Appendix B

How the Grey to Green Retrofit Guides Can be Used as a Tool to Develop Infrastructure Asset Management Plans

Appendix B – How the Grey to Green Road Retrofit Guide can be used as a Tool to Develop Infrastructure Asset Management Plans

The Ontario Ministry of Infrastructure (MOI) has launched a municipal infrastructure strategy that requires long-term asset management planning by municipalities seeking provincial capital funding. Given the pressures facing municipalities today, including growing infrastructure deficits as well as increasing development pressures, this strategy will support infrastructure needs for today and into the future. There are many principles that guide the strategy including the need for ***comprehensive asset management plans to guide investment decisions*****.**

> *"Asset management is an integrated, lifecycle approach to effective stewardship of infrastructure assets to maximize benefits, manage risk and provide satisfactory levels of service to the public in a sustainable and environmentally responsible manner "*
>
> *- Ontario Ministry of Infrastructure*

The MOI guide Building Together: Guide for Municipal Asset Management Plans outlines the required content for asset management plan submissions to the Province. This appendix will help municipalities with the preparation of asset management plans that meet these provincial requirements by highlighting the relevant sections of the Grey to Green Road Retrofits guide that apply to this planning process. See Table 1 for further details.

Table 1: How the Grey to Green Road Retrofit Guide can be used as a Tool to Develop Infrastructure Asset Management Plans

Building Together: Guide for Municipal Asset Management Plans - The asset management plans need to include:	Applicable chapters and sections of the Grey to Green Road Retrofit guide
"An explanation of how the goals of the municipality are dependent on infrastructure. This could include discussing how infrastructure assets support economic activity and improve quality of life. The municipality's goals may already be set out in documents, including the strategic plan and/or the Official Plan, or may need to be developed in consultation with residents." *"Clarification of the relationship of the asset management plan to municipal planning and financial documents (e.g. how the plan impacts the budget, Official Plan and Infrastructure Master Plan)."* *"Describes to the public the purpose of the asset management plan (i.e. to set out how the municipality's infrastructure will be managed to ensure that it is capable of providing the levels of service needed to support the municipality's goals)."*	**Chapter 1** Provides a detailed business case for why municipalities should implement green infrastructure/LID within the municipal ROW. The business case chapter includes several case studies that demonstrate how other municipalities are implementing LID to achieve the required level of service and additional benefits beyond what conventional infrastructure can provide. **Appendix A** provides an overview of how to meet legislative requirements and policies with LID at the municipal, regional, Provincial and Federal level. **Section 1.2** provides a detailed description of the various direct and indirect benefits and costs associated with Green Infrastructure. **Section 3.5** discusses the process of public consultation and engagement and its importance to gaining buy-in from residents and local businesses.
The municipality needs to define levels of service through performance measures, targets and timeframes. • *Discuss any external trends or issues that may affect expected levels of service or the municipality's ability to meet them (e.g., climate change impacts).* • *Shows current performance relative to the targets set out (A table may be useful for this).* • *Supporting documentation is required that specifies which performance measures are associated with which assets, current performance and expected performance over the planning period, as well as all assumptions.*	**Section 10.0 and Table 10.0.2** discuss how LID can reduce risk and uncertainty and support the municipality's ability to meet the required level of service (e.g. climate change impacts and how LID improves resiliency of a city's storm sewer system). **Section 6.13** discusses the need for infrastructure performance assessment and how green infrastructure performs in a real community setting. **Appendix C** includes case studies on several road ROW LID projects, including Elm Drive and Lakeview retrofits in the City of Mississauga. For details on Infrastructure performance and assessment results, refer to these case studies and to CVC's Infrastructure Performance and Risk

