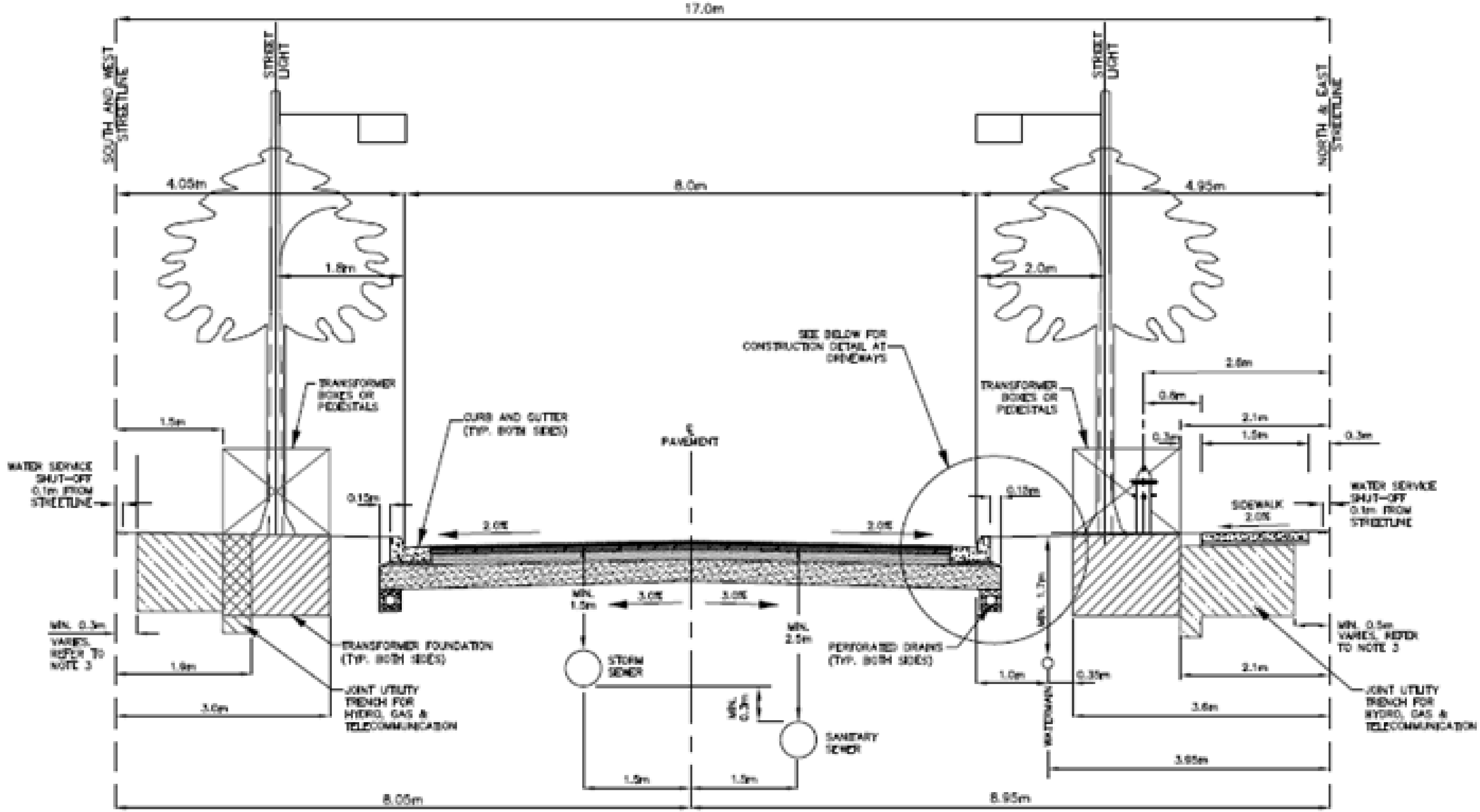
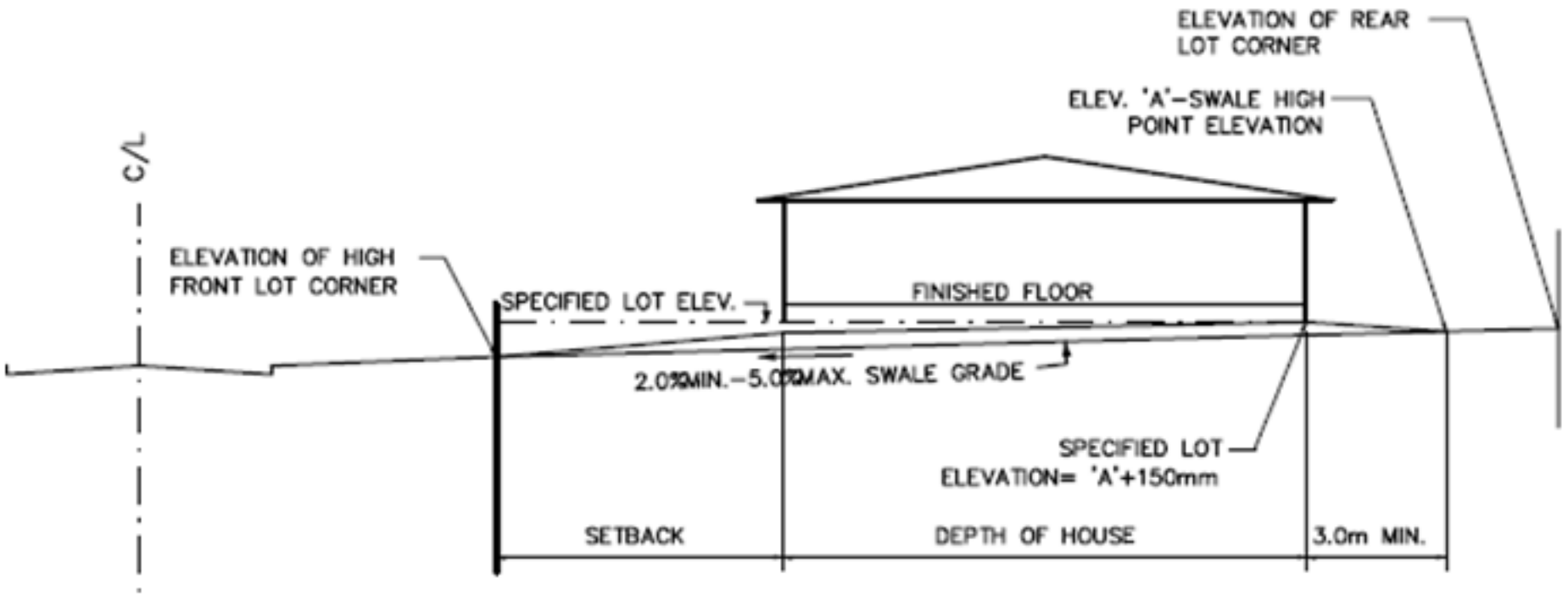
The Business Case for Low Impact Development

