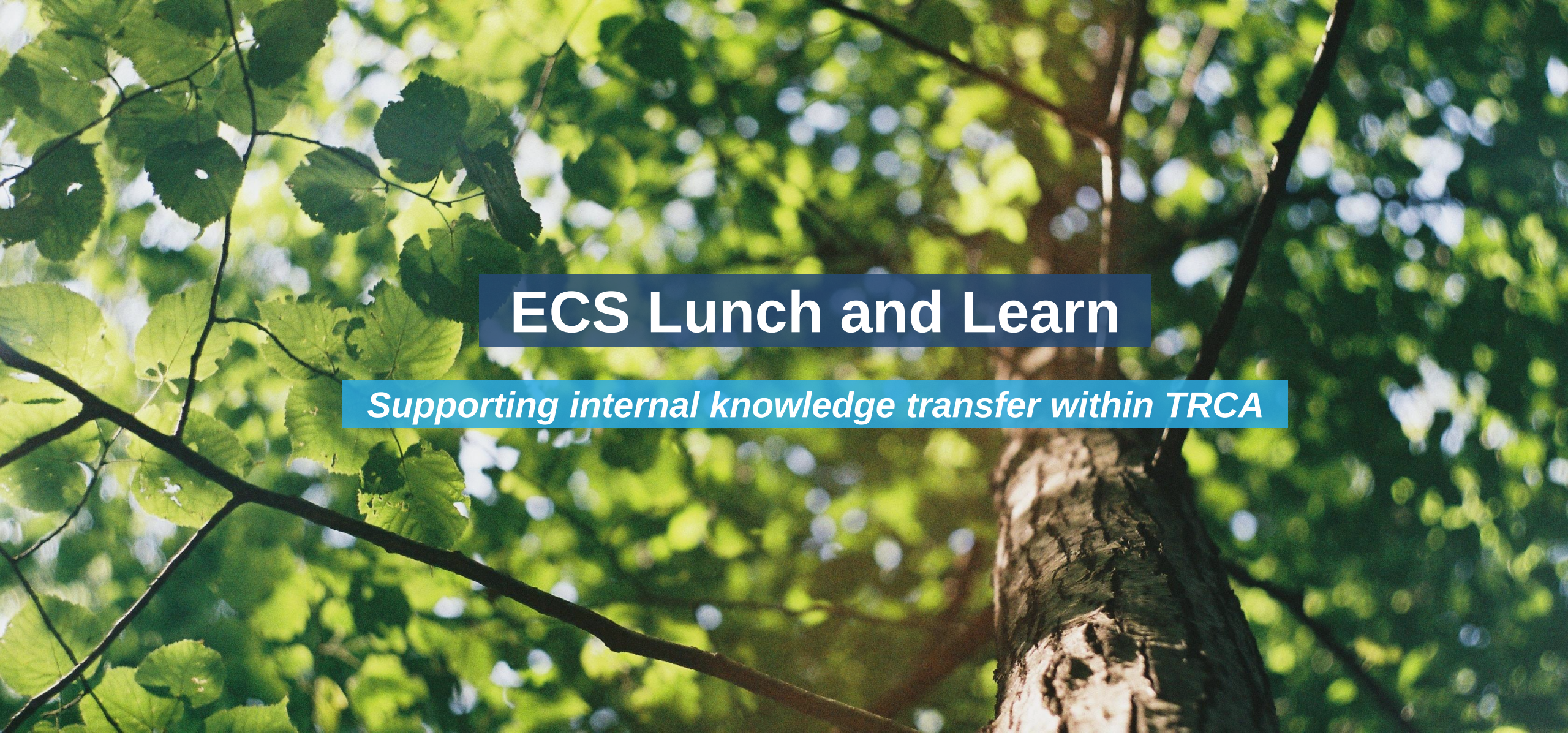


# ECS Lunch and Learn

***Supporting internal knowledge transfer within TRCA***

December 8, 2020

Toronto and Region Conservation Authority

# Green Infrastructure in Asset Management Planning

Presented by:
Michelle Sawka, Senior Research Scientist
Tracy Timmins, Research Analyst

Ecosystem and Climate Science

December 8, 2020

Toronto and Region Conservation Authority

# Agenda

1. Introduction/Background (15 minutes)
    - Green Infrastructure
    - Asset Management Planning
2. Green Infrastructure Asset Management Planning (5 minutes)
3. State of Infrastructure – Inventory (10 minutes)
4. State of Infrastructure – Valuation (10 minutes)
5. What’s Next (5 minutes)

# Asset Management Planning in Ontario

- Fairly advanced compared to other jurisdictions globally
- Required by provincial regulation
- Our Jurisdiction includes global leaders in integrating green infrastructure into asset management planning:
    - York Region
    - Richmond Hill
    - Ajax

# Our Role

- Support municipalities with integrating green infrastructure into asset management plans
- Advocacy through the Green Infrastructure Ontario Coalition (GIO)
- Share our knowledge and expertise

# Green Infrastructure

**Ontario Provincial Policy Statement**

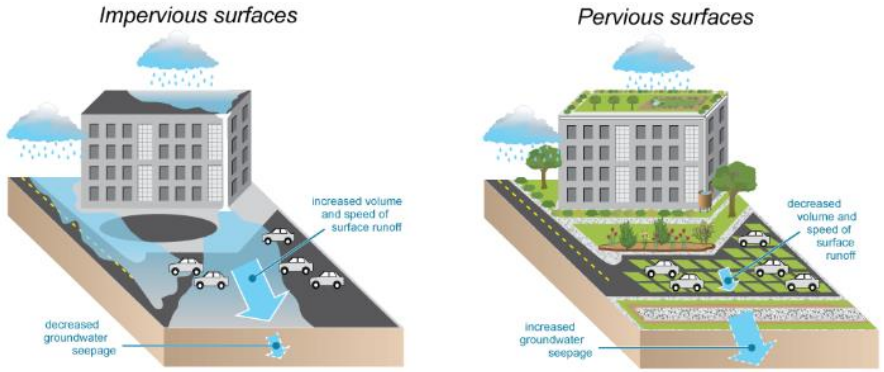
Natural and human-made elements that provide ecological and hydrological benefits. Green infrastructure can include components such as natural heritage features and systems, parklands, storm water management systems, urban forests, permeable surfaces, and green roofs.