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	Assessment (IPRA) technical reports posted at bealeader.ca **Appendix B.1** provides a Cost Effectiveness Analysis Tool to compare different infrastructure projects using a number of criteria, including direct and indirect cost and benefits.
Identifies how many years the asset management plan covers and when it will be updated. At a minimum, plans must cover 10 years and be updated regularly. Best practice is for plans to cover the entire lifecycle of assets.	**Section 4.4 and Chapter 10** outline the considerations for completing a life cycle cost analysis for LID practices. Toronto Region Conservation Authority has developed a Low Impact Development Practices Costing Tool to evaluate the capital and life cycle costs of LID practices based on a detailed assessment of input costs, maintenance requirements, rehabilitation costs and practice designs relevant to Canadian climates. This Tool and a full report titled *Assessment of Life Cycle Costs for Low Impact Development Stormwater Management Practices* is available at sustainabletechnologies.ca
Describes how the asset management plan was developed - who was involved, what resources were used, any limitations, etc.	**Chapter 3** outlines the typical team requirements for planning, designing, constructing and maintaining LID practices implemented as part of road retrofit projects.
Non-infrastructure solutions – actions or policies that can lower costs or extend asset life (e.g., better integrated infrastructure planning and land use planning, demand management, insurance, process optimization, managed failures, etc.).	**Section 10.3** lists the potential expansion activities for various types of LID practices implemented within the road ROW. **Table 4.4.1** is a high level costing table that can be used to compare different LID practices. This can be used by municipalities to assess the LID practices with higher and lower capital costs.
Life cycle activities: *Maintenance activities – including regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.* *Renewal/rehabilitation activities – significant repairs designed to extend the life of the asset. For example, the lining of iron water mains can defer the need for replacement.* *Replacement activities – activities that are expected to occur once an*	**Section 10.1** outlines maintenance activities for various types of LID practices implemented within the road ROW. **Section 10.2** provides renewal/rehabilitation activities for various types of LID practices implemented within the road ROW. **Section 10.3** lists the potential expansion activities for various types of LID practices implemented within the road ROW.

Building Together: Guide for Municipal Asset Management Plans - The asset management plans need to include:	Applicable chapters and sections of the Grey to Green Road Retrofit guide
asset has reached the end of its useful life and renewal/rehabilitation is no longer an option. *Disposal activities – the activities associated with disposing of an asset once it has reached the end of its useful life, or is otherwise no longer needed by the municipality.* *Expansion activities (if necessary) – planned activities required to extend services to previously un-serviced areas - or expand services to meet growth demands.*	Toronto Region Conservation Authority has developed a Low Impact Development Practices Costing Tool to evaluate the capital and life cycle costs of LID practices based on a detailed assessment of input costs, maintenance requirements, rehabilitation costs and practice designs relevant to Canadian climates. This Tool and a full report titled *Assessment of Life Cycle Costs for Low Impact Development Stormwater Management Practices* is available at sustainabletechnologies.ca
Discusses procurement methods. To ensure the most efficient allocation of resources, best practice is for a number of delivery mechanisms to be considered - such as working with other municipalities to pool projects and resources, or considering an AFP model.	**Section 3.5** provides details on developing partnerships to optimize the sharing of costs and resources. **Chapter 8** outlines the tender and contract document requirements providing details on documentation and front matter, standard specifications, materials, testing, maintenance requirements, construction supervision requirements, and level of input required by municipal representatives, design consultants, manufactures, and suppliers.
Includes an overview of the risks associated with the strategy (i.e. ways the plan could fail to generate the expected service levels) and any actions that will be taken in response.	**Chapter 10** provides a discussion on risk management and uncertainty to support this activity. CVC's Draft Stormwater Management Certification Protocols: Bioretention Practices provide a series of tests that are conducted post-construction to ensure that the facility was constructed to design and specification to reduce the risk to owner. Visit bealeader.ca to view the guide.
The asset management plan will also need to compare options based on Lifecycle costs. • *Lifecycle costs are the total cost of constructing, maintaining, renewing and operating an infrastructure asset throughout its service life.* • *An assessment of all other relevant direct and indirect costs and benefits associated with each option*	**Chapter 4** provides a screening process for selecting the appropriate LID practice based upon the type of construction (road resurfacing, reconstruction, etc.) and the type of road (local residential, collector, etc.) **Table 4.4.1** is a high level costing table that can be used to compare different LID practices. This can be used by municipalities to assess the LID practices with higher and lower capital costs.
Opportunities to save resources by coordinating solutions to multiple problems must be explored. The asset management strategy is the set of actions that, taken together, has the lowest total cost - not the set of actions that each has the lowest cost individually.	**Table 4.4.1** is a high level costing table that can be used to compare different LID practices. This can be used by municipalities to assess the LID practices with higher and lower capital costs.

