



Making the Case for Green Infrastructure

An overview of the study:

Assessing the Economic Value of Protecting the Great Lakes: Rouge River Case Study for Nutrient Reduction and Nearshore Health Protection

Mary Trudeau – ICF Marbek

Presentation Outline

- Collaborators
- Background
- Study Objectives and Scope
- Study Approach
- Key Findings
- Uncertainties and Implications
- Bottom Line



Collaborators

- TRCA
- Ontario MOE
- Project Steering Committee
- Dr John Livernois, U Guelph
- Earlier phase: Drs Stephen Renzetti and Diane Dupont, Brock U



Background

- 2005 - the U.S. Great Lakes Regional Collaboration released the *Strategy to Restore and Protect the Great Lakes*.
- 2007 - follow-up study, *America's North Coast: A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes*
- \$26B (present value) in Great Lakes restoration = benefits of at least \$50B(long-term) and \$30B - \$50B (short term).
- Costs/benefits for Ontario?

Marbek (now ICF Marbek) was retained to undertake the study:

“Assessing the Economic Value of Protecting the Great Lakes”



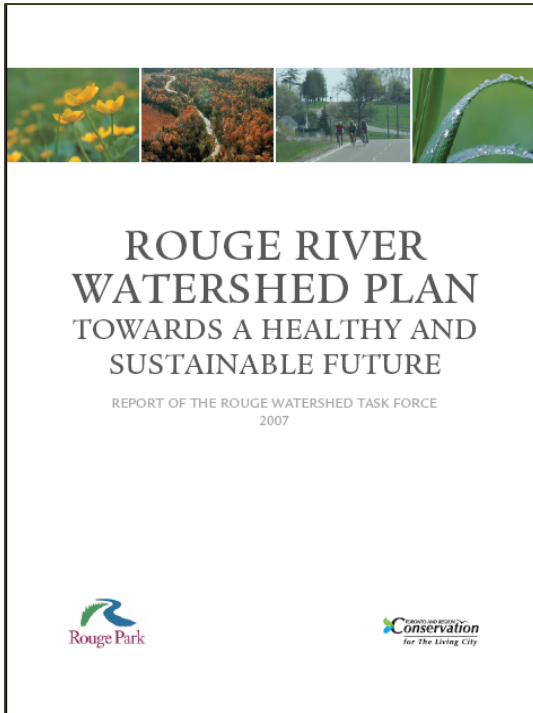
Study Objectives and Scope

- Economic analysis to understand the economic value (to Ontario) of protecting the Great Lakes.
- Ecological goods and services valuation – benefits and costs
- Three analyses conducted
- Nutrient loading reductions and improved nearshore health
- Case Study based on detailed modeling by TRCA for the Rouge River
- Rough extrapolation to Golden Horseshoe



Foundation for the analysis:

- *Rouge River Watershed: Scenario Modeling and Analysis Report (TRCA, 2007)*
- Intervention strategies and land cover changes
- Study tracked changes in 7 ecosystem indicator themes (e.g. surface water quality, quantity, aquatic systems and nature-based recreation).



Compared two scenarios

Sustainable
Communities (SC)

VS

Full Build-Out
(FBO)



