capital budgets typically include a wide range of expenditures (i.e. growrth and service expansions) which, if included, will over value this metric.
A ten year plan may not provide a complete picture of sustainable funding levels for longer term assets.

References:

Service Area: **Generic**

Asset: **System**

O&M Cost per unit measure of asset

Description: Total operational dollars spent/budgeted on system over the size of the system.

Category: Financial

Type of Metric: Lagging

Inputs to Metric: Operating Expenditure/Budget over a measure of the size of the system.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: Expectation is to always lower costs, but when metric is not used in context of metrics that impact customer values, this metric cannot be objectively intepreted.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [x] Impact on Environment
- [x] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: local year over year comparitor and long term funding forecasts in context of asset condition and targeted levels of service.

PROS

Easy to obtain from financial statements/budgets and Asset Inventory.

CONS

Local context and not comparable to other municipalities as it is absent of system condition, reliability, capacity, and expected service levels.

Often used as a financial comparitor to other jurisdictions or historical costs that does identify the associated level of deferred maintenance.

Use of this metric in isolation of other information is often used as a surrogate to 'efficiency' and has a tendancy to lead to increased deferred maintenance, reactive repairs, lower reliability, etc..

Historical trends do not equate to future needs due to complexity of newer assets, regulatory requirements, higher expectations, and the aging stock of existing infrastructure.

References: OMBI, NWWBI

Service Area: **Generic**

Asset: **System**

Service Area: **Roads**

Asset: **Non-Specific**

# of incidents on a section of road or intersection

Description: A simple count of incidents reported on the roadway on an annual basis.

Category: Technical

Type of Metric: Lagging

Inputs to Metric:

Suitability as a LOS Metric: Low

Interpretation of Metric Values:

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: Best used if municipality has a program in place to assess each reported incident by a traffic engineer as part of a comprehensive traffic safety program.

PROS	CONS
It may be used to prioritize road rehabilitation, intersection improvements, geometric changes, signage and line painting programs.	Requires access to full incident reports and a traffic engineering review of each reported incident to identify root cause and what changes would have a positive impact on reducing incidents.

References:

Municipal Metric Catalogue

Service Area: **Roads** Asset: **Pavement**

% of roads cleared within minimum maintenance regulation response requirements.

Description: A measure of the length of road that has been maintained within the prescribed time frame to respond to winter weather conditions defined within the regulation.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: length of road covered within each plow route within the prescribed response time.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A value less than 100% is a liability for the municipality and the underlying cause needs to be determined and actionable items be identified to address the shortfall. If the value is regularly below 100%, this may have a larger social/economic impact beyond the risk of reduced ability to defend a claim.

Recommended Uses: Ongoing monitoring of compliance with minimun maintenance regulation. Routine audits of logs is recommended to validate this metric.

Impact on Customer Values:

- ☑ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Easily obtained if maintenance management systems and/or AVL systems have been configured to track and monitor this.	It is difficult to configure systems to produce this information. More commonly, this metric is reported subjectively and proven through logs when needed to defend a claim.

References:

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **Pavement**

Average response time to repair potholes

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Date/time of discovery of each pothole and date/time of repair of each pothole. Requires tracking of each pothole, size, depth, and class of road.

Suitability as a LOS Metric: High

Interpretation of Metric Values: Meeting the regulated response time will mitigate liabilities and improve the municipalities ability to defend claims. Not meeting the regulated response time exposes the municipality to claims and associated payouts.

Impact on Customer Values:

- ☑ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Best used when metrics are broken down by class of road and threshold of size based on Minimum Maintenance Standards to verify compliance with regulation.

PROS

Can be a comprehensive metric to demonstrate compliance with regulations or degree of effort needed to meet regulated level of service.

CONS

Metric requires comprehensive reporting of potholes and tracking crew deployments. Metric can easily be over-stated if using crowd-sourced pothole reporting where same pothole is reported multiple times and all 'repaired' together. This metric focuses on reactive repairs, and may indicate a larger issue of under-investment in capital renewal of the roadway or quality control issues with work being completed on the roadway.

References:

Municipal Metric Catalogue

Service Area: **Roads** Asset: **Pavement**

Description or images that illustrate the different levels of road class and pavement condition.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: GIS roadsegment mapping, AADT values, Posted Speed Limits, Pavement Condition Assessments

Suitability as a LOS Metric: Context Dependant

Interpretation of Metric Values:

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: General information for the community.

PROS	CONS

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **Pavement**

For paved roads in the municipality, the average pavement condition index value

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: May be PCI or PQI or assigned by 'windshield method'

Suitability as a LOS Metric: High

Interpretation of Metric Values: Higher value indicates, generally, a better network of roads.