Appendix B.1: Cost Effectiveness Analysis Tool (Spreadsheet)

A cost effectiveness analysis can be used to compare LID and conventional infrastructure alternatives and uncover hidden benefits that LID practices can provide if integrated into a ROW. A simple cost effectiveness analysis tool was developed in Microsoft Excel and the layout can be seen in Table 2. The tool outlines the following costs that need to be evaluated when determining the most effective or viable solutions.

1. Project options are listed across the top row in the column headings. The first option should be the standard practice (e.g. the conventional road reconstruction). Project options may differ greatly (e.g. conventional stormwater management and LID practices) or may be variations of the same practice (e.g. bioretention and bioretention with phosphorus removal media).
2. Direct project costs are displayed in the first section of the tool including both capital and lifecycle costs that will be required for most project options. This includes planning, design, construction, operations and maintenance, as well as replacement and disposal.
3. Indirect project costs are displayed in the second section including permitting fees, real estate costs for land acquisition, energy utility costs, and costs associated with sampling and analysis.
4. Direct benefits are goals, objectives, and targets that the project must be designed to achieve. Stormwater criteria should always be direct benefits. Other direct benefits for road retrofits may include neighbourhood aesthetics or parking requirements. In section 3, each option receives a score from 0 (does not meet objective) to 3 (greatly exceeds objective). The scores for each option are added for a total direct benefit score.
5. Indirect benefits are additional benefits that can be achieved beyond primary goal, objectives, and targets. Consult municipal sustainability plans or strategic plans for indirect benefits. In section 4, each project option receives a Y (yes) or N (no) indicating whether each indirect benefit is achieved. The scores for each option (1 for Y, 0 for N) are added for a total direct benefit score.
6. In section 5, for each project option the additional cost is equal to the total cost minus the total cost of option 1 (the standard practice).
7. In section 6, to compare cost effectiveness the additional cost should be divided by the total benefit score. The lower this value is, the more cost effective the project option is at providing benefits. Based on these results each option is ranked.
8. The last section provides space for any special conditions or additional comments that need to noted.

A Microsoft Excel version of this spreadsheet is available at bealeader.ca

Table 2: Cost Effectiveness Analysis Tool

Cost Effectiveness Analysis		Standard Option	Option 2	Option 3 (Example)	Option 4	Option 5
Direct project costs	Planning	$	$	$ 25,000	$	$
	Design	$	$	$ 55,000	$	$
	Construction	$	$	$ 625,000	$	$
	Operations & Maintenance	$	$	$ 200,000	$	$
	Replacement & Disposal	$	$	$ 90,000	$	$
Indirect project costs	Permitting fees	$	$	$ -	$	$
	Real estate costs	$	$	$ -	$	$
	Energy/ Utility costs	$	$	$ -	$	$
	Sampling and analysis	$	$	$ 10,000	$	$
Total Cost		$ 635,000	$	$1,005,000	$	$
Direct benefits 0=objective not met 1=objective met 2=objective exceeded 3=objective greatly exceeded	Volume reduction			3		
	Erosion control			3		
	Water quality treatment			3		
	Flood control			1		
Direct Benefits Total				10		
Indirect benefits Y=provides benefit N=does not provide benefit	Climate change mitigation & adaptation			Y		
	Protect Great Lakes			Y		
	Increase amenity value			Y		
	Drinking water source protection			Y		
	Increases usable space (e.g. lot yield)			N		
	Encourages economic development			N		
	Increased public safety			Y		
	Environmental strategic plan objectives			Y		
	Community objectives			Y		
Indirect Benefits Total				7		
Additional Cost (compared to conventional road reconstruction)		-	$	$ 370,000	$ 55,000	$
Cost effectiveness (Additional Cost /Sum of Direct and Indirect Benefits) - Lower is more cost effective		-		21,765	3,667	
Rank		-		2	1	
Comments:						