Sustainable Community Scenario

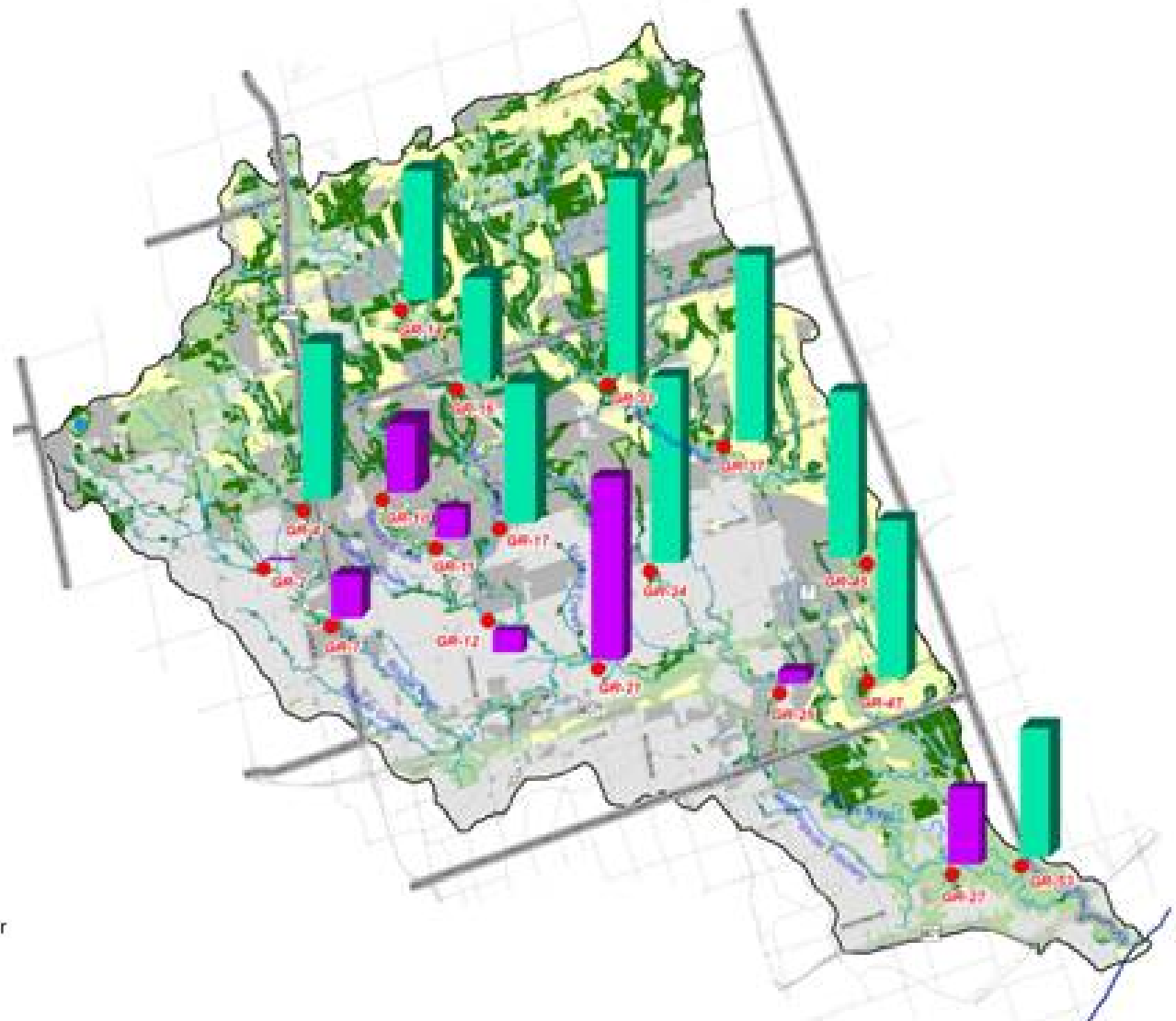
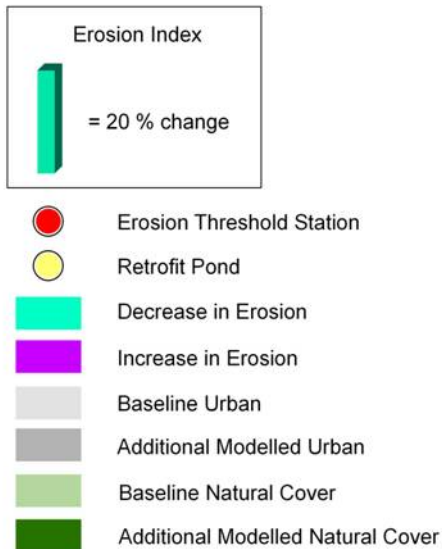
Key water management assumptions:

