

2022-23 Asset Management Technical Assistance Project

Milestone #2

Levels of Service

October 19, 2022

Eastern Ontario Region

Levels of Service Strategy Objectives

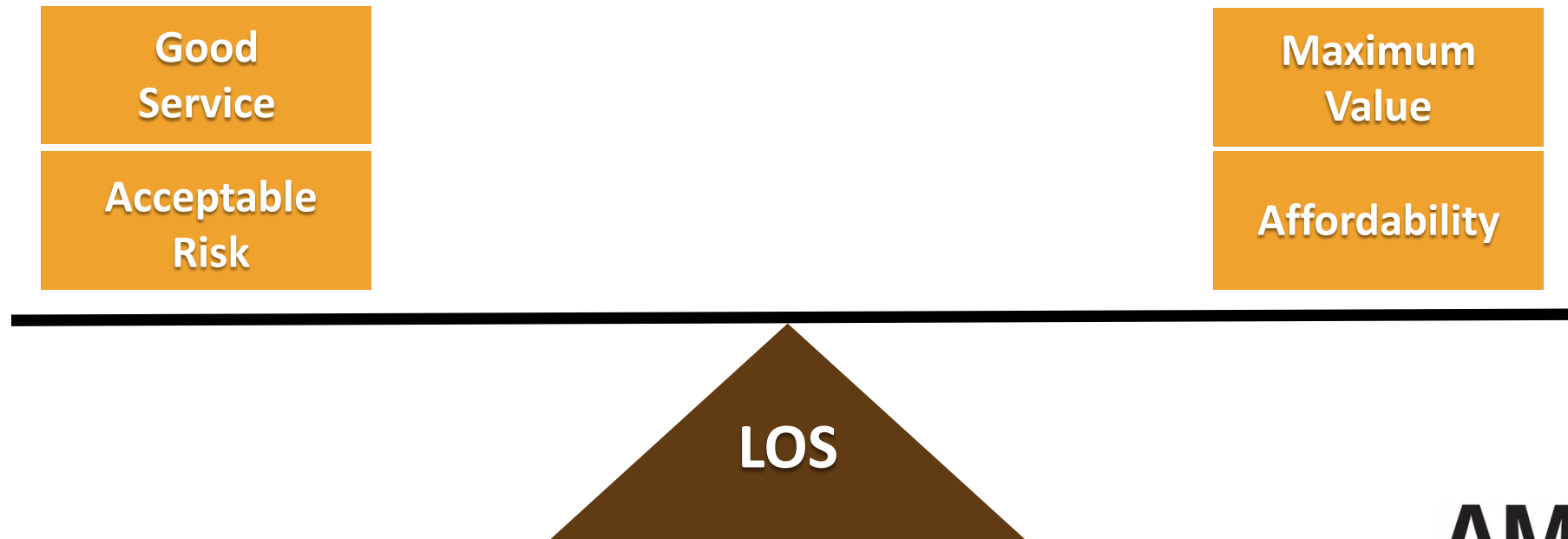


- LOS align with strategic service objectives
- There is line-of-sight between service levels to the community & asset service level requirements
- LOS targets maximize asset value
- LOS have multifunctional uses for planning & decision making
- LOS are simple, outcome-based & few as possible
- Use industry precedent & regulations as much as possible when defining LOS