Recommended Uses: General indicator of state of roads in the municipality.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS	CONS
Relatively easy value to obtain and update on an annual basis.	Pavement condition index values are often 'bell curved' by municipaliy and are often not directly comparable across jurisdictions.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **Pavement**

PCI **Pavement Condition Index**

Description: Overal condition of pavement

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Interpreted measure of pavement based on a series of prescribed visual observations

Suitability as a LOS Metric: Medium

Interpretation of Metric Values:
1 - Failed and likely has load restrictions
5 - Road is in Poor condition is past point of effective rehabilitation
7 - Road is in Fair condition and may still be rehabilitated
8 - Road is in good condition and may benefit from preservation
10 - New

Recommended Uses: Jurisdictions where number of road sections are limited (less than 200) and can be done by a single individual consistently year over year

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Fairly easily obtained	Can be difficult to get consistency between individuals and between different jurisdictions

References:

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **Pavement**

PQI — Pavement Quality Index

Description: General condition of pavement taking into account a number of factors

Category: Technical

Type of Metric: Lagging

Inputs to Metric: A calculated blended value based on a number of other imperical field measures that are also considered lagging measures.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values:
1 - failed
5 - Poor (typically in need of reconstruction)
7 - Road is fair condition and may still be rehabilitated
8 - Pavement is good and may still be a candidate for pavement preservation
10 - Pavement is new

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: Jurisdictions having large road networks to proritize and coordinate road renewal and reconstruction work and to estimate life cycle needs into the future.

PROS	CONS
Calculated based on imperical measures	No standard formula in industry, typically calibrated locally and not comparable between jurisdictions

References:

Metric Relationships

INFLUENCED BY	Riding Comfort Index	MEDIUM
INFLUENCED BY	Structural Adequacy Index	MEDIUM
INFLUENCED BY	Surface Distress Index	MEDIUM

Municipal Metric Catalogue

Service Area: **Roads** Asset: **Pavement**

RCI — Riding Comfort Index

Description: A measure of how 'bumpy' the road feels to drivers and passengers

Category: Technical

Type of Metric: Lagging

Inputs to Metric: data collected using accellerometer or subjective value assigned by a operations staff

Suitability as a LOS Metric: Medium

Interpretation of Metric Values:
1 - poor
10 - perfectly smooth

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [ ] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Quality of new pavements and suitable measure for higher speed roads. Best use in combination with other pavement related measures to help prioritize paving programs.

PROS

in extreme poor condition - it can have a direct impact on safety. It may also be a measure of quality of new pavements

CONS

Measure is proportional to speed of travel and is often 'calibrated' to local conditions.

References:

Metric Relationships

INFLUENCES	Pavement Quality Index	MEDIUM

Municipal Metric Catalogue

Service Area: **Roads** Asset: **Pavement**

SAI Structural Adequacy Index

Description: A measure of the strength of the road to support traffic loadings

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Typically based on a alling weight deflectometer and is direct measure of the strength of the road.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: 1 - road should have significant load restrictions.
10 - road is at design strength or better

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Good input to pavement renewal options, low strength suggests the base needs to be reconstructed or reinforced. High strength suggests that overlay or pavement recycling.renewal are good options.

PROS

It is a direct measure of the road itself made up of all layers and components (i.e. top and base asphalt, and supporting base).

CONS

Highly dependant on sampling density.

References:

Metric Relationships

INFLUENCES	Pavement Quality Index	MEDIUM

Service Area: **Roads** Asset: **Pavement**

SDI Surface Distress Index

Description: A measure of physical cracks and discontiunities in the pavement surface.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Typical measured via video analysis or laser profiling

Suitability as a LOS Metric: Low

Interpretation of Metric Values:
1 - Many physical defects beyond repair
10 - New pavement showing now distress defects

Recommended Uses: Raw technical values to contribute to engineering analysis and determination of best rehabilitation or preservation technique to apply to pavement.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Imperical objective value	

References:

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **System**

Annual number of public transport trips per capita.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Count of trips vs population

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A higher number represents more usage by residents and/or visitors.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☑ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses: Metric used to monitor overall effectiveness of a public transportation plan and associated initiatives.

PROS	CONS
Metric is fairly easily obtained by most pay-per-use systems.	Good monitoring metric, but, is difficult to change and requires long term strategic transportation and planning efforts.

References: CAN/CSA-ISO 37120:15

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **System**

ATT — Average Travel Time

Description: Average time required per average trip for an average trip length

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Average trip length and average trip time

Suitability as a LOS Metric: High

Interpretation of Metric Values: Lower trip times are always desirable.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☑ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses: A general measure of congestion within the road network. It can be used over time to identify increases in efficiency of overal transporation systems. Best used to monitor the long term impacts of road improvements, public transportation system changes or implementations, change in population planning policies.