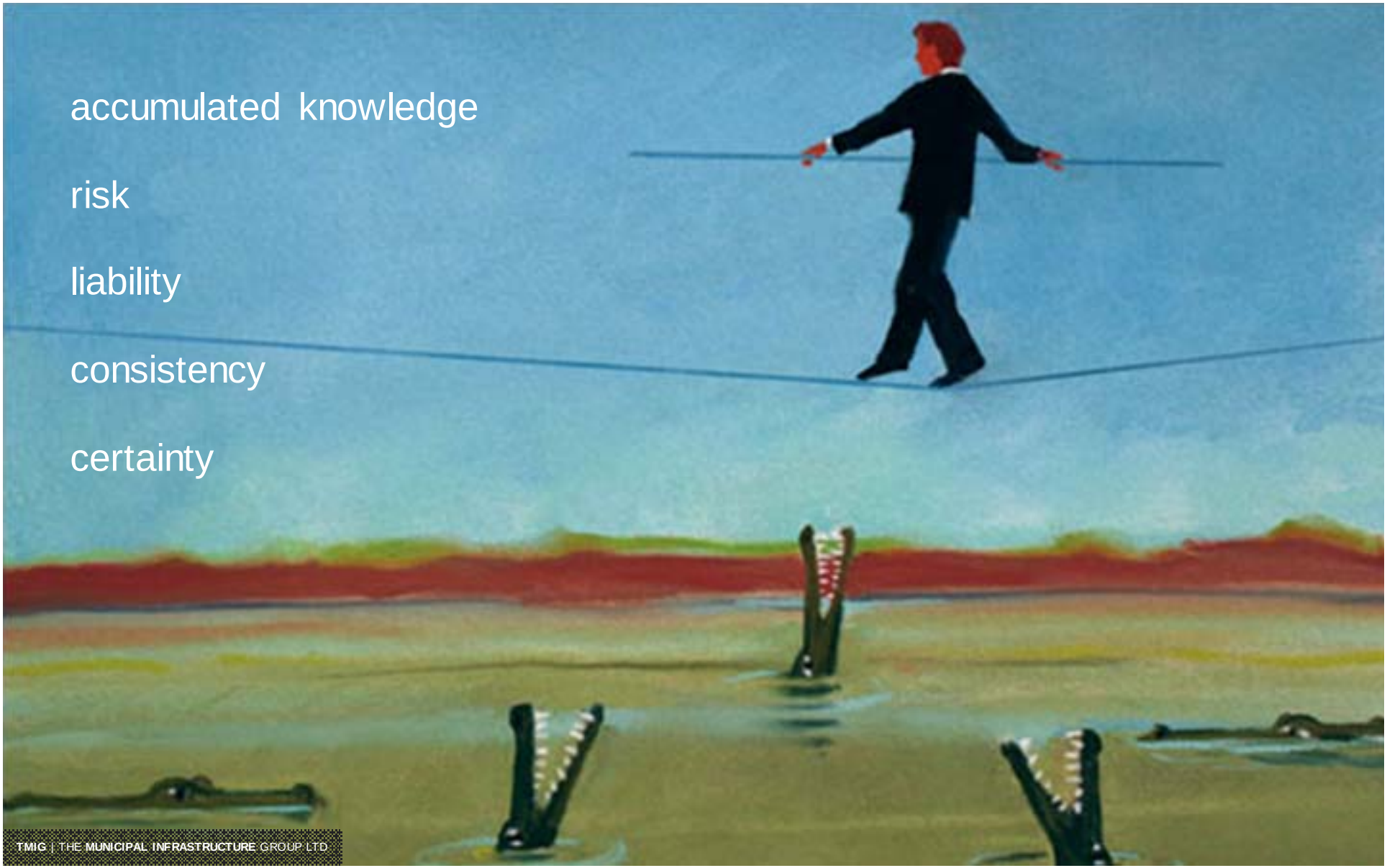
TRIECA 2013 | March 26/27 2013

TMIG
The Municipal Infrastructure Group Ltd.