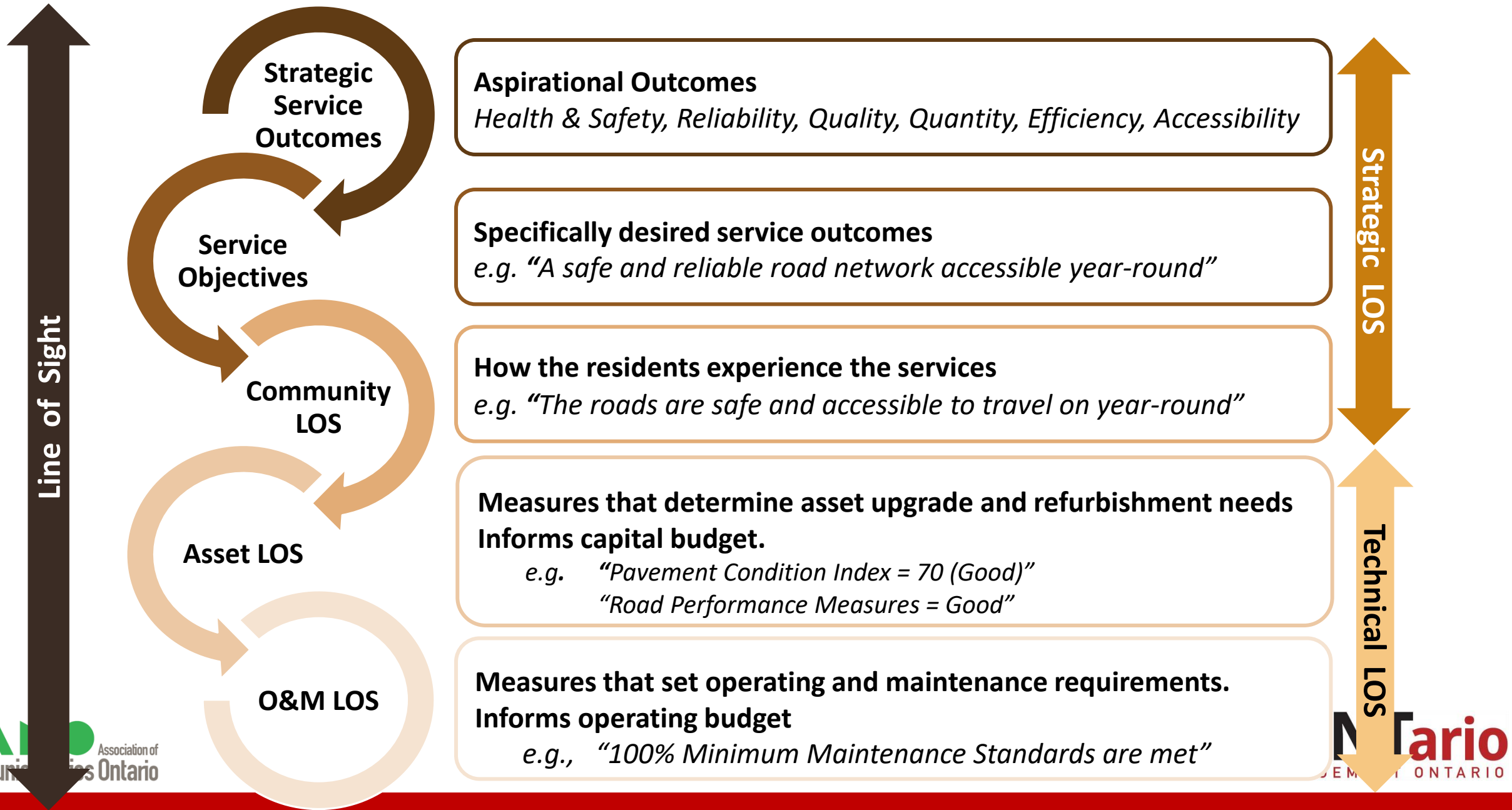
Finding Balance

Consider:

- What is a “Good” or desired LOS?
- Do the LOS targets manage risk at acceptable levels?
- What is the cost to provide the LOS?
- Does the LOS maximize asset value?