PROS

Overal good measure of efficiency of system and is easily underestood by the general public.
Can be obtained using GPS tracking along defined travel corridors and defined trip start/end locations.

CONS

Very difficult to obtain data on a broader scope. Highly context sensitive with respect to the degree of urbanization, population density, availability and effectiveness of public transit systems, physical road network, location of residential vs employment lands. Each individual study will take into account different aspects and is difficult to do comparable studies even within the same jurisdiction over time. Metric is not comparable between jurisdictions due to various reasons. Nevertheless, it is often a metric individuals will refer to (from personal experience) when making decisions on relocating where they live and/or work.

References:

Municipal Metric Catalogue

Service Area: **Roads** Asset: **System**

For unpaved roads in the municipality, the average surface condition (i.e. good, fair, poor).

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: windshield assessments by staff

Suitability as a LOS Metric: High

Interpretation of Metric Values: value is typically a relative value in local context.

Recommended Uses: Generalized indicator of condition of unpaved roads.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS	CONS
easy to obtain	wide variation in interpretation and not comparable between jurisdictions.

References:

Service Area: **Roads**

Asset: **System**

Kilometers of high capacity public transport systems per 100,000 population

Description:

Category: Technical

Type of Metric: Leading

Inputs to Metric: length of public transport systems such as subway systems, commuter rail, local road networks.

Suitability as a LOS Metric: Context Dependant

Interpretation of Metric Values: Higher values may be desirable in dense urban environments where trip generating destinations are within reach of the public transport network.

Recommended Uses: LOS metric for high density urban environments with larger populations

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☑ Impact on Social Well Being

PROS	CONS
Easy metric to obtain	Underlying changes to affect movement in this metric is complex.

References: CAN/CSA/ISO 37120:15

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **System**

Kilometers of light passenger public transport systems per 100,000 population

Description:

Category: Technical

Type of Metric: Leading

Inputs to Metric: length of light passenger public transportation systems such as bus, streetcars, tramways, trolley, etc..

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A higher value indicates availability of public transportation.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Suitable for urban environments in efforts to encourage sustainable modes of transportation. Best used in conjunction with other metrics such as ridership.

PROS	CONS
easily obtained metric.	Metric itself does not incdicate level of utilization nor capacity.

References: CAN/CSA-ISO 37120:15

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **System**

Number of lane-kilometers of each of arterial roads, collector roads, and local roads a proportion of square kilometers of land area of the municipality.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: GIS road segment mapping attributed by road classification.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: A low values represent more rural areas. Higher values indicate higher urbanization.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses: General information. Not a suitable comparitor between jurisdictions as the value more determined by geography, local population, topography, land use, and variety of other factors.

PROS	CONS
	Definition of arterial and collector are somewhat subjective in local contexts and not consistent across jurisidictions. Value is not a meaningfull comparitor between municipalities, but, it good general information.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **System**

Percentage of local roads with sidewalks

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: length of sidewalk vs length of roads

Suitability as a LOS Metric: High

Interpretation of Metric Values: Value must be seen in a local context and only meaningfull if also used in conjunction with other forms of pedestrian transportation infrastructure such as trails and walkways that may not follow the road network.

Recommended Uses: Best used in conjunction with an active transportation strategy.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [x] Availability of Service
- [ ] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [x] Impact on Climate Change
- [x] Impact on Social Well Being

PROS	CONS
An easily obtained value that can be aligned with common corporate objectives related to active transportation.	Common pushback by property owners for installation of new sidewalks due to expectations of maintenance and direct impact to frontage. The value itself is not generally comparable to other jurisdictions.

References:

Municipal Metric Catalogue

Service Area: **Roads**

Asset: **System**

Percentage of local roads with street lights

Description: Percentage of local roads serviced with street lighting.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Length of roads having street lights over total length of local roads

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Dependant on the community and degree of urbanization.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [x] Availability of Service
- [ ] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: General community, and Health and Safety LOS. Can be used as a basis to identify what locations street lights may be needed for the municipality.

PROS	CONS
Easy to obtain, simple metric. Good measure to use to set future LOS objectives in context of the municipality.	Metric may not be a relavent comparitor between jurisdictions due to a number of factors.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **Pipe**

# of Blocked Sewers

Description: Annual count of sewer blockages reported and cleared.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Operations staff and customer call centre

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Local context dependant. In extreme cases, it can have a significant impact on the safety and social impact of the community. If it results in overflows it may also have an environmental impact.