# Municipal Green Infrastructure Assets

| Asset Category | | Green Infrastructure Focus Areas | | | | |
|---|---|---|---|---|---|---|
| | | **Urban Forest** | **Storm water** | **Parks & open space** | **Agriculture & urban agriculture** | **Green roofs & walls** |
| | **Natural** | Forest/Woodlot | Natural wetland | Meadow | Agricultural land | n/a |
| | | Park tree | Natural watercourse | Ravines/valley land | Soil | |
| | | Street tree | Lake/pond | Natural open space | | |
| | | Soil | Soil | Soil | | |
| | **Enhanced** | Engineered soil | Constructed wetland | Trails | Community garden | Green roof garden |
| | | Soil cell | Bioswale | Park land | | Green roof |
| | | | Dry/wet pond | | | Green wall |
| | | | Rain Garden | | n/a | n/a |
| | **Engineered** | n/a | Permeable paving | Sports field | | |
| | | | Infiltration trenches/chambers | Playground | | |
| | | | Rain barrels | | | |

# Green Infrastructure Services

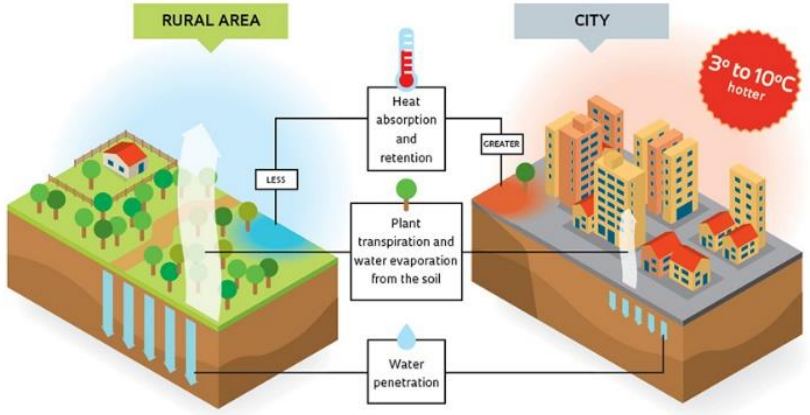
## Stormwater Management




Water Quantity and Quality Improvements

## Climate Change Adaptation & Mitigation


## Urban Heat




Reduce Urban Heat Islands & Direct Shading

## Multifunctional Services

# Benefits of Incorporating Green Infrastructure into Asset Mgmt Planning

- Increase priority of green infrastructure relative to grey
- Understand priorities, risks and management options
- Support strategic management to enhance green infrastructure
- Develop and support financial strategies
- Defend budgets
- Eligibility for federal and provincial infrastructure funding

# Asset Management Planning in Ontario

Asset Management Planning for Municipal Infrastructure Regulation, O. Reg. 588/17 (January 2018)

5. (1) Every municipality shall prepare an asset management plan in respect of its core municipal infrastructure assets by July 1, 2021, and in respect of **all of its other municipal infrastructure assets by July 1, 2023.**

Definitions

"municipal infrastructure asset" means an infrastructure asset, **including a green infrastructure asset,** directly owned by a municipality or included on the consolidated financial statements of a municipality, but does not include an infrastructure asset that is managed by a joint municipal water board

**"green infrastructure asset"** means an infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs

# Asset Management Planning

Asset management planning aims to

manage municipal assets over their life cyle to ensure **sustainable service delivery**

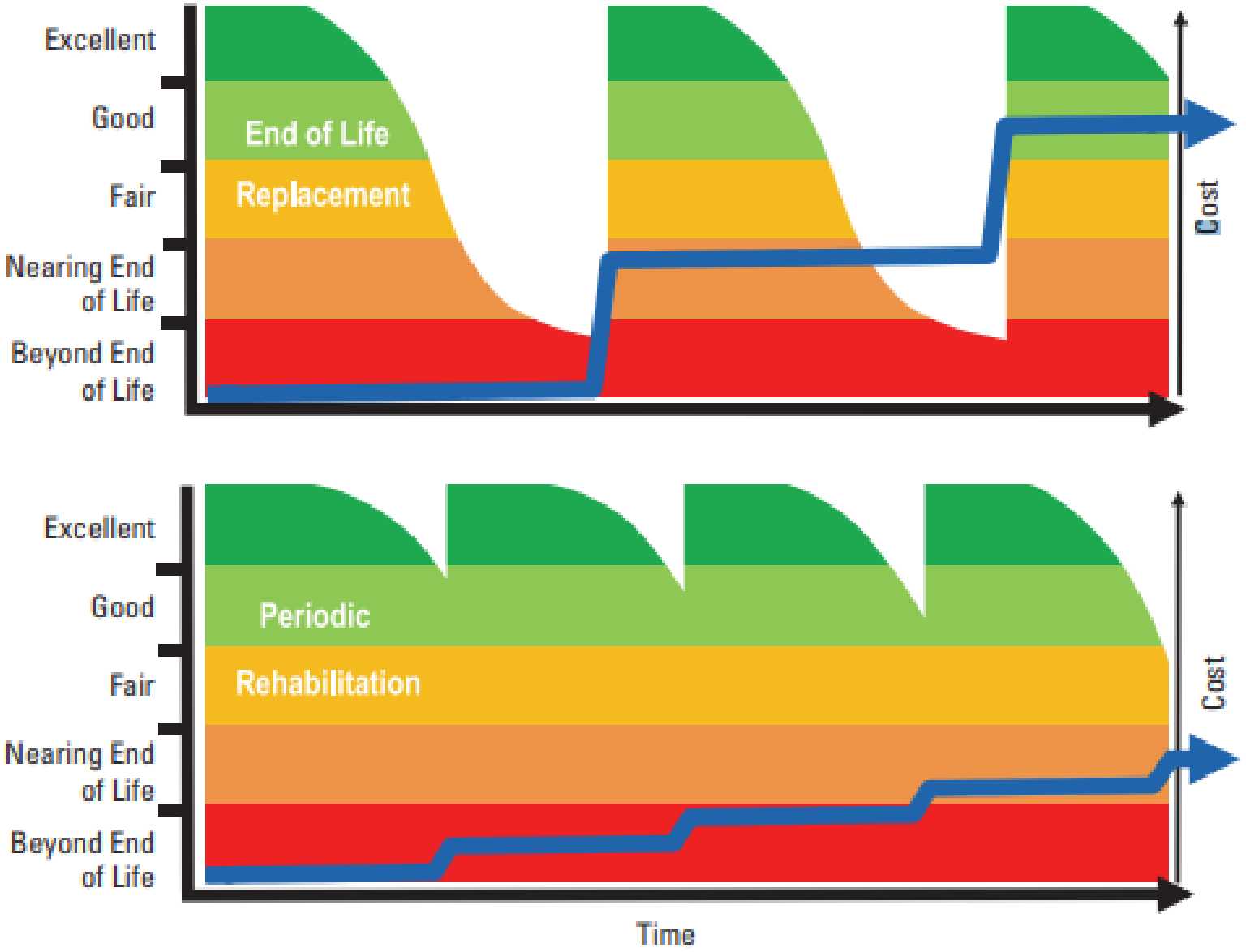


manage risks to an acceptable level

keep costs to a minimum

# The Approach

Make regular investments into assets to reduce costs and ensure more reliable services




From Town of Richmond Hill 2016 Asset Management Plan

# Four stages of asset management planning

**1) State of infrastructure**

- Asset register & inventory

**2) Levels of service**

- Metrics on current and proposed services

**3) Life cycle management plan**

- Management options, risks, costs

**4) Financial strategy**

- Costs of plan, funds available, shortfalls

# Differences between Traditional Assets & Green Infrastructure Assets

**Traditional Assets**

1. Must be constructed or bought
2. End of life/Must be replaced
3. Provides one or two services
4. Expected service levels achieved after construction/installation
5. Accounting standards for valuation

**Green Infrastructure Assets (some)**

1. Naturally forming
2. No end of life
3. Many services provided
4. Desired service capacity can take months to decades to achieve
5. No accounting standards for valuation

# Natural Assets: Formed Naturally and Have No End of Life

Existing rivers, forests, lakes, wetlands, etc.