LOS Hierarchy: A line-of-sight between service objectives & asset requirements

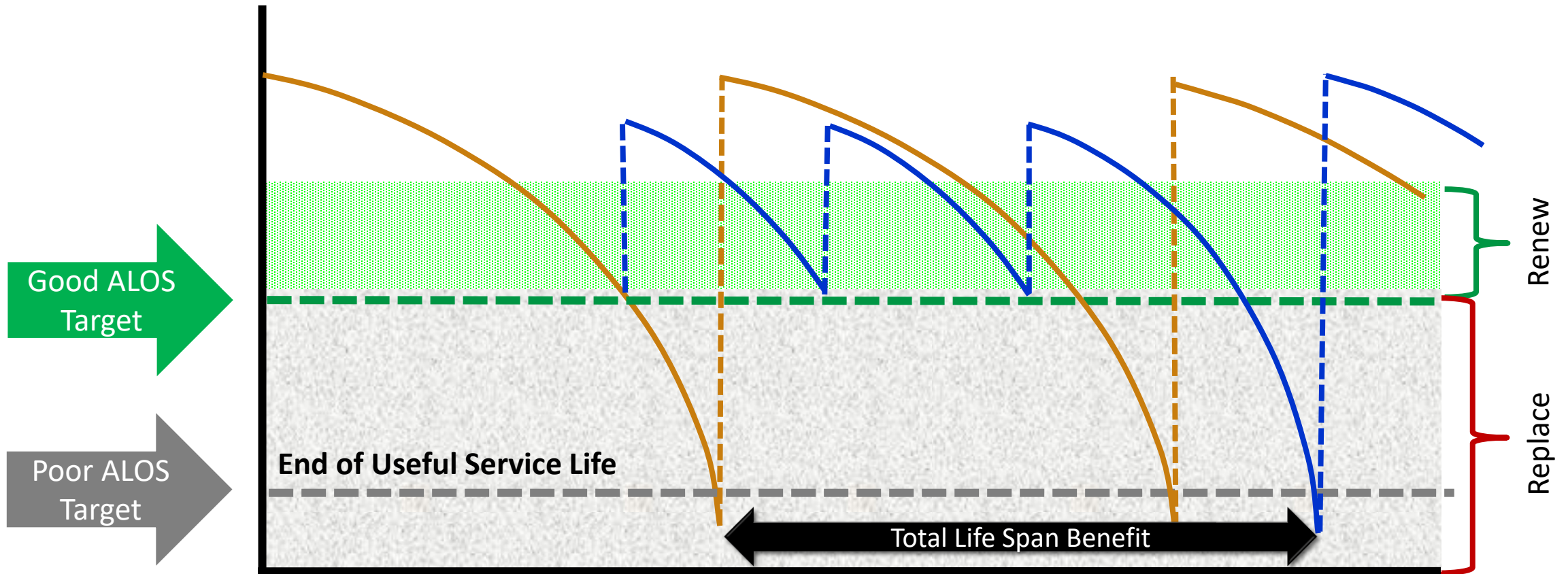


AMONTario Level of Service Template

(Roads Example)

Service	Program Service Objectives	Community Levels of Service	Service Division	Supporting Asset Classes	Technical Levels of Service								
					Target Asset Levels of Service (by Asset Class)	Current Asset Levels of Service					O&M Levels of Service		
						Asset Class Average	Distribution by Asset Rating				Activity	Current LOS	Target LOS
%	%	%	%	%									
Roads	A safe, reliable, efficient road network accessible year round	Roads are kept in good condition	Pavement	HCB Local Urban Roads	Condition	Condition							
					HCB pavements: PCI = 70	PCI = 60	40	50	10	Road Patrols	Meet Min. Maintenance Standards	Meet Min. Maintenance Standards	
					Performance	Performance					Line Painting	100% of roads every 2 years	100% of roads every year
					Operational Functionality = Good	Fair	40	60		Sweeping	Once a year	Once a year	
					Capacity - Good	Good	100			Snow Removal	Meet Min. Maintenance Standards	Meet Min. Maintenance Standards	
					Environmental Resiliency = Good	Fair	30	70		Pavement Spot Repairs	Meet Min. Maintenance Standards	Meet Min. Maintenance Standards	
										CB/CBMH Cleaning	Every 10 years	Every 5 years	