Recommended Uses: Many variations include count by cause or type system or strictly of mainline or service connections. This metric is a direct measure of # of service interruptions.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

PROS	CONS
It is a direct measure of service interruptions and reliability and not difficult to obtain.	This is an absolute measure only valuable in a local context and based on population served and size of system and local conditions. Further analysis and use of other metrics are needed to identify actionable items that will influence this lagging metric.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **Pipe**

% of pipe network inspected by CCTV

Description: A measure of the degree of pro-active efforts by the municipality. There are many variations that include annual measures or targeted inspection based on age or condition of infrastructure.

Category: Technical

Type of Metric: Leading

Inputs to Metric: Operations staff and inspection records

Suitability as a LOS Metric: Low

Interpretation of Metric Values: varies on local context

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Used in context of pipline blockage metrics, it can be an effective metric to drive/monitor pro-active inspection efforts and the impact it has on service interruptions (Provided that issues identified by inspection are resolved in a timely manner).

PROS	CONS
Good indicator of the degree of good stewardship of infrastructure through pro-active inspection programs.	Degree of inspections needed is very much a local context with respect to condition of system, materials, local use, bylaw enforcement and public education regarding Fats/Oils/Grease.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **Pipe**

Structural Defect Index

Description: Generalized condition of a pipe based on underlying defects

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Based on the type, severity, and frequency of defects found on a pipe section

Suitability as a LOS Metric: Low

Interpretation of Metric Values:
0 - Good with limited defects found
5 - Failed in at least one location

Recommended Uses:

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Standardized methodology if following NAASCO	Under NAASCO - rating may not represent the whole pipe, but a localized issue that can be resolved by spot repair. If not using NAASCO - rating may be subjectively assigned and not consistently applied by individual inspectors.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Sanitary Sewer** Asset: **Plant**

Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Routine monitoring of effluent vs CofA for plant vs current standards.

Suitability as a LOS Metric: High

Interpretation of Metric Values:

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [x] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: Plain language description of the effluent in terms of impact to local receiving waters and comparison to current standards.

PROS	CONS
	Reporting effluent in terms of CofA for the plant will provide public confidence in compliance, however, reporting effluent in terms of current standards may result in unrealistic expectations for upgrades.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **Plant**

Raw Sewage Bypasses

Description: Number of times a sewage treatment has exceeded capacity and has diverted raw sewage into environment.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Operations staff

Suitability as a LOS Metric: High

Interpretation of Metric Values: Varies in local context.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Metric is a good indicator of system or serious technical or design flaw that should be considered a high priority to mitigate.

PROS	CONS
A significant indicator	Metric when published is perceived as negative to municipal reputation.

References: MOECC regulation ??

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **Pump**

% Redundancy of Pumps in System

Description: Measure of deliberate mechanical backup equipment installed in system

Category: Technical

Type of Metric: Leading

Inputs to Metric: Total HP of all standby pumps / total HP of all pumps.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: High percentage indicates a higher focus on reliability of service

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses:

PROS	CONS
Relatvely easy metric to obtain.	May be locally influenced by other factors such as high INI rates and weather patterns.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **System**

% Combined System

Description: Percentage of Sewer System that is combined stormwater/sanitary sewage

Category: Technical

Type of Metric: Leading

Inputs to Metric: Length of pipe that receives storm water into sanitary system vs length of whole sanitary system.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: High percentage is generally considered a low level of service

Recommended Uses:

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☑ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Easily calculated and presented.	Physical constraints, geography, and degree of urbanization are often insurmountable constraints to improve this metric.

References:

Service Area: **Sanitary Sewer** Asset: **System**

Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Technical design parameters of the system

Suitability as a LOS Metric: High

Interpretation of Metric Values:

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☑ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☑ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses: A plain language version of the design of the system when combined systems exist and presented as information and education of users of the system within the community. It provides a good indication of the level of risks the community has accepted.

PROS

Good information for the public at large so they are aware of their susceptability to weather events and climate change.

CONS

Information presented may be difficult to understand unless there is a focus on plain language. Wording may not clearly articulate risks.
Public may not understand the constraints that exist to reduce or eliminate combined systems and/or increase overflow controls.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Sanitary Sewer** Asset: **System**

Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid stormwater intrusion to sanitary system.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Local design standards and remediation strategies.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A good indicator of the efforts being made by the muncipality to address I&I and climate change mitigation efforts.

Recommended Uses: Can be helpful to identify the measures that are being taken (or have been) to reduce Inflow and Infiltration (I&I).

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☑ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Sanitary Sewer** Asset: **System**

Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into the streets or backup into homes.

Description:

Category: Qualitative

Type of Metric: Context Dependant

Inputs to Metric:

Suitability as a LOS Metric: Context Dependant

Interpretation of Metric Values: If wording specifically outlines the susceptable parts of the system, it may be a lagging measure of the overall system. If wording is generic, it would simply be education for the community.

Recommended Uses: Public education

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☑ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
This is good information for users of the sytem to understand.	