1. Increase natural cover
2. Manage water balance in new communities through design and LID practices
3. Retrofit stormwater management practices in existing urban areas
4. More “sustainable” community designs and practices overall



Effect of “sustainable communities”

Legend



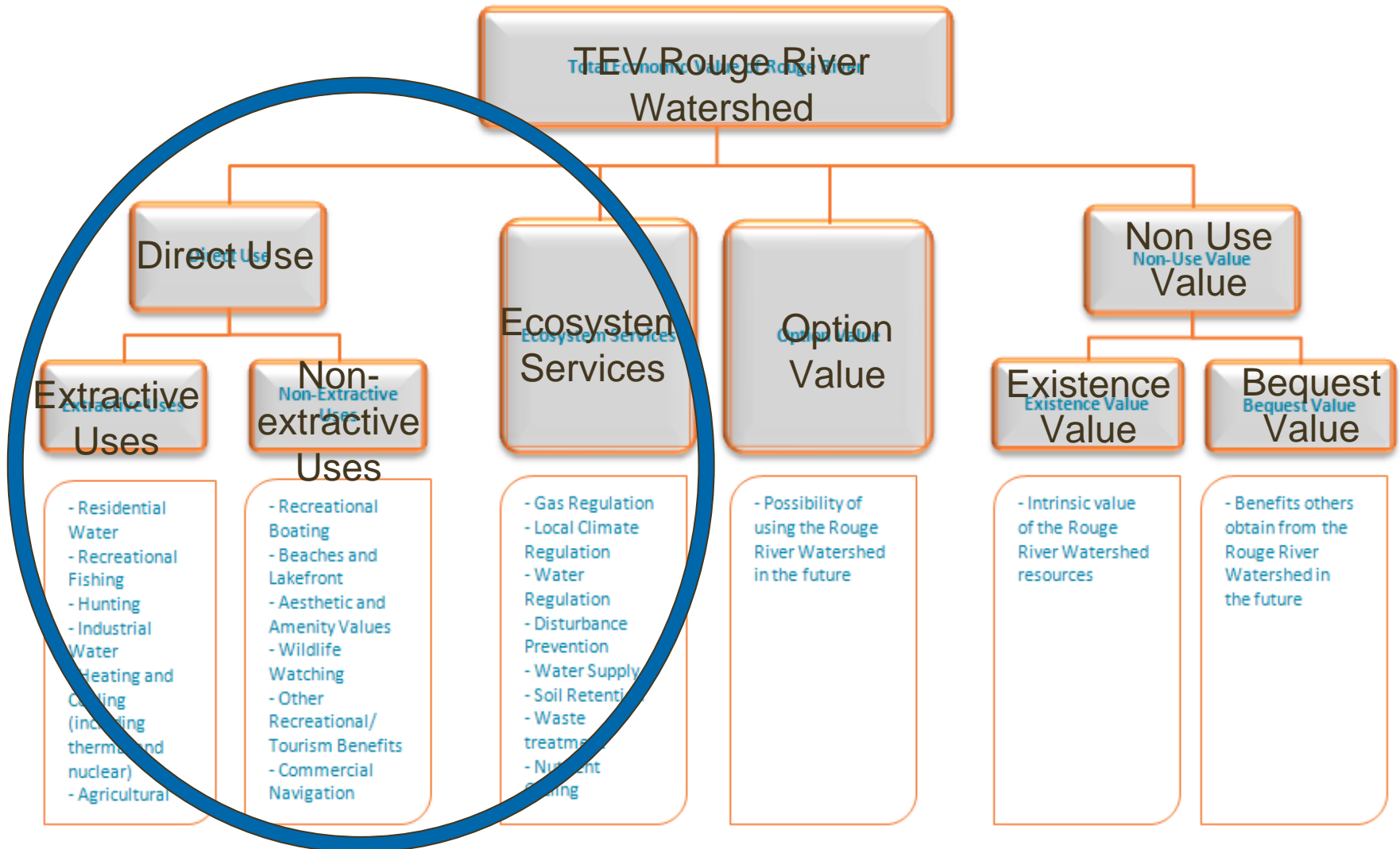
Overview of Study Approach and Methodology