Ideal LOS Targets Maximize Asset Value

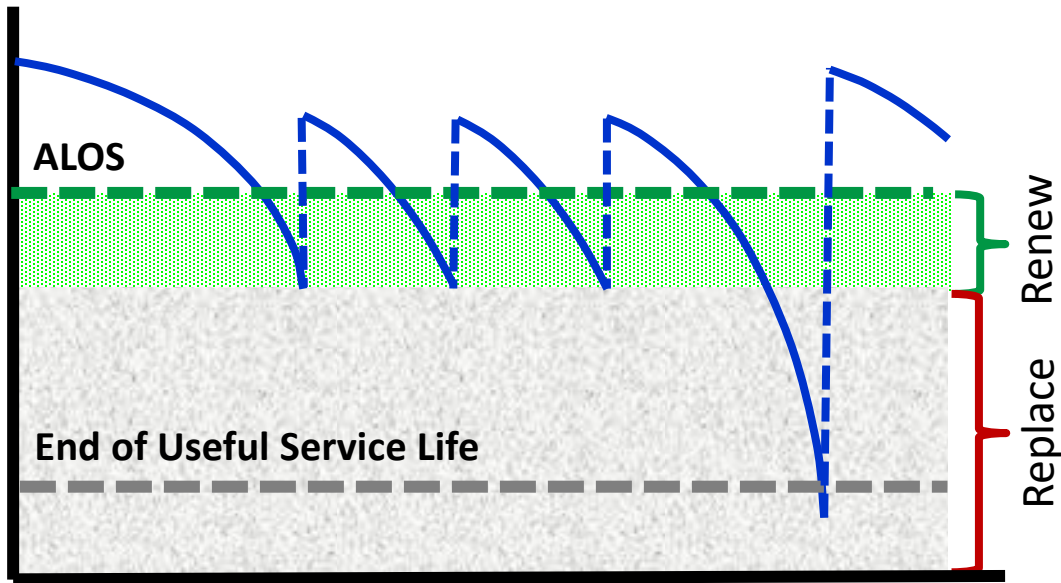


— Renew then replace life cycle strategy: TCO = \$10/yr.

— Replace-only life cycle strategy: TCO = \$12/yr.

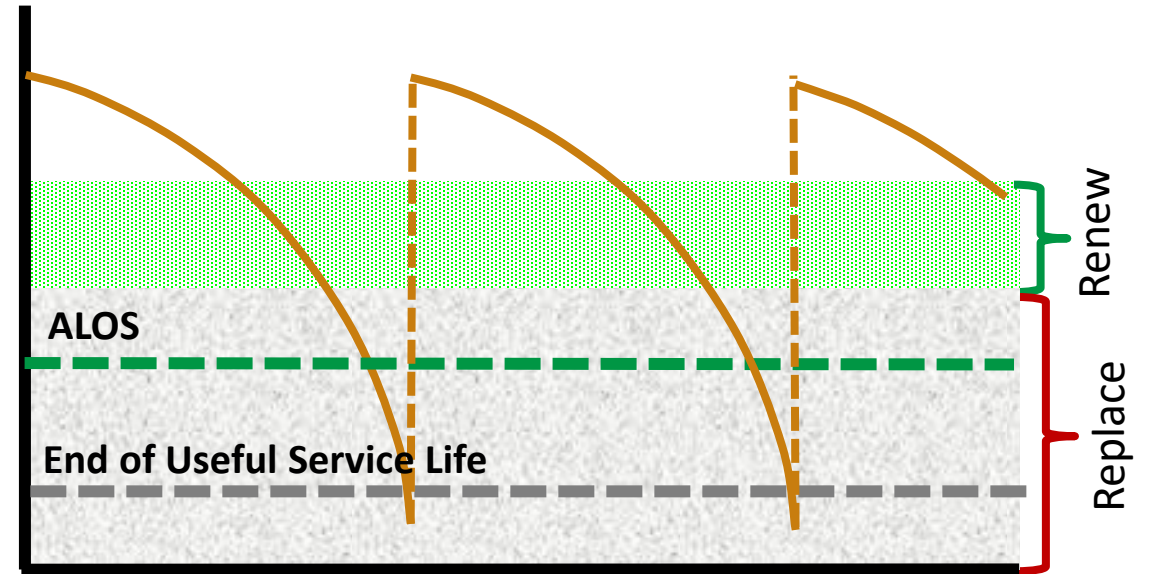
Higher O&M cost zone due to deterioration & emergency repairs