References: Ontario Regulation 588/17

Service Area: **Sanitary Sewer**

Asset: **System**

Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in the habitable areas or beaches.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Summary of overflow event reports that estimate volume of each overflow.

Suitability as a LOS Metric: High

Interpretation of Metric Values:

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [x] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: Public education about the existing system.

PROS	CONS
Clearly identifies immediate risks to public	

References: Ontario Regulation 588/17

Service Area: **Sanitary Sewer** Asset: **System**

INI Infiltration and Inflow percentage

Description: % of inflitration and inflow of storm or ground water into sewage network.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Volume of sewage at treatment plant received vs total water supplied less an estimated consumed water (i.e. food processing, landscaping, industrial uses not entering sewage stream) otherwise referred to as "consumptive use".

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Low values indicate system is well isolated from ground water or stormwater runoff and is more resilient to extreme storm events. A lower value is expected to perform or exceed design prameters.

High values indicate that a significant volume of liquid in the system and at treatment plant is rain or ground water reducing capacity of the system and is likely to be performing lower than design parameters. The system is likely experiencing direct storm water runoff connections or is partially installed below water table with poor joints and seals.

Recommended Uses: A very good metric in context of effeciency and resilience to climate change. Also a good indicator of level of risk to environment and private property damage.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [x] Impact on Environment
- [x] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS

Most underlying measures are easily obtained in smaller urban systems having a smaller number of water supply and treatment facilities.

An indicator of demand on downstream facilities and risk of by-passes events.

Identifies opportunities to support growth with existing system.

CONS

Difficult to obtain water supply figures and estimated volume of water consumed and not directed into sewage system.

Typical studies do not adequately address INI component within base-flows and may be a very substantial volume.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **System**

Percentage Effluent Treated vs Operating Capacity of Plant

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Volume of sewage entering plant vs design operating capacity

Suitability as a LOS Metric: High

Interpretation of Metric Values: A high percentage indicates little room for growth or ability to handle weather event induced peak flows.

Recommended Uses: Capacity for growth and/or resilience to climate change. Metric also represents degree of risk of overflow and/or by-passes.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☑ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☑ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Easy number to obtain.	

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **System**

Retention Time in Collection System

Description: The amount of time sewage spends travelling through the system from source to treatment.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: flow monitoring and sewage flow models

Suitability as a LOS Metric: Low

Interpretation of Metric Values: Longer times increase the likelihood of anaerobic activity that damage components of system or require use of chemicals to control. Higher levels are also likely to generate odour complaints by residents.

Recommended Uses: Best utilized by operations and engineering staff to pro-actively inspect and or replace pipes and components susceptable to hydrogen sulphide or implement mitigation measures if retention time is long.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer** Asset: **System**

SSO **Sanitary Sewer Overflows**

Description: Number of reported sewage overflows/surcharges. Metric has many variations that can focus on separated or combined systems that do or do not correspond to weather events.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Customer call center and operations staff. Overflows may occur in any part of the system as a surcharge and be related to localized pipe failures, issues at pump stations, or related to weather events in systems susceptable to inflow/infiltration.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Locally dependant, however, overflows and surcharges are generally considered an event that is negative and likely has associated collatoral public or private property damages in monitary or reputational context.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [x] Impact on Environment
- [x] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Typical a priority metric in municipalities where sewage capacity is an issue and/or includes combined storm/sanitary systems.

PROS	CONS
A good indicator of overall system performance and resiliency.	

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **System**

The number of connection-days per year having wastewater backups compared to the total number of properties connected to the municipal wastewater system.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Sum of backup incident reports and number of hours until the backup is cleared. This is expected to include only basement backups to main blockages or surcharges and excludes service backups due to failed or blocked private sewer connection.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A higher number indicates one or more issues including, but not limited to: insufficient sewer capacity, I&I, pipes in poor condition, deferred maintenance.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Likely best expressed as a value per 1,000 connections

PROS	CONS
Good indicator of overall reliability of service and level of risk to users.	There can be many different causes and requires substantial effort to investigate each occurance for root-cause and then to develop strategic initiatives. Level of record keeping to support this metric is likely higher than typically done.

References:

Municipal Metric Catalogue

Service Area: **Sanitary Sewer**

Asset: **System**

The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total numbe of properties connected to the muncipal wastewater system.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric:

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A higher value indicates an ongoing risk from climate change and need to either increase storage capacity or focus on system separation.

Recommended Uses: Year over year reporting and target setting. Likely best expressed as a value per 1,000 connections.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☐ Availability of Service
- ☑ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☑ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Should be easy to report.	Difficult to set target due to direct impact of weather events.