The study was conducted in five phases:

1. Value the Incremental Cost of SC over FBO scenario
2. Value the Incremental Benefits of SC over FBO scenario
3. Compare Costs and Benefits
4. Extrapolate Results to the Golden Horseshoe and Lake Ontario
5. Conduct Uncertainty Analysis and Report Findings

- Identify assumptions
- Be conservative in assumptions

Total Economic Value Framework



Costs

Incremental **Cost** of SC over FBO scenario estimated within 2 categories:

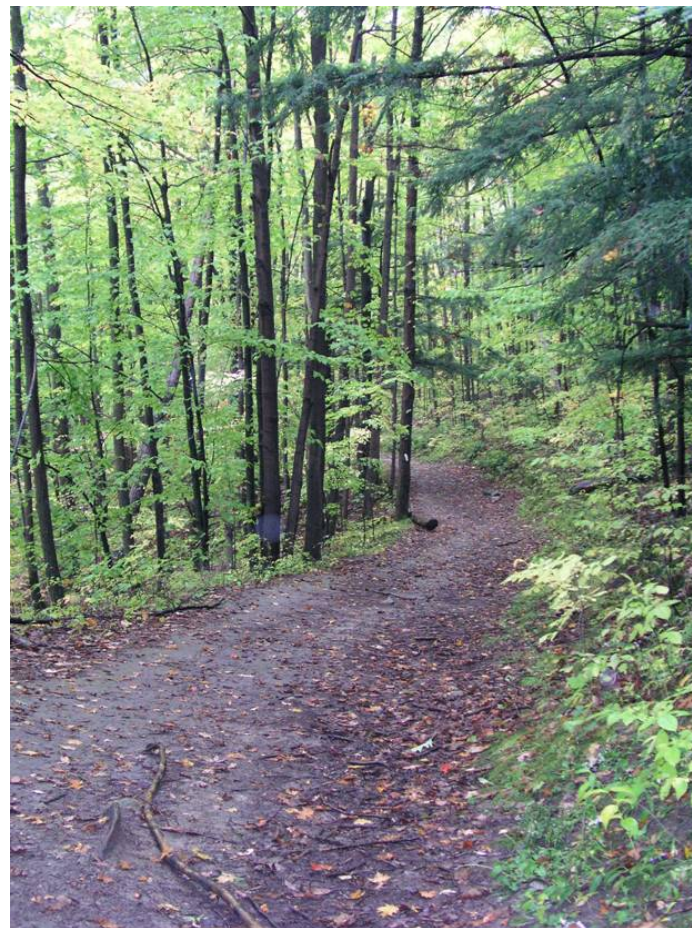
- Interventions (LID, stormwater management retrofits, pollution controls, etc)
- Land cover changes (agricultural, urban)



Benefits

Incremental **Benefits** of SC scenario over FBO scenario in 2 categories:

- Changes in ecosystem indicators (water quality, nature based recreation, etc.)
- Avoided costs associated with the SC scenario (ponds, potable water)