- Non-typical lifecycle: No historical cost and no plans to replace
- But these assets can become degraded and sometimes are lost
- *Asset replacement = Ecosystem restoration*

# Living Green Infrastructure Provides Many Services

- Need to identify all the services that the assets are being managed for and which are valued by the public

- Restoration and management actions must replace or maintain these services (as much as possible)

# Delay in Service Provision / Services Increase with Time

- Slow growing assets like trees and forests take years to reach desired service levels.
- Need to consider delay in service provision in management plan
- Consider increasing service levels in asset valuation

# No Generally Accepted Accounting Principles

- There are no accounting standards for valuing green infrastructure assets

- This can increase resistance to including green infrastructure into asset management planning

# Four stages of asset management planning

**1) State of infrastructure**

- Asset register & inventory

**2) Levels of service**

- Metrics on current and proposed services

**3) Life cycle management plan**

- Management options, risks, costs

**4) Financial strategy**

- Costs of plan, funds available, shortfalls


# Stage 1: State of Infrastructure

Where municipalities/organizations answer the following questions:

- What assets are they responsible for?
- What are they worth?
- How old are they?
- What is their condition?

# Overview

Asset Inventory

- **Asset Hierarchy** — Classification structure
- **Asset Register** — Centralized source of asset information
- **Asset Attributes** — What information is collected and tracked

State of Infrastructure

The foundation for decisions and recommendations within the asset management planning process

# Asset Management Classes/Categories

## Town of Ajax

- Transportation
- **Stormwater Management**
- **Outdoor Active Recreation**
- **Forestry**
- Facilities
- Fleet
- Information Technology

## City of London

- Water
- Wastewater – Sanitary
- **Wastewater – Stormwater**
- Transportation
- Parking
- Solid Waste
- **Parks**
- Recreation
- **Urban Forestry**
- Fire
- Long Term Care
- Corporate & Cultural Facilities
- Fleet
- Information Technology
- **Land**
- Corporate Security

## York Region

- Housing Services
- Paramedic Services
- Seniors Services
- Information Technology
- Property Services
- Energy Management
- **Forestry**
- Waste Management
- **Wastewater**
- Water
- Roads
- Transit
- Police Services

## Bruce County

- Road Network
- Bridges & Culverts
- Social Housing
- Buildings
- Land Improvements
- Machinery & Vehicles
- Equipment
- Technology & Communication
- **Trail Programs**

# What assets does the municipality own or manage?

# Example – Types & Quantity of GI Assets

| Table 6.1 Asset Inventory and Valuation (Wastewater – Stormwater Services) | | | |
|---|---|---|---|
| **Asset Type** | **Asset** | **Inventory** | **Unit** |
| Stormwater Conveyance System | Storm Sewers (< 450 mm diameter) | 494 | km |
| | Storm Sewers (450 mm >= to < 1,500 mm diameter) | 766 | km |
| | Storm Sewers (=> 1,500 mm diameter) | 117 | km |
| Stormwater Management | Open Conveyance (Municipal Drains, Drains, Channels, Dyke) | 89 | km |
| | Storm Water Management Facilities (Wet Facility, Dry Facility, Dissipation Pools, Online Flood & Erosion Control Facilities) | 64 | Ea. |
| | SWM Green Infrastructure (Bioretention cells with or without underdrain, Drywells) | 63 | Ea. |
| | Minor Treatment (Oil/Grit Separators) | 37 | Ea. |

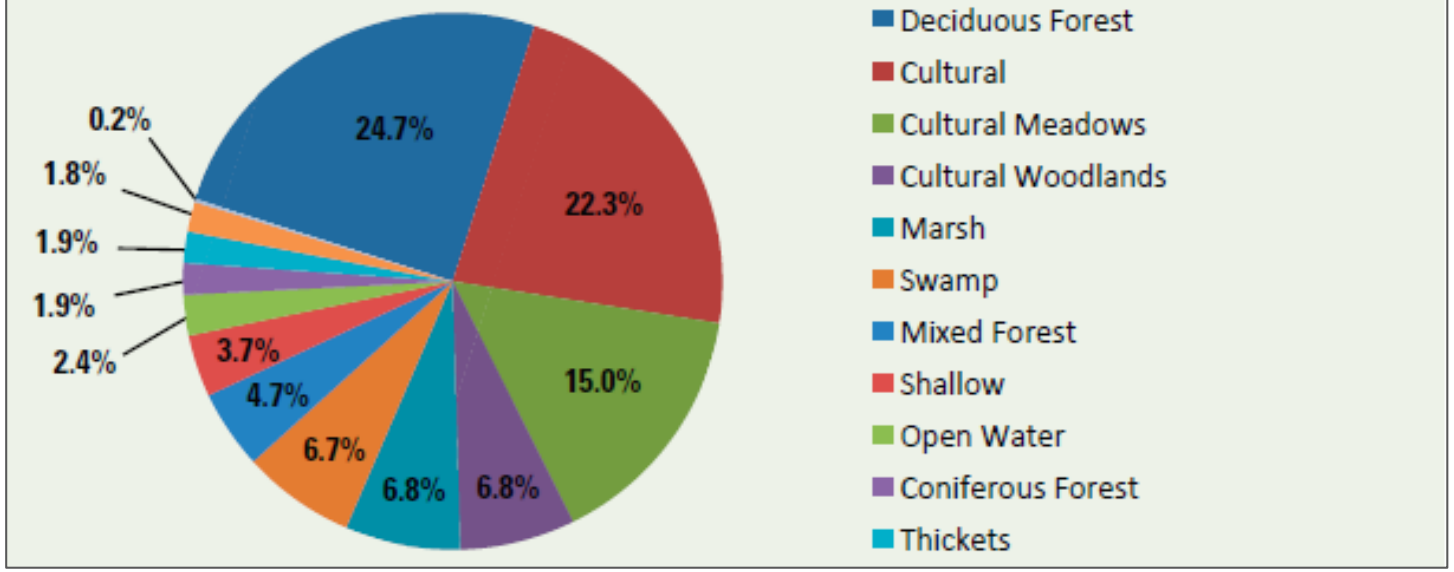
City of London Corporate AMP 2019

# Example – Types & Quantity of Assets

**Table 18: Environmental Assets Inventory and Current Value**

| Asset Class | Replacement Cost (2014 dollars) | Quantity | Data Confidence |
|---|---|---|---|
| Street Trees | $13.4 M | 43,217 trees | Intermediate |
| Natural Areas - Forest | $74.2 M | 696.2 hectares | Intermediate |