References: Ontario Regulation 588/17

Service Area: **Storm Sewer** Asset: **Pipe**

PACP Condition Rating

Description: An assigned rating based on a combination of types, severity, and frequency of defects found in a section of pipe.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: severity and frequency of defects from CCTV PACP Condition assessments

Suitability as a LOS Metric: Low

Interpretation of Metric Values: 1 - Pipe is in excellent condition
5 - Pipe is in critical condition and has likely failed in at least one location

Recommended Uses: Prioritization of pipeline replacement and renewal programs and short/medium term renewal planning (<30 years).

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS	CONS
A good indicator of current condition	Algorithm is focused on failure that may be localized issue Condition may not be representative of the whole pipe segment Not suitable for degredation predictions Expensive to obtain

References: NAASCO, CSA Gravity Pipeline Condition Assessment Guideline

Municipal Metric Catalogue

Service Area: **Storm Sewer**

Asset: **System**

# of days of beach closure

Description: Number of days local beaches have been closed due to high levels of bacteria. Typically a result of surface run-off, but, may also be a result of overflows from sanitary or combined sewer systems.

Category: Technical

Type of Metric: Lagging

Inputs to Metric:

Suitability as a LOS Metric: High

Interpretation of Metric Values: Locally dependant, but any number of days are considered public service interruptions.

Recommended Uses: Lagging measure if strictly monitoring, but is a very good measure to set LOS targets through re-allocation of resources to resolve underlying issues.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [x] Impact on Environment
- [x] Impact on Climate Change
- [x] Impact on Social Well Being

PROS

CONS

References:

Metric Relationships

INFLUENCED BY	Sanitary Sewer Overflows	HIGH	
INFLUENCED BY	% Combined System	LOW	only if this is a root cause of overflows

Municipal Metric Catalogue

Service Area: **Storm Sewer**

Asset: **System**

Percentage of properties in municipality resilient to a 100-year storm

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Local flood mapping and parcel mapping. Local street and subdivision drainage plans including major overland flow routes.

Suitability as a LOS Metric: High

Interpretation of Metric Values:

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [ ] Impact on Environment
- [x] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: A good indicator of risk that the municipality has and can be a good measure to target future values that will direct future infrastructure investments and planning efforts. Best accompanied with maps showing the areas that are susceptable to flooding and buildings that exist within those properties.

PROS

Easy metric to obtain

CONS

Flood mapping updates are infrequent.
Cliimate change is challenging the design storm parameters we rely on.
Overland flow routes are not always integrated between development (re-development) phases resulting in localized flooding outside of expected locations along rivers and streams.

References: Ontario Regulation 588/17

Service Area: **Storm Sewer**

Asset: **System**

Percentage of properties that have a low risk of flooding

Description: Proportion of properties that are not susceptable to flooding.

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Climate data, flood mapping, sanitary and storm sewer system design information (i.e. degree of INI or combined systems), major overland flow paths, topography. May include historical records of flooding and/or insurance claims.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A high percentage indicates a combination of good planning and engineering efforts to restrict development of properties in flood prone areas as well as ensuring that all developments have accounted for major overland drainage paths in extreme rain events.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [x] Sustainability of Service Delivery
- [ ] Impact on Environment
- [x] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Measure of the community's resiliance to climate change.

PROS

Relatively easy to obtain if current flood plain mapping has been completed and engineering design standards have included major overland flow design requirements.

CONS

May be difficult to obtain this metric in areas that have developed over a long period of time under evolving standards and regulations. In these cases, susceptability to flooding may exist in developed areas where overland flow paths are not well established and/or grade changes have occurred.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Storm Sewer** Asset: **System**

Percentage of the municipal stormwater management system reslient to a 5-year storm.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Detailed infrastructure mapping indicating which sections of the system are to which design standard.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A higher number indicates a higher proportion of the system has been constructed or re-constructed more recently to updated standards.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [x] Impact on Climate Change
- [ ] Impact on Social Well Being

Recommended Uses: General measure indicating proportion of stormwater system system designed to older standards vs most commonly used new standards.

PROS

CONS

Likely a very difficult measure to obtain as it requires very detailed infrastructure mapping that includes the design standard or integrated models. There are likely few municipalities in Ontario that can accurately report this measure with high level of confidence.
Most municipalities will likely report estimated values.

References:

Municipal Metric Catalogue

Service Area: **Storm Sewer**

Asset: **System**

The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Routine monitoring of effluent

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: A higher value indicates eiher an issue with treatment and/or regular exceedance in volume coming into the plant.

Recommended Uses: Likely best expressed as a value per 1,000 connections.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
An easy number to report.	This value is relative to the CofA of the particular plant which represents compliance. However, it does not accurately provide a complete picture of the impact to receiving waters.