Non-monetized Benefits

Impact Categories

Industrial Water

Agricultural Water

Recreational Boating

Commercial Fishing

Other Recreation

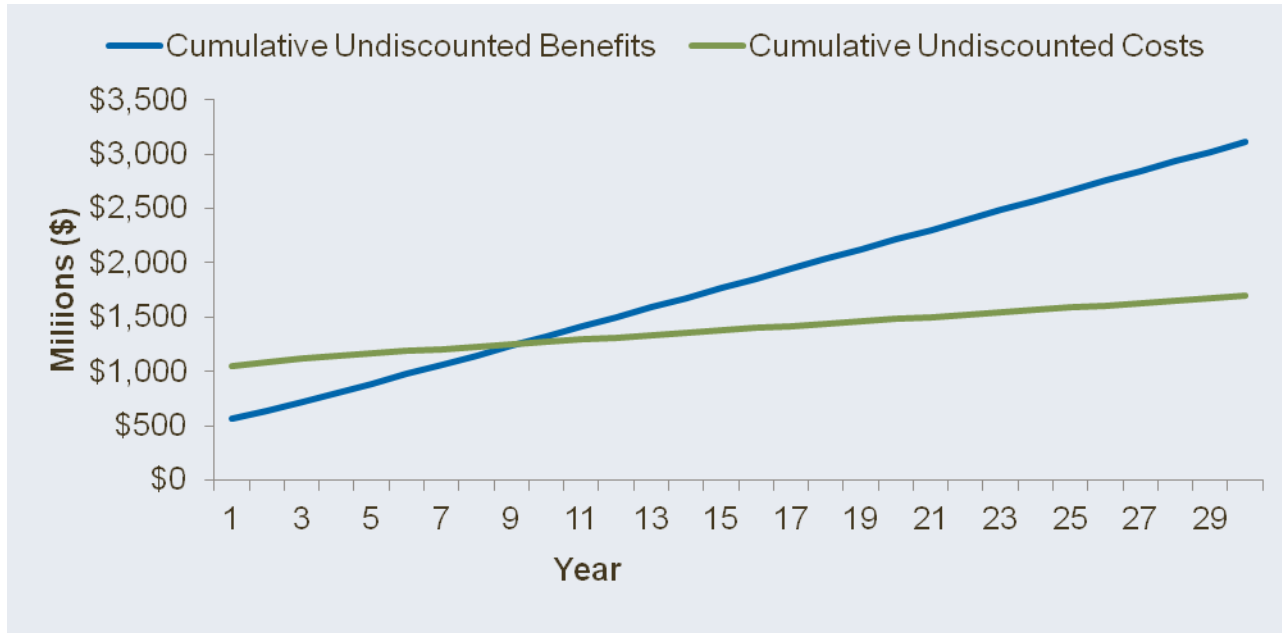
Water Purification /
Waste Treatment

Soil Retention

Nutrient Cycling

Biodiversity

Summary of Findings – Rouge River



	Low	Mean	High
Benefit Cost Ratio	1.27	1.47	1.67

Extrapolated to Golden Horseshoe

	Low	Mean	High
Benefit Cost Ratio	1.58	2.06	2.40

Lake Ontario Impacts Valuation

(\$millions)	Annual Value		Present Value	
	Low	High	Low	High
Beaches	\$38.4	\$76.8	\$706.3	\$1,412.5
Recreational Fishing	\$4.9	\$9.8	\$69.3	\$138.6
Total	\$43.3	\$86.6	\$775.6	\$1,551.1

Uncertainties and Implications

- Static analysis of costs and benefits of the land use patterns and modeled
- To achieve the SC scenario - investments are required by a variety of public and private sector stakeholders and benefits will accrue to various stakeholders. We do not attempt to estimate the allocation of costs and benefits among stakeholders.
- No attempt to assess the marginal benefits of each separate intervention.



Bottom Line

- The combined effects of expanded natural cover, sustainable greenfield development and retrofits of existing development comprise a beneficial management approach
- Benefits that could not be included are significant – results are very conservative
- Benefits do not necessarily accrue to developers – policy and management instruments needed for LID
- LID is only the beginning – of course we need to implement low impact development. Our economic metrics indicate we win with LID.