**Figure 38: Vegetation Communities in Richmond Hill's Natural Areas**




Richmond Hill AMP 2016

# Example – City of Newcastle, Australia

| Service Output | Asset Stock | |
|---|---|---|
| Aquatic Centres | 5 Aquatic Centres<br>2 Ocean Bath Facilities | |
| Arts and Cultural Facilities | 1 Museum Facility including collections<br>1 Art Gallery Facility including collections<br>1 City Hall Facility<br>1 Civic Theatre Facility | 1 Fort Exhibition Facility<br>1 Historic Fort<br>147 Public Art, Fountains and Monuments |
| Bushland, Watercourses and Public Trees | 88 Bushland Parcels totaling 4.8Mill sqm<br>97,428 Street and Park Trees<br>607 Creek Reaches totaling 79km | 42 Inland Clifflines totaling 20,444 sqm<br>45,269m of tracks and trails<br>106 Nest Boxes |
| Car Parking | 1 Parking Station | 108 Off Street Carparks |
| Caravan Park | 1 Holiday Park | |
| Cemeteries | 3 Cemeteries | |
| Child Care | 11 Child Care Centres | |
| Coastal, Estuary and Wetland | 12 Beaches (6 Main)<br>4.5 km Dunes<br>3 Lifeguard Facilities<br>3 Boat ramps | 63 Wetlands covering 187ha<br>21 Coastal clifflines totalling 3.6km<br>29 sea and river walls totalling 1.1km<br>9 Rock platforms totalling 3.3km |
| Community Buildings | 3 Senior Citizen Facilities<br>9 Community Centres<br>7 Community Halls | 8 Surf Clubs<br>1 Neighbourhood Centre<br>7 Scout/Guide Halls |
| Libraries | 9 Library Facilities including collections | |
| Parks and Recreational Facilities | 54 Sporting Amenities Facilities<br>116 Playgrounds<br>15 Grandstands<br>18 Kiosks<br>15 Animal Enclosures<br>115 Shade and Shelter Structures | 8 Skate facilities<br>65 Support Buildings e.g. clubhouses and sheds<br>Support structures e.g. fencing, flagpoles, scoreboards, lighting |
| Public Amenity | 39 Public Toilet Facilities | |

# How old are assets?

# Age-Related Attributes

Age-related attributes can act as a surrogate for condition & indicate when rehabilitation or replacement may be required.

Attributes:

- Age
- Expected useful life
- Remaining useful life

For each asset category report:

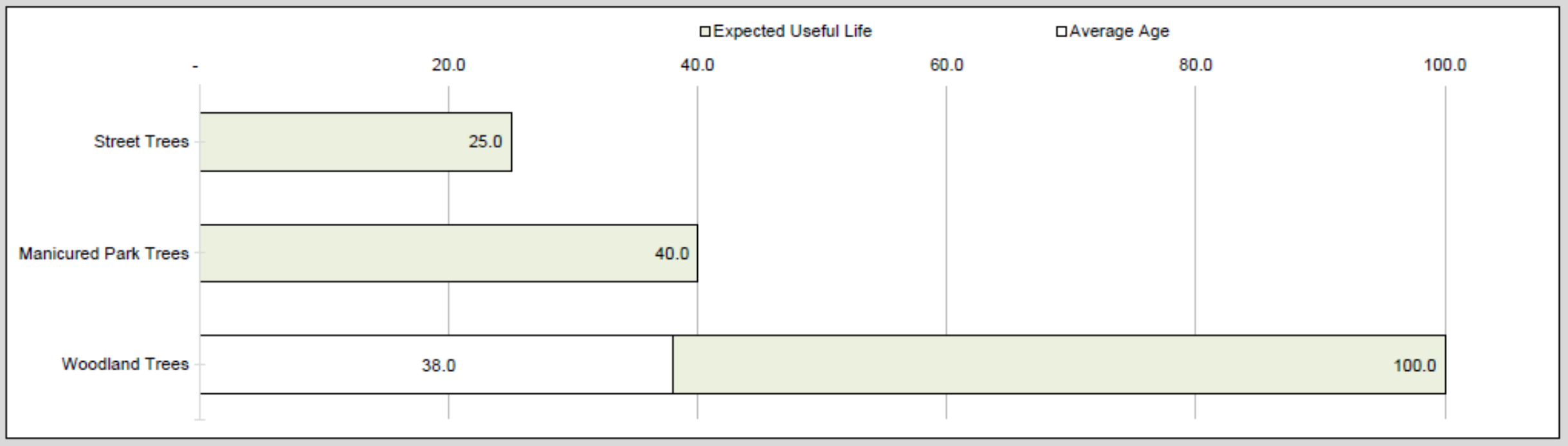
- average age or age as a proportion of expected useful life
- proportion of assets within each age class

# An Example of Asset Useful Life

| Asset Group | Asset Type | Asset Sub-Type | Asset Useful Life |
|---|---|---|---|
| URBAN FOREST | | | |
| Biological Assets | Street Trees | Urban Trees | 35 years |
| | | Suburban Trees | 44 years |
| | | Rural Trees | 53 years |
| | Plants | Shrubs | Not applicable – entire bed replaced when street trees are replaced (individual failed plants are considered a maintenance cost) |
| | | Perennials | |
| | Growing Medium | Soil Cells | 50 years (when sidewalk is replaced) |
| | | Boulevard Soil Trench | Not applicable – made up of native soils |
| | | Engineered Growing Medium | 35 years |
| | | Native Soils | Not applicable |

York Region's GI AMP 2017

# Example of Average Age & Average Remaining Life




City of London Corporate AMP 2019

# What is the condition of assets?

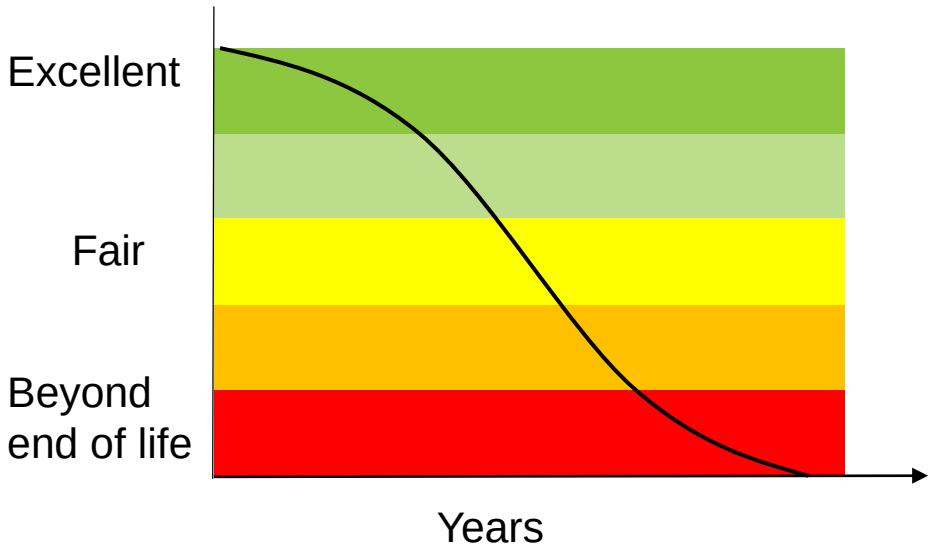
# Condition Attributes

- Attributes which measure physical condition

- Report:

  average condition and condition profile for asset group or category

- Develop a condition scoring system for use among all asset types




**Attributes**

- Condition Rating
- Specific condition attributes
- Date of assessment
- Method of assessment