Set LOS Targets to Suit the Assets and Desired Lifecycle Strategies



Higher ALOS targets are suitable for:

- Costly, critical & complex assets
- Assets that are more cost effective to renew than replace
- Assets with higher O&M costs



Lower ALOS targets may be suitable for:

- Simpler, less costly, non-critical assets
- Assets where complete change-outs are more cost effective or practical
- A short turnaround to replace the assets
- Assets with lower or less variable O&M costs

Most efficient operating zone

Higher O&M cost zone due to deterioration & emergency repairs

Defining Asset Levels of Service

- Use simple measures
 - Make them outcome-focused
 - Use industry precedent where possible

- Minimize the number of LOS
 - Only what is required for asset planning & decision-making
 - Easier to understand & communicate asset needs

- Targets should set minimum asset conditions to meet service objectives:
 - Minimum condition requirements
 - Minimum capacity and/or back-up capacity requirements
 - Adequate resiliency and reliability
 - Adequate functionality
 - Meets current regulations

AMONTario ALOS	AMONTario ALOS Measurement Attributes Using Industry Measures, Ministry Design Guidelines, Regulations & Other Precedents
Condition Levels of Service	Physical state of the asset measured by condition rating systems: PCI, BCI, FCI, PACP,, Very Good to Very Poor etc.
Operational Functionality	<ul style="list-style-type: none"> - Efficiency and effectiveness of service delivery - Ability to meet minimum current design and/or safety requirements - Level of operational problems experienced and whether they affect community services. - Compliance with current Regulations and/or Standards (including the level of "grandfathering") - Whether all required elements are present. - Relevance and effectiveness of technology - Efficiency of resource consumption including a focus on reduction of greenhouse gas emissions
Capacity to Meet Demands	<ul style="list-style-type: none"> - To what degree capacity meets current demands and minimum community service levels - Level of operational problems experienced. - Are there noticeable negative affects on community service levels or stakeholders (residents and businesses)
Operational Resiliency	<ul style="list-style-type: none"> - To what degree minimum service requirements are maintained/protected with back-up systems, spare capacity or alternative supply. - To what extent the assets are secure from acts of vandalism, trespassing, theft, assault or terrorism.
Environmental Resiliency	<ul style="list-style-type: none"> - To what extent the assets are resilient to environmental stresses including climate change; e.g., impacts from wind, fire, flooding, excessive rainfall/snowfall etc.. - The extent to which assets have been specifically protected or adapted for climate change where such actions have been identified.

AMONTario ALOS Mapped to Typical Service Outcomes

- Ensure ALOS align with strategic service objectives

AMONTario ALOS	Predominant Community Service Outcomes					
	Health & Safety	Reliability	Quality	Quantity	Efficiency	Accessibility
Condition Levels of Service	X	X	X	X	X	
Operational Functionality	X	X	X		X	X
Capacity to Meet Demands	X	X	X	X	X	X
Operational Resiliency	X	X				
Environmental Resiliency	X	X				X