References:

Municipal Metric Catalogue

Service Area: **Water**

Asset: **Pipe**

Percentage of water main cleaned

Description:

Category: Technical

Type of Metric: Leading

Inputs to Metric: Daily tracking of pipes that have been flushed/swabbed.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: Higher value indicates a focus on preventative. Higher values normally result in lower water quality complaints (outside of flushing/swabbing activity).

Recommended Uses: Good measure of the degree of focus on pro-active maintenance programs for the system.

Impact on Customer Values:

- ☐ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

PROS	CONS
Easy measure to obtain	

References: NWWBI

Municipal Metric Catalogue

Service Area: **Water**

Asset: **Pipe**

Percentage of water main network length with diameter < 200mm

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: m of pipe in inventory that are < 200mm in diameter

Suitability as a LOS Metric: High

Interpretation of Metric Values: A low value indicates that very little of the system is below the minimum local design standard.

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Monitoring progress of a local program to meet local design standards.

PROS	CONS
An example of a good way to monitor progress on a local strategic initiative.	Metric in itself does not clearly identify the purpose for the strategic inititiave and would have to be further explained in publishing documents.

References: City of Cambridge

Metric Relationships	
INFLUENCES	Percentage of properties where fire flow is available
INFLUENCES	# of water qualilty complaints per 1,000 customers

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

# of boil advisories

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Annual total number of boil water occurances.

Suitability as a LOS Metric: Low

Interpretation of Metric Values: A low number indicates few occurances of system repairs and few occurances of mesaured bacterial level exceedances.

Impact on Customer Values:

- ☑ Public Safety
- ☑ Quality of Service
- ☐ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Generalized metric that identifies overall quality and reliability of the water supply and distribution system, however, it is not adequately represented unless it is presented in context with other metrics that identify numbers of customers impacted and is therefore not a good comparitor over time or other jurisdictions.

PROS

Metric is easily obtained.

CONS

Metric does not incorporate the degree of impact on customers as a small number of occurances on a small number of customers will not be distinguishable from a small number of occurances that affect very large populations. Metric may be misleading as it may not represent system or safety issues.

References:

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

WQC **# of water qualilty complaints per 1,000 customer**

Description: Count of number complaints received within the year.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Count of calls from customers that have a concern with water quality over total population being provided water service.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A high number is considered less desirable. Analysis of other metrics is required to identify the source of concerns and to develop strategies to address them (i.e. improve communications, reduce main breaks, increased flushing programs, etc..).

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [ ] Availability of Service
- [x] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [x] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: A metric that can provide information about alignment with service delivery and customer expectations.

PROS

Metric is easily obtained.
This is a good example of a pure lagging measure as it is an outcome of many underlying business decisions and operating conditions.

CONS

Unless the complaints are addressed through a root-cause-resolution methodology, this metric itself does not provide sufficient information to direct efforts for improvement.
The metric does not necessarily represent an issue with the system.
This metric will include a mix of issues related to construction, repairs, and individual customer preferences and tolerances.

Measure is impacted dramatically by system repairs and maintenance activities and is inversely proportional to customer communication efforts.

References:

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Description of boil advisories and service interruptions.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: May include a log of events from the prior year.

Suitability as a LOS Metric: Context Dependant

Interpretation of Metric Values:

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Public education if a pure descriptor.
A good metric to include in an annual report if it includes a summary of the interruptions/advisories that have occurred in the prior year.

PROS	CONS
In alignment with typical Drinking Water Quality Management Systems. Good general information to customers regarding the service being provided and when service is being interrupted.	

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Water** Asset: **System**

Description, which may include maps, of the user groups or areas of the municipality that have fire flow.

Description:

Category: Qualitative

Type of Metric: Lagging

Inputs to Metric: Infrastructure mapping and modelled or measured fire flows.

Suitability as a LOS Metric: High

Interpretation of Metric Values: In comparison to the map showing where water is provided it easily communicates the difference between potable water services being provided and what portion of the system (if any) supports fire suppression volumes. Interpretation is context sensitive to the community.

Recommended Uses: Best shown as a map to communicate where the water system has sufficient capacity to provide fire protection.

Impact on Customer Values:

- [x] Public Safety
- [ ] Quality of Service
- [x] Availability of Service
- [x] Capacity to meet Demand
- [ ] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [ ] Impact on Social Well Being

PROS	CONS
Excellent way to communicate the capacity of the system to provide fire protection to the community.	Precision of this map is subject to the degree that fire flows have been conducted or level of calibration done on a water model.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Non-Revenue Water (L/connection/day)

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Total water supply vs metered volume consumption. Ideally, volume of water used for flushing, fire flow testing, fire suppression etc.. Are excluded from this measure and are billed at some bulk rate.