# Condition Criteria for Street Trees

| | | Grade | 1 / A | 2 / B | 3 / C | 4 / D | 5 / E |
|---|---|---|---|---|---|---|---|
| | | Condition | Very Good | Good | Fair | Poor | Very Poor |
| | | LoS | *Conforming Level* | *Conforming Level* | *Observation Level* | *Intervention Level* | *Non-Conforming* |
| STREET TREES | Status | | Thriving | Satisfactory | Potential Trouble | Declining | End of Life |
| | Health | | Perfect specimen with excellent form and vigor, well-balanced crown. Likely to exceed life expectancy. | Imperfect canopy density in 10% of tree, Less than half normal growth rate; pest damage controllable. Typical life expectancy. | Crown decline and dieback up to 30% of the canopy. Obvious signs of pest problems. Below average life expectancy. | Significant dieback affecting larger branches. Stunting obvious with obvious pest problems. Life expectancy is low. | Will likely die within 5 years. |
| | Management | | Implement routine maintenance | Implement routine maintenance | Requires corrective pruning | Requires major corrective pruning, or replacement | Will require replacement or removal |

# Example of  Condition Profile for Stormwater Assets

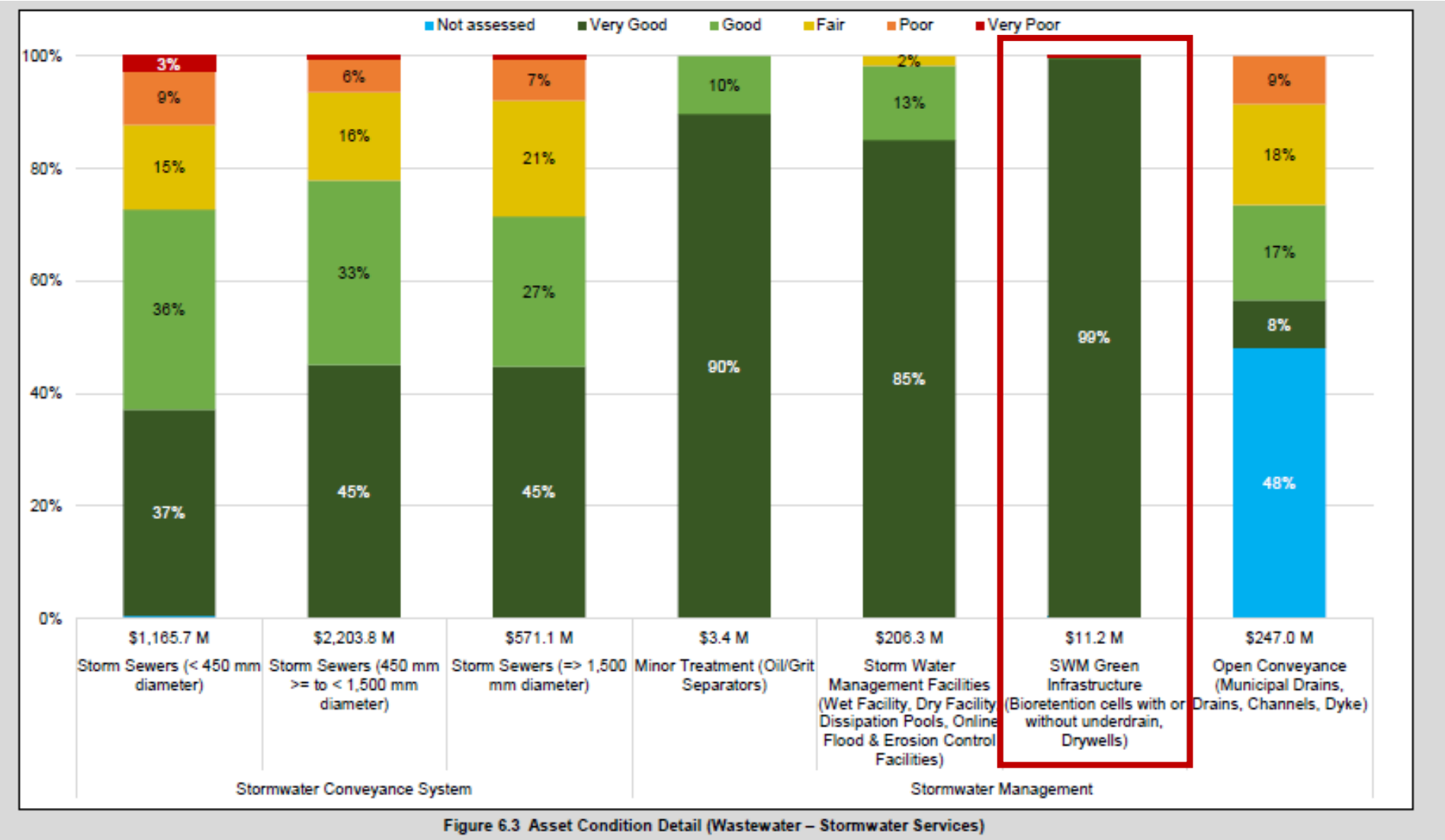


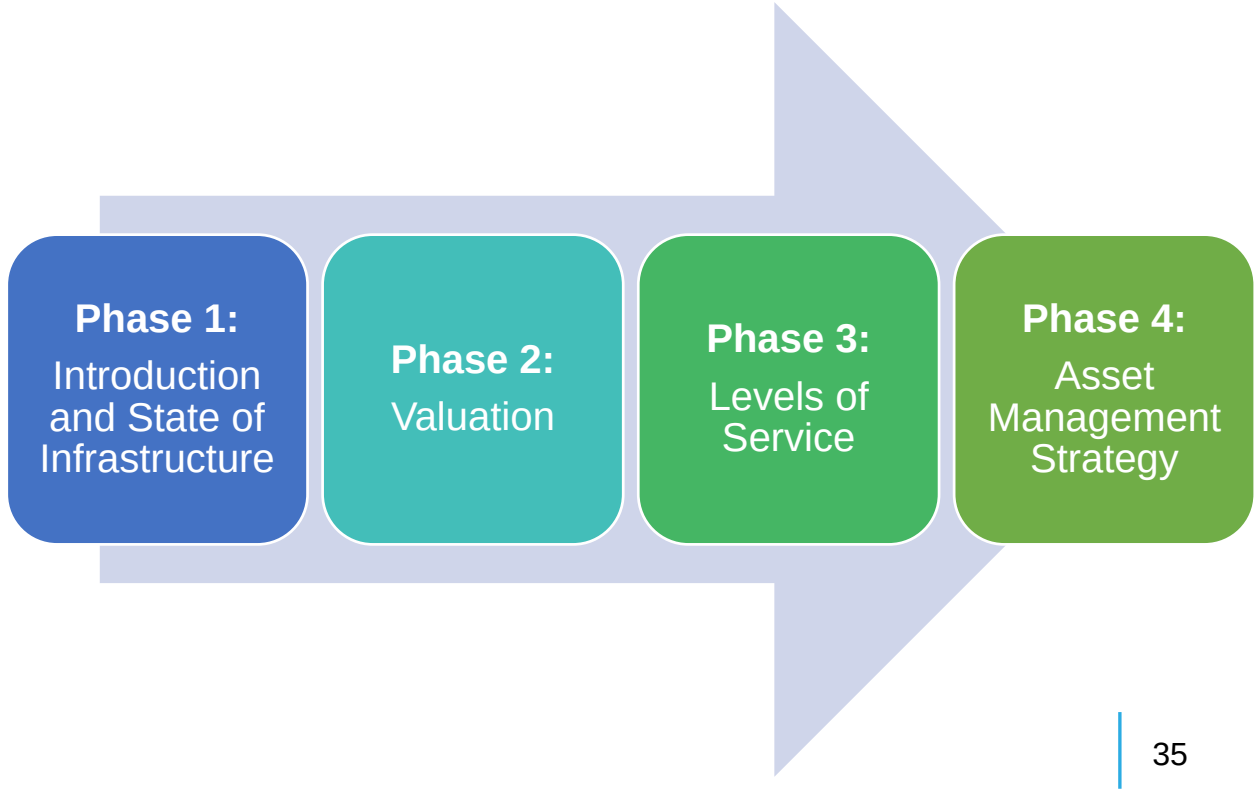

Figure 6.3 Asset Condition Detail (Wastewater – Stormwater Services)