Asset Levels of Service

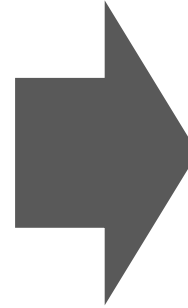
Measures/
Determines

Likelihood of Failure

RISK =  Consequence  LoF 




Failing ALOS targets OR
setting inadequate ALOS targets
= **Unacceptable Risk**



Meeting appropriate ALOS targets
= **Acceptable Risk**

AMONTario Asset Level of Service Framework

Asset Level of Service and Corresponding Likelihood of Failure							
Condition Levels of Service				Performance Levels of Service			
ALOS Measures	Corresponding Likelihood of Failure Measures			ALOS Measures	Corresponding Likelihood of Failure Measures		
Varies by asset type and rating method.	Likelihood of Failure Ratings	Estimated Timeframe	% Likelihood of Failure	1. Operational Functionality 2. Capacity to Meet Demands 3. Operational Resiliency 4. Environmental Resiliency	ALOS Rating	Likelihood of Failure Ratings	% Likelihood of Failure
Very Good to Good	Very Unlikely	>20 yrs.	<10%		Very Good	Very Unlikely	<10%
Good to Fair	Unlikely	11-20 yrs.	10%-30%		Good	Unlikely	10%-30%
Fair to Poor	Possible	6-10 yrs.	30%-60%		Fair	Possible	30%-60%
Poor to Very Poor	Likely	1-5 yrs.	60%-90%		Poor	Likely	60%-90%
Very Poor to Failed	Very Likely or Certain	<1 yr.	>90%		Very Poor	Very Likely or Certain	>90%



Milestone #2 Activities

AMONTario Level of Service Packages

Milestone Activity #1a: Enter Current and Target ALOS in Tab #1

Tab 6: Performance ALOS Ratings – Asset Class

Tab 4: Condition ALOS Ratings

Likelihood of Failure Very Unlikely Estimated beyond 20 yrs. OR Estimated less than 10%	Likelihood of Failure Unlikely Estimated 11 - 20 yrs. OR Estimated 10% - 30%	Likelihood of Failure Possible Estimated 6 - 10 yrs. OR Estimated 30% - 60%	Likelihood of Failure Likely Estimated 1 - 5 yrs. OR Estimated 60% - 90%	Likelihood of Failure Very Likely or Certain Estimated within 1 yr. or Now OR Estimated greater than 90%
The assets are rated 'Very Good'. - Fit for the future. - Well maintained, in good condition, new or recently rehabilitated. - Minor defects and/or wear	The assets are rated 'Good'. - Adequate for now. - Modest defects and/or wear.	The assets are rated 'Fair'. - Shows signs of deterioration and some elements exhibit deficiencies. - May require attention. - Moderate defects and/or wear	The assets are rated 'Poor'. - An increasing potential for asset conditions to affect the services it (or they) provides. - Approaching the end of service life. - The condition is below the standard and a large portion of the system (or asset) exhibits significant deterioration. - Significant defects and/or wear.	The assets are rated 'Very Poor'. - Unfit for sustained service. - Near or beyond its expected service life and shows widespread signs of advanced deterioration. - The asset or some assets may be unusable. - Severe defects and/or wear

Tab 1: Level of Service Template

Supporting Asset Classes	Target Asset Levels of Service (by Asset Class)	Current Asset Levels of Service					
		Asset Class Average	Distribution by Asset Rating				
			%	%	%	%	%
Pumping Stations	Condition						
	Mechanical Equipment = Good	Fair	40	50	10		
	Electrical Equipment = Good	Fair	10	30	40	20	
	Civil Assets = Good	Good	70	30			
	Performance						
	Operational Functionality = Good	Fair	2	66	5	22	6
	Capacity to Meet Demands = Good	Good		80	10	10	
	Operational Resiliency = Good	Fair		71	7	15	6
	Environmental Resiliency = Good	Good		100			