Suitability as a LOS Metric: Medium

Interpretation of Metric Values: Higher values indicate leakage or unauthorized use of water.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Measure represents overall management of water revenue.

PROS	CONS
Easy to obtain for metered systems.	May include volume of water used for maintenance purposes (i.e. flushing, fire flow testing, etc..) if those volumes are not measured/estimated and discounted. Measure includes unauthorized use of water and meter inaccuracies Includes water loss which indicates system issues, but not distinguishable from other non-revenue uses.

References: NWWBI

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Number of connections-days per year where a boil advisory notice is in place compared to the total number of properties connected to the municipal water system.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Number of services affected by each water boil advisory and over how many days it is effective. Total number of services within the system.

Suitability as a LOS Metric: High

Interpretation of Metric Values: Low numbers are most desirable. Higher values may indicate a social impact either due to frequency or extent of service interruption(s).

Impact on Customer Values:

- [x] Public Safety
- [x] Quality of Service
- [x] Availability of Service
- [ ] Capacity to meet Demand
- [x] Reliability of Service Delivery
- [ ] Sustainability of Service Delivery
- [ ] Impact on Environment
- [ ] Impact on Climate Change
- [x] Impact on Social Well Being

Recommended Uses: Specific LOS that measures overall reliability of the system and can be compared between jurisdictions. Number is best expressed as a value per 1,000 connections to be a functional comparitor across jurisdictions.

PROS	CONS
A normalized metric suitable for cross-jurisdictional comparisons regardless of degree of urbanization.	Value may be skewed low in high density urban environments where a connection may service a multi-res properties.

References: Ontario Regulation 588/17, NWWBI

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Number of connections-days per year where water is not available due to water main breaks compared to the total number of properties connected to the municipal water system.

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Number of connections affected by each main break and for how many hours. Days are proportional to hours (i.e. a 12 hour outage would be considered 0.5 days).

Suitability as a LOS Metric: High

Interpretation of Metric Values: A low value is desirable and a higher value is likely an indicator of insufficient capital re-investment in system.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☑ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Specific LOS that measures overall reliability of the system and can be compared between jurisdictions. Number is best expressed as a value per 1,000 connections to be a functional comparitor across jurisdictions.

PROS	CONS
A normalized value that is comparable across jurisdictions that provides a direct measure of reliability of service.	Requires main break record keeping at a higher level of detail then typically maintained by service providers. Number may be skewed low in high density urban environments where individual connections service multi-res complexes.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Number of No Water Complaints

Description: A direct measure of occurances when water is not available when the customer is expecting it to be.

Category: Technical

Type of Metric: Lagging

Inputs to Metric: # of customer calls reporting no water.

Suitability as a LOS Metric: High

Interpretation of Metric Values: A high number is less desirable.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☐ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: Ongoing metric as a general indicator of system reliability from the customer perspective.

PROS

Easy to measure and report.

CONS

Measure is not proportional to number of customers and is not comparable to other jurisdictions.

Measure may indicate a communication issue between municipality and customer, not necessarily an issue with the system itself.

References:

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Percentage of properties connected to the municipal water system

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: Count of water services that exist vs number of properties within the community.

Suitability as a LOS Metric: High

Interpretation of Metric Values: Interpretation is dependant on the community and degree of urbanization and a number of other local factors.

Impact on Customer Values:

- ☐ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☑ Sustainability of Service Delivery
- ☑ Impact on Environment
- ☐ Impact on Climate Change
- ☐ Impact on Social Well Being

Recommended Uses: General LOS metric for the community but not necessarily a valid comparitor with other jurisdictions.

PROS	CONS
A simple metric. Good metric to use to set future LOS objectives.	Metric may not a relavent comparitor between jurisdictions due to a number of factors.

References: Ontario Regulation 588/17

Municipal Metric Catalogue

Service Area: **Water**

Asset: **System**

Percentage of properties where fire flow is available

Description:

Category: Technical

Type of Metric: Lagging

Inputs to Metric: properties that have verified fire flow through fire flow tests or modeled to have fire flow from a water model.

Suitability as a LOS Metric: High

Interpretation of Metric Values: Interpretation is dependant on local context and degree of urbanization.

Impact on Customer Values:

- ☑ Public Safety
- ☐ Quality of Service
- ☑ Availability of Service
- ☑ Capacity to meet Demand
- ☐ Reliability of Service Delivery
- ☐ Sustainability of Service Delivery
- ☐ Impact on Environment
- ☐ Impact on Climate Change
- ☑ Impact on Social Well Being

Recommended Uses: General community LOS measure

PROS	CONS
A good measure of overall capacity of the system and risk tolerance in the community.	May not be a valid comparitor to other jurisdictions for a number of reasons.

References: Ontario Regulation 588/17