City of London Corporate AMP 2019

# Integrating Green Infrastructure Assets into Mississauga's Stormwater Asset Management Plan

In 2019, the City of Mississauga approached TRCA to examine how GI assets can be incorporated into the City's Stormwater Asset Management Plan

- Project Lead: Kristina Dokoska
- GI assets examined for this project include:
  - Watercourses
  - Stormwater Management Ponds
  - Low-Impact Development Features



# Phase 1: Introduction and State of Infrastructure

1. Best practice review & provide guidance on defining ‘green and natural’ infrastructure

2. Best practice review & develop a framework for green infrastructure asset inventory

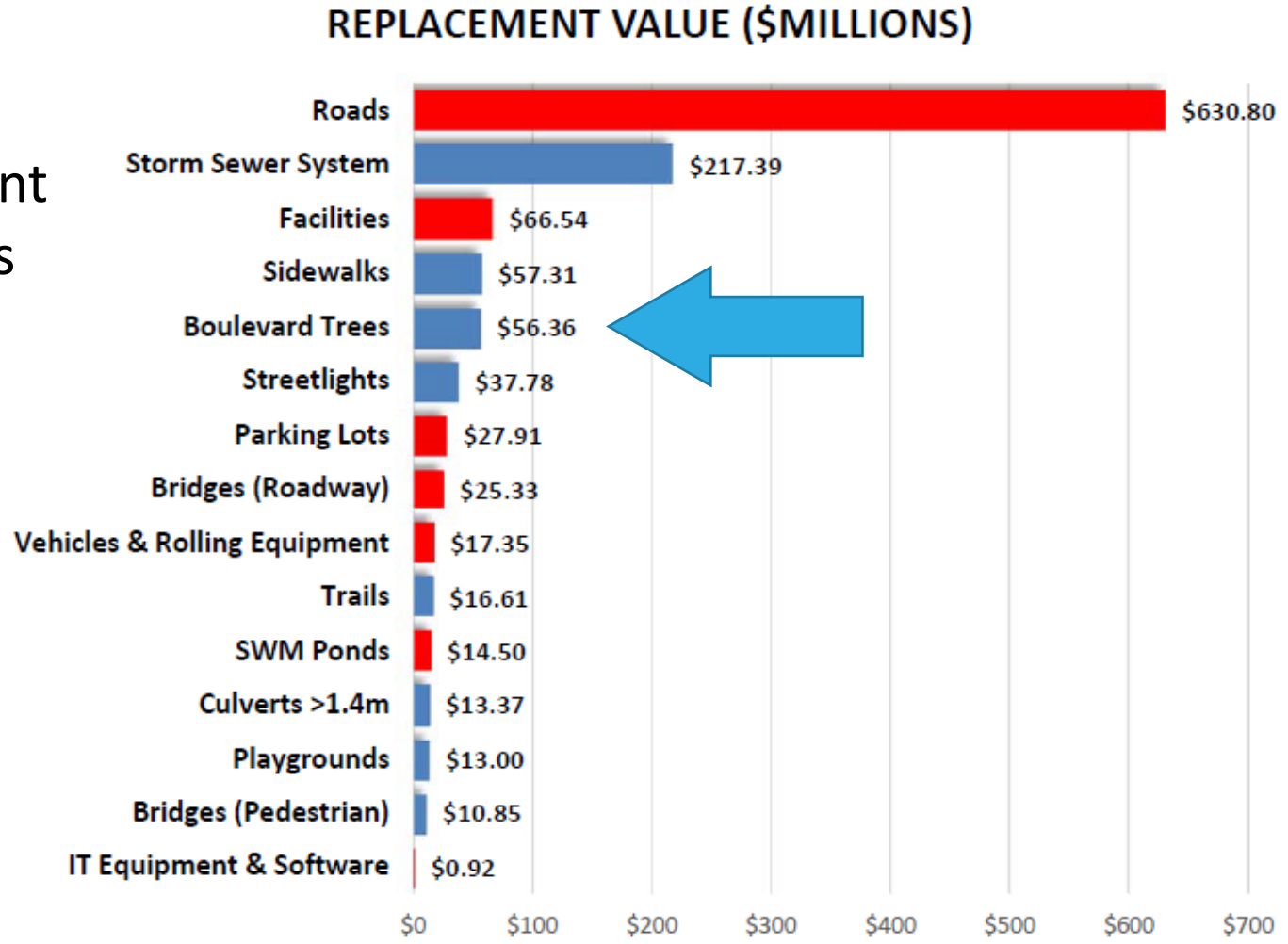
3. Build the inventory for pilot sites

# State of Infrastructure Report: What is the value of assets?

# How Asset Value is Used

- Informs long-term asset management and financial management decisions
- Internal and external reporting
- Allows for **comparison** between service areas and asset categories

Why green infrastructure assets need to use the same method



# General Valuation Approaches

| | |
|---|---|
| Historical cost | The original cost to purchase or construct the asset |
| Current cost | The cost of the asset in today's dollars |

# Asset Management Planning Valuation

## Current Replacement Cost

Costs of replacing an existing asset with a new asset that will provide the **current required level of service** in the same operating environment. It should also consider changes in technology and construction methods and materials and use the least cost option.

# PSAB 3150 vs. Asset Management Plan Valuation

**PSAB 3150**

Public Sector Accounting Board Handbook, Section 3150 – Tangible Capital Assets (TCAs)

- Valuation of assets for financial statements
- TCAs = historical cost of asset minus accumulated depreciation/amortization
- Restricts the inclusion of natural assets as TCAs

**Asset Value for Asset Management Planning**

- Current replacement cost, used for financial planning
- Should include any asset with a role in service delivery and requires deliberate management, whether they are TCAs under PSAB 3150 or not.