Scoring Distribution for each ALOS Performance Criteria ^{1, 2}						
% Very Good	% Good	% Fair	% Poor	% Very Poor	% NA	TOTAL
90	10					100
90	10					100
20	50	10	20			100
50		50				100
					100	N/A
50			30	20		100
2	66	5	22	6	17	100
Fair						
80	10	10				100
0	80	10	10	0	0	100
Good						
100						100
50		50				100
50	20		30			100
50	30	20				100
100						100
0	71	7	15	6	0	100
Fair						
100						100
					100	N/A
0	100	0	0	0	50	100
Good						

Milestone Activity #1b: Enter O&M Activities and Current and Target LOS in Tab #1

Supporting Asset Classes	Technical Levels of Service									
	Target Asset Levels of Service (by Asset Class)	Current Asset Levels of Service					O&M Levels of Service			
		Asset Class Average	Distribution by Asset Rating					Activity	Current LOS	Target LOS
			%	%	%	%	%			
Pumping Stations	Condition	Condition								
	Mechanical Process Systems =	Fair		20	80		Vibration Testing	Every 5 years	Every 2 years	
	Electrical Process Systems = "Good"	Fair		10	80	10	Major Equipment Testing and Inspection	Annually	Annually	
	Distribution Civil Assets = "Good"	Fair		10	10	70	10	Chemical Application	Ontario Drinking Water Quality Standards	Ontario Drinking Water Quality Standards
	Performance	Performance								
	Operational Functionality = Good	Fair		2	66	5	22	6		
	Capacity = Good	Good			80	10	10			
	Operational Resiliency = Good	Fair			71	7	15	6		
Environmental Resiliency = Good	Good			100	50	50				

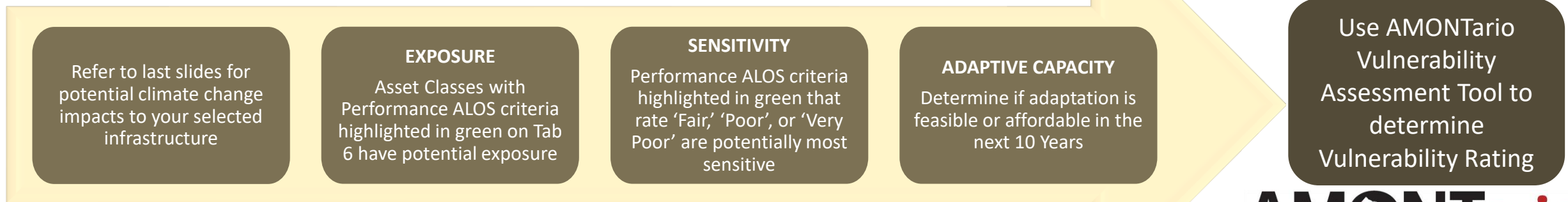
Climate Change Vulnerability Assessment

- Assessing asset vulnerability to climate change is the combination of asset **exposure**, **sensitivity** and municipal **capacity to adapt** the assets to climate change

Climate Change Vulnerability Assessment Process



AMONTario Climate Change Vulnerability Assessment Process



Milestone Activity #2: Complete a Climate Change Vulnerability Assessment on Tab 10

(Only for Performance ALOS criteria highlighted in GREEN that are rated 'Fair', 'Poor' or 'Very Poor')

Tab 10: Climate Change Vulnerability Assessment

Climate Change Vulnerability Assessment						
Asset Class	Performance ALOS	Affected ALOS Criteria (Copy and paste criteria below)	Sensitivity Factor ¹ (per the Performance ALOS criteria rating)	Adaptive Capacity ²	Vulnerability Score ³	Vulnerability Rating ³
Trunk Sewers	Capacity to Meet Demands	- Sufficient pipe capacities to meet peak design flows and design extraneous inflows (storm and groundwater).	Fair	Low	6	Medium
Trunk Sewers	Capacity to Meet Demands	- Sufficient pipe capacities to meet peak design flows and design extraneous inflows (storm and groundwater).	Poor	Low	9	High