Thank You

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Full study available for download at:

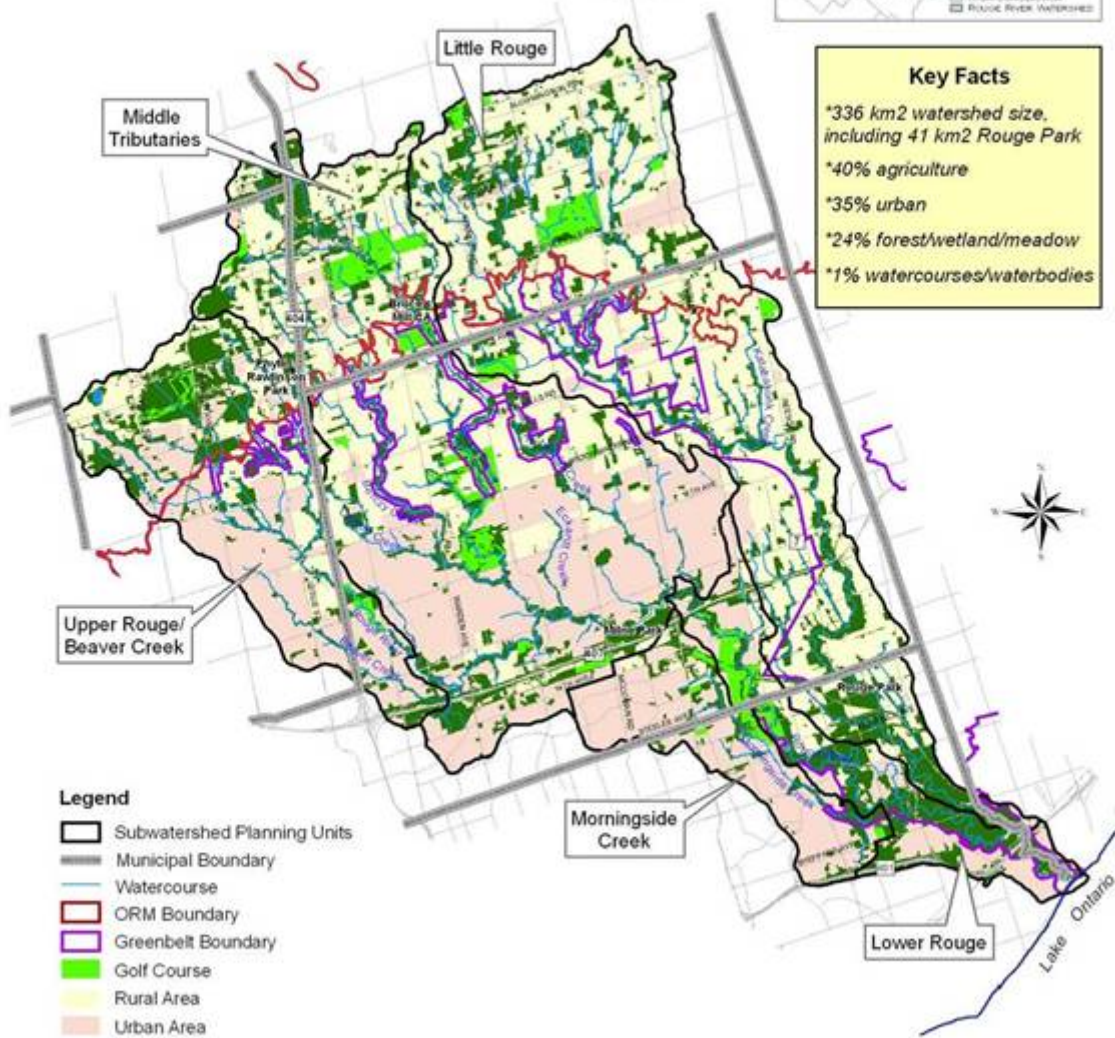
http://www.ene.gov.on.ca/environment/en/resources/STDPROD_086940.html