# Asset Management Plan Valuation vs. Ecosystem Service Valuation

**Ecosystem services valuation**

- Economic Valuation
- Useful for making a business case for protecting and managing green infrastructure
- Does not align with the valuation method used for traditional assets

**Asset value for asset management planning**

- Current replacement cost
- Asset focused
- Consistent across all assets in an asset management plan

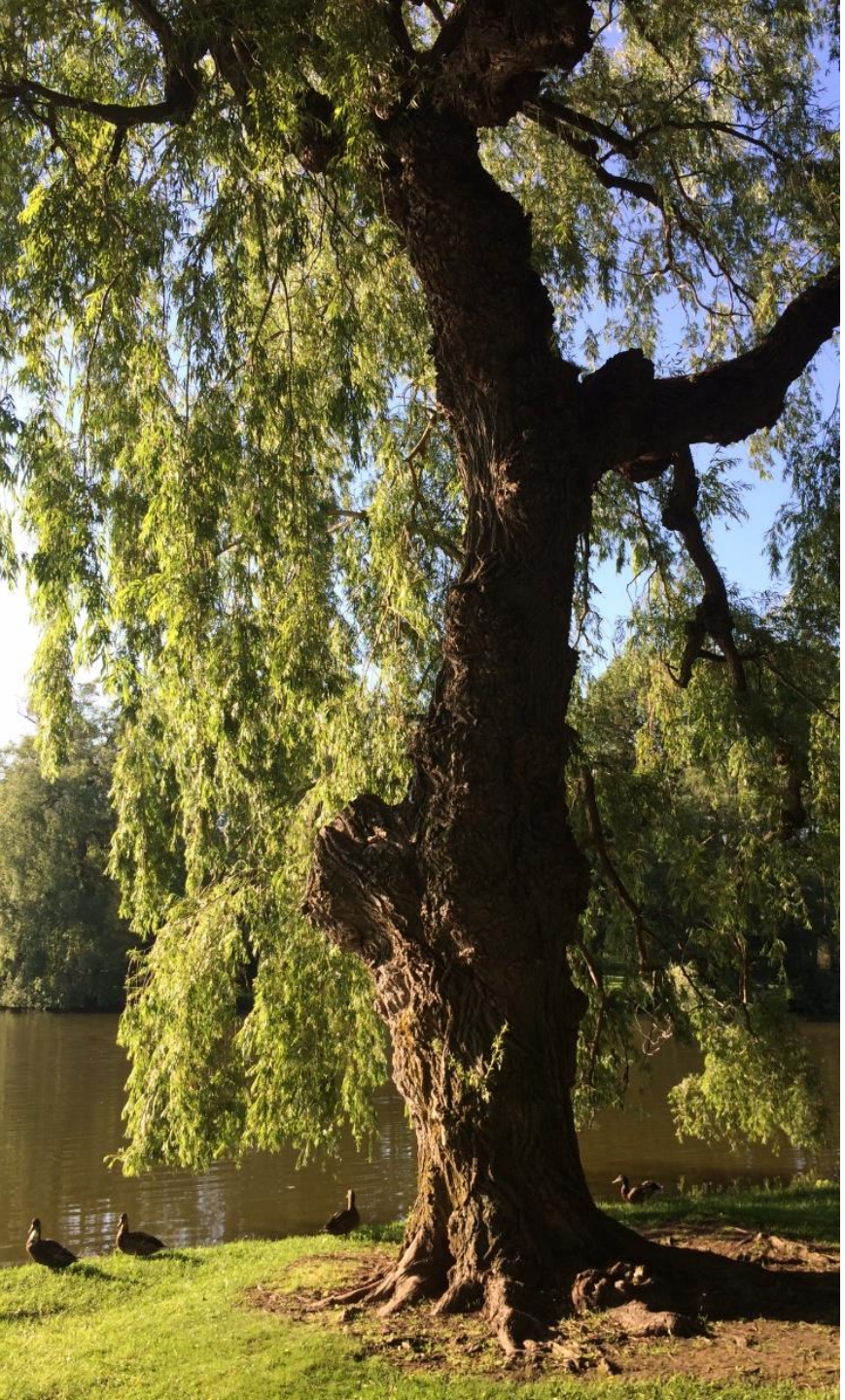
# Applying the Replacement Cost Method to Green Infrastructure

- Use a benchmark cost ($/unit)
- Total quantity of asset: area, length, number

**Replacement cost = Benchmark cost x Quantity**

General replacement cost approach

- Engineered assets: Construction costs
- Natural assets: Restoration costs



# Replacement Cost of Trees (street and park)

**Step 1)** Decide on an approach

- 1 tree of any size is replaced by 1 small tree, OR
- Account for the size of the tree

**Step 2)** Set a benchmark cost

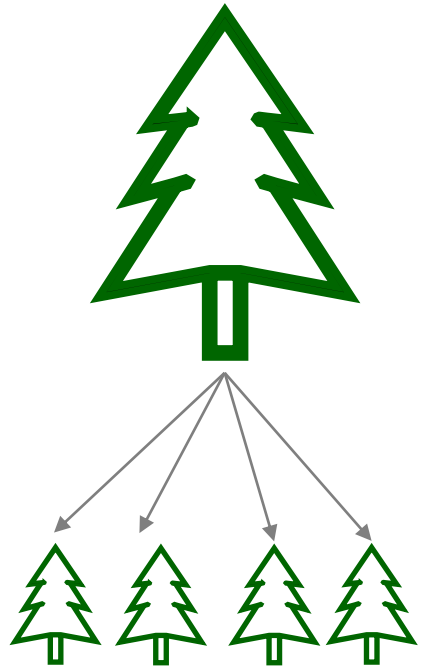
**Step 3)** Multiply benchmark cost by the number of trees

# Option 1: 1 Tree is Replaced by 1 Caliper-Sized Tree

- Benchmark cost: $ / tree
- All trees effectively have the same value, irrespective of their size.
- Basic replacement cost can be used to calculate costs of lifecycle management plan and in financial planning

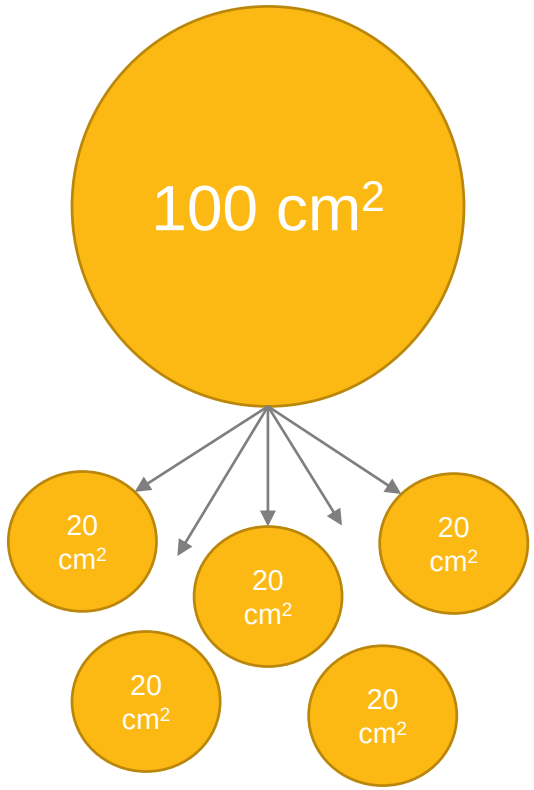
# Option 2: Larger Trees have Greater Replacement Cost

- Larger trees provide exponentially more services than smaller trees.
- The services they provide are not matched by replacement with a single young tree
- Basic principle: replacement cost of 1 large tree = replacement cost of several caliper-sized trees