Lookup for the Asset Class
Lookup for the Performance ALOS

Lookup for the ALOS Criteria
Lookup for the Sensitivity Factor

Look up for the Adaptive Capacity

Asset Class Types ⁴	ALOS	Context for Evaluating Performance Criteria	Select and/or Modify Applicable ALOS Performance Criteria (For additional information on the ALOS criteria, refer to Ontario Design Guidelines for Sewage Works)	Criteria Weightings based on importance to ALOS ³ (Optional)	Scoring Distribution for each ALOS Performance Criteria ^{1, 2}						
					% Very Good	% Good	% Fair	% Poor	% Very Poor	% NA	TOTAL
- Trunk Sewers	Capacity to Meet Demands	- To what degree capacity satisfies current peak demands and minimum community service levels - Level of operational problems experienced. - Are there noticeable negative affects on community service levels or stakeholders (residents and businesses)	- Sufficient pipe capacities to meet peak design flows and design extraneous inflows (storm and groundwater).			40	30	30	0	0	100
Average Capacity to Meet Demands ALOS Ratings				0	0	40	30	30	0	0	100
ALOS Rating - Capacity to Meets Demands				3	Fair						

Adaptive Capacity	
High Capacity (X1)	The municipality can readily adapt the assets to achieve a 'Very Good' or 'Good' ALOS criteria rating within the next 10 years.
Medium Capacity (X2)	With some difficulty and reallocation of resources, the municipality can adapt the assets to achieve a 'Very Good' or 'Good' ALOS criteria rating within the next 10 years.
Low Capacity (X3)	The assets are not practical to be adapted and/or the municipality currently has very limited or no ability to adapt the assets to achieve a 'Very Good' or 'Good' ALOS criteria rating within the next 10 years. Significant reprioritization of resources, changes in levels of service and/or higher risk tolerances and response planning are required.

Potential Climate Change Impacts

Courtesy: Asset Management BC's Climate Change and Asset Management: A Sustainable Service Delivery Primer

Water

- Drought leading to loss of reliable water sources
- Reduced source water quantity and quality
- Increased water demands leading to system capacity issues and stress on water sources
- Increased need for the water system to deliver sufficient fire flows to protect properties against wildfires
- Damage to water buildings, tankage and process equipment from flooding and wildfires
- Taste/odour problems in the summer

Wastewater

- Increased inflow and infiltration leading to system capacity being more frequently exceeded which may lead discharges to surfaces, water and sources, basement flooding and water borne health affects
- Changes to wastewater effluent characteristics
- More frequent wastewater process overflows and untreated discharges/bypasses into water bodies
- Damage to wastewater buildings, tankage and housed process equipment from flooding and wildfires

Storm Water Management

- Major and minor system capacity more frequently exceeded causing overland flooding leading to property and infrastructure damage
- Increased energy costs due to increased pumping
- Water-borne health effects from flooding

Potential Climate Change Impacts

Courtesy: Asset Management BC's Climate Change and Asset Management: A Sustainable Service Delivery Primer

Roads

- Road damage caused by erosion, landslides, and embankment failure
- Higher temperatures increasing the frequency and severity of thermal cracking and rutting
- More frequent freeze/thaw cycles causing frost heave and thaw weakening
- Road washouts caused by overflowing culverts and storm sewers
- Increased risk that low-lying roads, bridges and bridge foundations will be inundated, undermined or damaged by flooding

Buildings and Property

- Damage due to wildfires and flooding
- Increased reliance on cooling systems causing increased energy use
- Reduced service life and functionality of components and systems
- Increased odour and pests in solid waste systems during longer summer periods

Parks

- Drought leading to increased stress on vegetation and potential water restrictions for built water features
- Loss of trees due to drought, windstorms and wildfires
- Increased temperatures leading to increased demand on parks with water features (natural or constructed)
- Changes to water quality of adjacent lakes or rivers impacting recreational use
- Increased erosion and decreased slope stability

Questions