Non-monetized Benefits

Impact Categories	Possible Impact from SC	Reason not Quantified/Monetized	Possible Significance
Industrial Water	Improved SWQ; improved water supply	Lack of data on value of marginal improvements in water quality/quantity for industrial use	Avoided cost of industrial water treatment and water consumption
Agricultural Water	Improved SWQ; improved water supply	Lack of data on value of marginal improvements in water quality/quantity for agricultural use	Avoided economic losses to agricultural production due to poor irrigation water quality
Recreational Boating	Improved SWQ; improved water supply	Part of the benefit is incorporated in the value of SWQ; lack of data on value associated with incremental water level changes	Value of improvements in recreational boating
Commercial Fishing	Increased abundance and diversity of fish species populations	Lack of information on impact to commercial fishing industry	Increased value of commercial fishing industry
Other Recreation	Increased magnitude and value of other recreational activities	Lack of data on impact to other recreational activities	Increased value of other recreational activities (i.e.: hiking, camping, picnicking, mountain biking, etc.)
Water Purification / Waste Treatment	Improved SWQ	Part of the benefit is incorporated in the value of improved SWQ; cannot value costs to wastewater treatment plants because there are none in the watershed	Avoided cost of drinking water treatment for sediments and nutrients
Soil Retention	Reduced soil erosion, increased soil formation	Part of the benefit is incorporated in the value of improved SWQ; lack of data on impact on and value of infrastructure	Avoided cost of damage to infrastructure caused by soil erosion; avoided costs to water treatment plants, Loss of shoreline/lakefront property; loss of recreational fishing value due to increased turbidity
Nutrient Cycling	Reduced nutrient loading; improved nutrient cycling due to increase in tree cover and soil formation	Lack of information on impact to nutrient cycling	Value of fertile soil for plant growth; avoided cost of nutrient control measures
Biodiversity	Increased abundance and diversity of threatened and endangered fish and wildlife	Lack of clear indicator on biodiversity effects from SC scenario	Value of improved biodiversity to Rouge River Watershed residents

ROUGE RIVER WATERSHED General Map



Key Facts

- *336 km² watershed size, including 41 km² Rouge Park
- *40% agriculture
- *35% urban
- *24% forest/wetland/meadow
- *1% watercourses/waterbodies

- Legend**
- Subwatershed Planning Units
 - ▬ Municipal Boundary
 - Watercourse
 - ▭ ORM Boundary
 - ▭ Greenbelt Boundary
 - Golf Course
 - Rural Area
 - Urban Area
 - Natural Cover



Note: Watershed boundary delineated from 1:10,000 Ontario Base Elevation



Lake Ontario



Costs

Incremental **Cost** of SC over FBO scenario estimated within 2 categories:

Interventions of
the SC scenario



<ul style="list-style-type: none">• Infiltration trench• Green roofs• Water harvest/cistern• Permeable driveways• Naturalized landscaping (trees and bushes).• Operations and maintenance, chemical controls through reduced fertilizers and pesticides and road de-icing management.• Stormwater pond/rain garden• Lot re-grading• Foundation drain disconnection• Enhanced street sweeping• Rain barrels	<ul style="list-style-type: none">• Oil/grit separators• Chemical controls through reduced fertilizers and pesticides.• Route parking lot runoff to grass; biofilters• SWM ponds• Retrofitted SWM ponds• Etobicoke Exfiltration System• Rural land management practices to reduce soil loss and pollution (e.g. conservation tillage, vegetated buffer strips).• Expanded natural cover• Markham's small stream policy• Pervious parking
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Land Cover
changes



<ul style="list-style-type: none">• Agricultural Area	<ul style="list-style-type: none">• Urban Area
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Benefits

Incremental **Benefits** of SC scenario over FBO scenario in 2 categories:

Changes in ecosystem indicators



- Surface Water Quantity
- Surface Water Quality
- Groundwater

- Terrestrial System
- Nature-Based Recreation
- Aquatic Systems

Avoided costs
(associated with intervention strategies implemented in SC scenario)



- Stormwater management (stormwater ponds)

- Potable water infrastructure