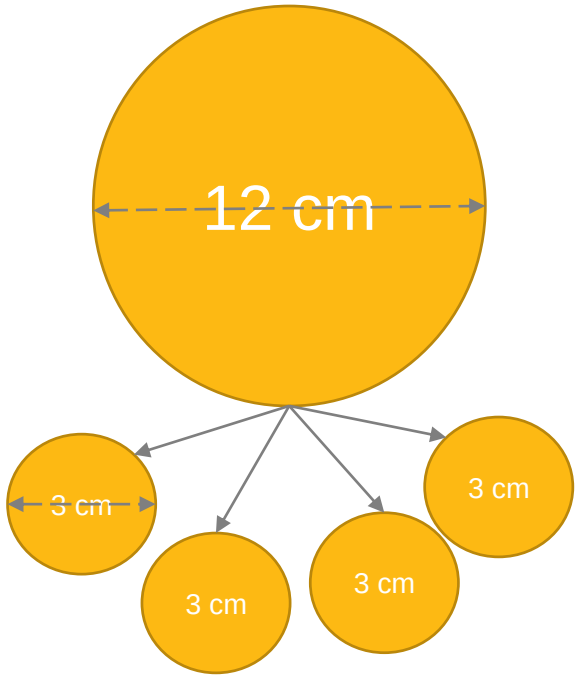


# One Large trees; multiple smaller trees

CLTA Trunk Formula Method



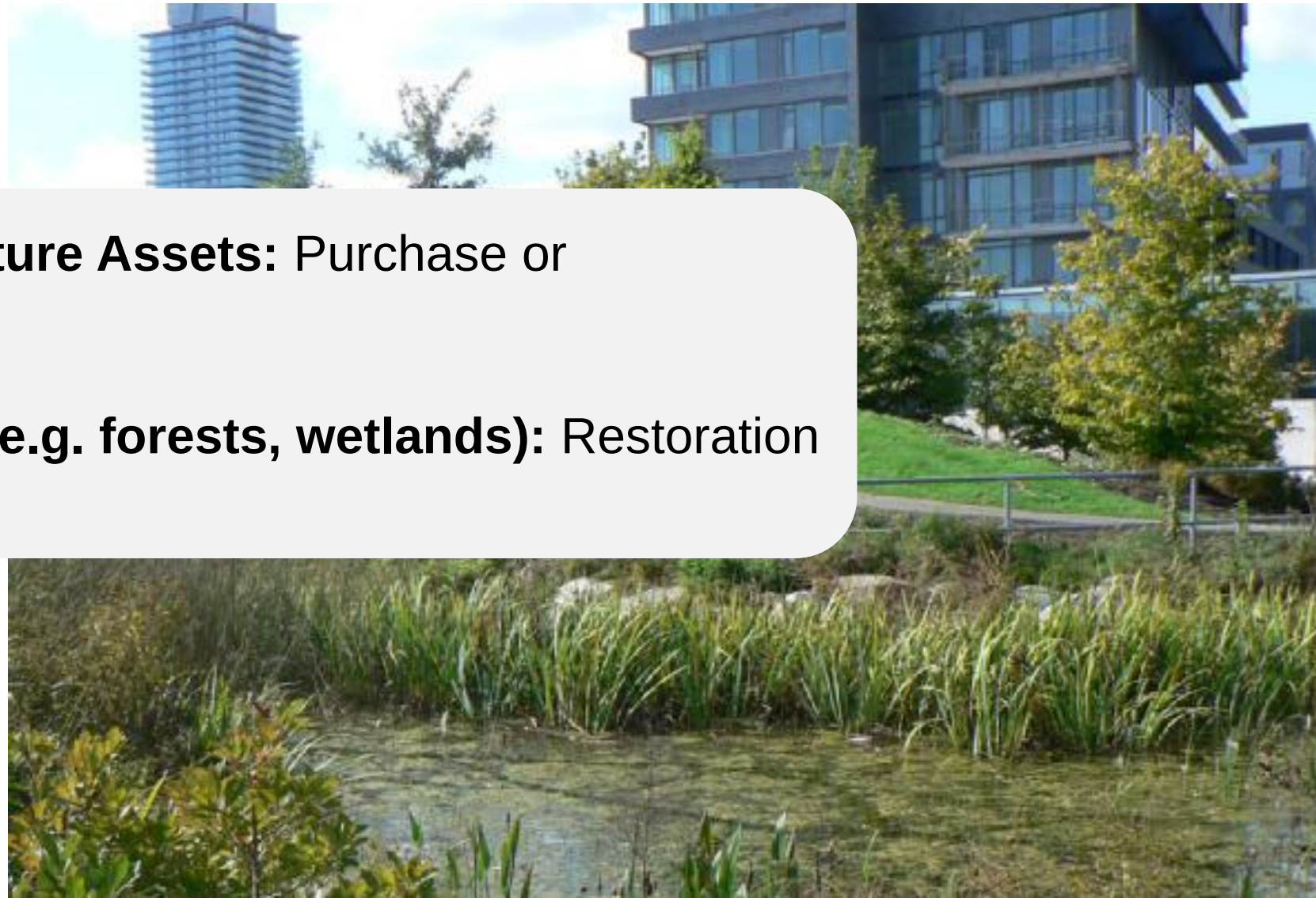

Replace Diameter



# Examples of Street Tree Valuations

| AMP | Asset | Method details | # Trees | Average Cost / Tree | Asset value |
|---|---|---|---|---|---|
| Richmond Hill, ON | Street trees | 1:1 replacement cost | 43,217 | $310 | $13.4 million |
| London, ON | Street trees and manicured park trees | Replace tree with multiple trees to achieve equivalent *trunk diameter* | 171,874 | $1,867 | $321 million |
| Ajax, ON | Boulevard trees | Value is based on the *trunk diameter* | 39,000 | $1,445 | $56.4 million |

# Other Green Infrastructure Benchmark Costs



**Most Green Infrastructure Assets:** Purchase or construction costs

**Some Natural Assets (e.g. forests, wetlands):** Restoration costs

# Final Points

- Value calculation and condition assessment methods need to be feasible, replicable, and establish a process for regular updates
- New or better information can emerge, this is okay and to be expected
- Be sure to document your method and any assumptions

# Conclusions

- Green infrastructure assets need to be included in municipal asset management plans by July 1, 2023 (*O. Reg. 588/17*)
- Assets do NOT need to be Tangible Capital Assets (TCAs) to be included in asset management plans
- Asset valuation should be calculated using current replacement cost
- There are differences between green and traditional infrastructure, but there are strategies for addressing those differences.
- All the data isn’t required before you can start to integrate green infrastructure assets into asset management plans.

# Questions

# Last ECS Lunch and Learn of 2020!

Wednesday, December 16
11:30am-12:30pm

**Terrestrial Environmental Monitoring and Evaluation**

By Paul Prior and
Gavin Miller

**More sessions planned for 2021!**

# Past Recordings

# Thank you

For questions about the ECS Lunch and Learn Series, please contact:

Sharon Lam
sharon.lam@trca.ca

Toronto and Region Conservation Authority