Standards

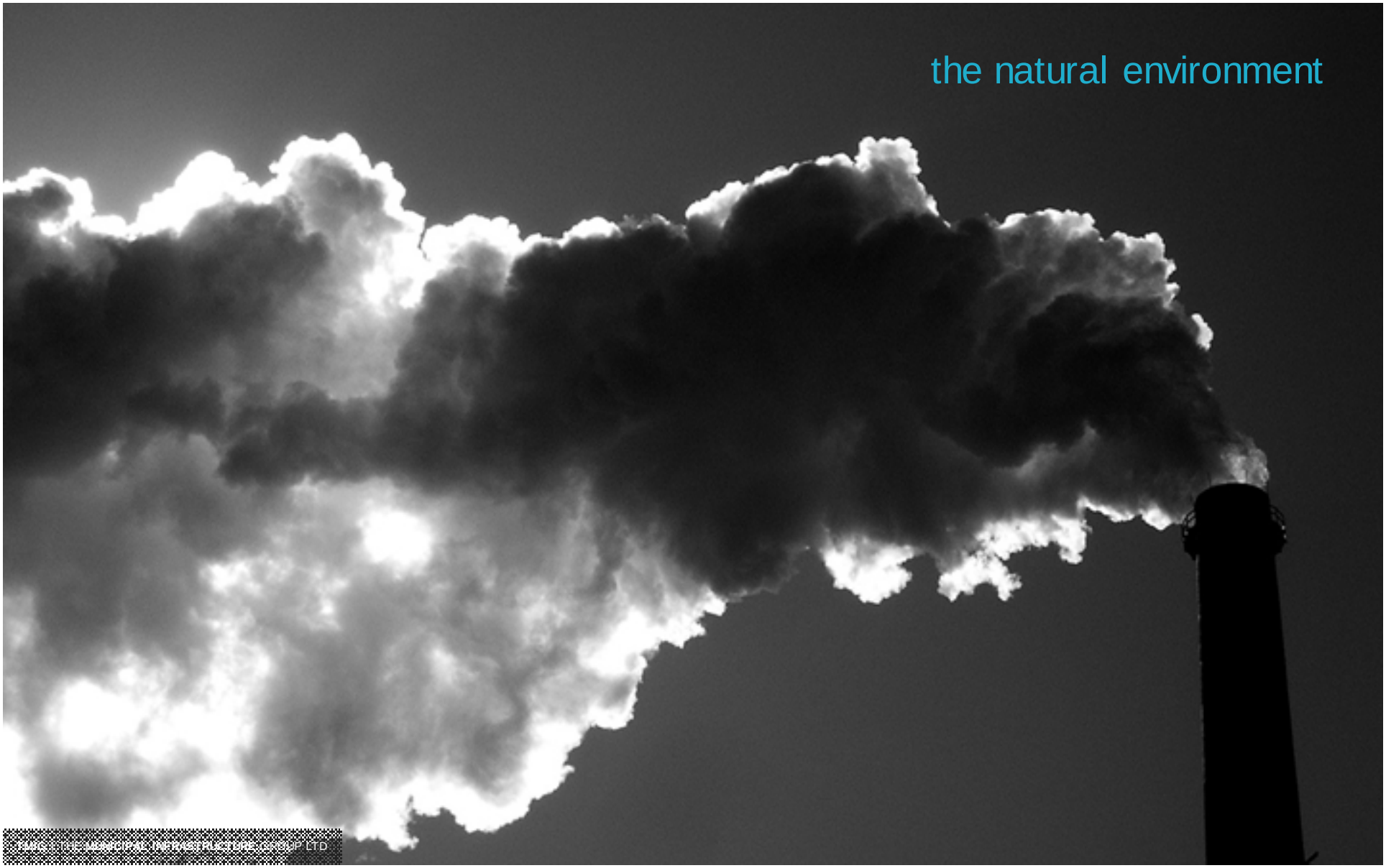





accumulated knowledge
risk
liability
consistency
certainty


CHANGE
AHEAD


aging infrastructure
infrastructure deficits

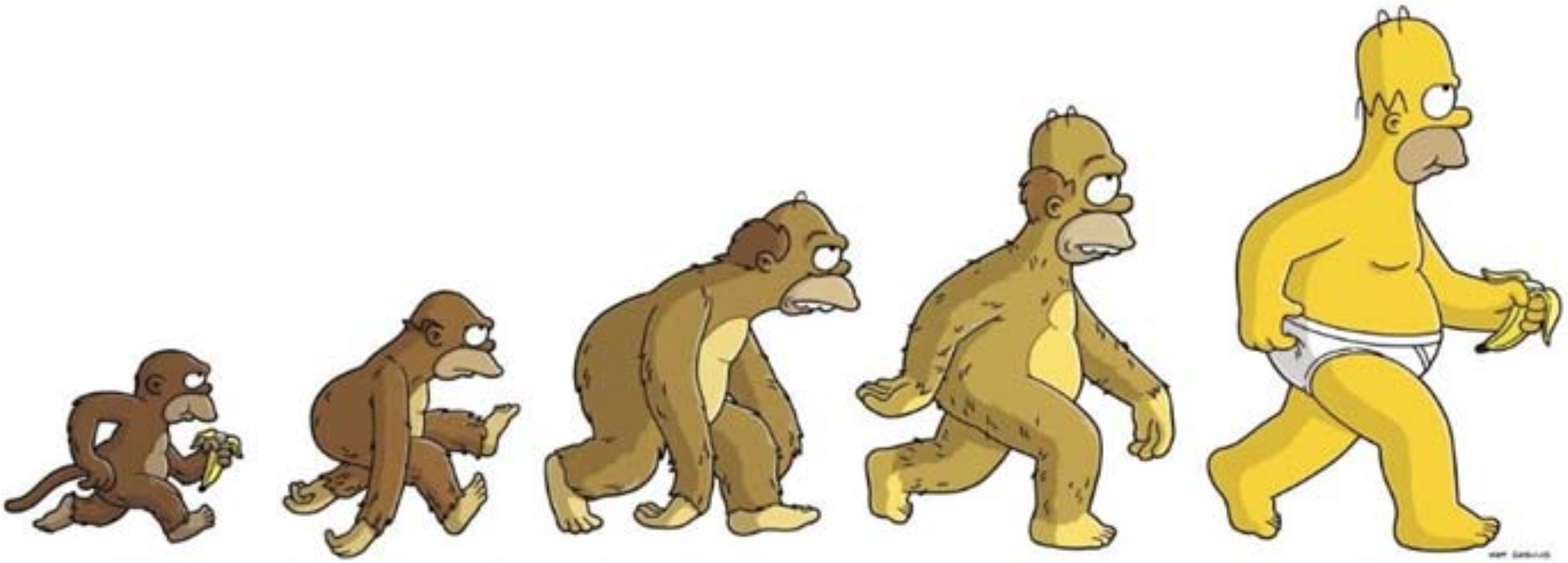

the natural environment


changing climate


healthy communities ► quality of life


sustainability

stability in the status quo



change is necessary

limited
funds

Nine Rules for Stifling Innovation

by Rosabeth Moss Kanter (Harvard Business Review Blog Network, Jan 15 2013)

2. Invoke history

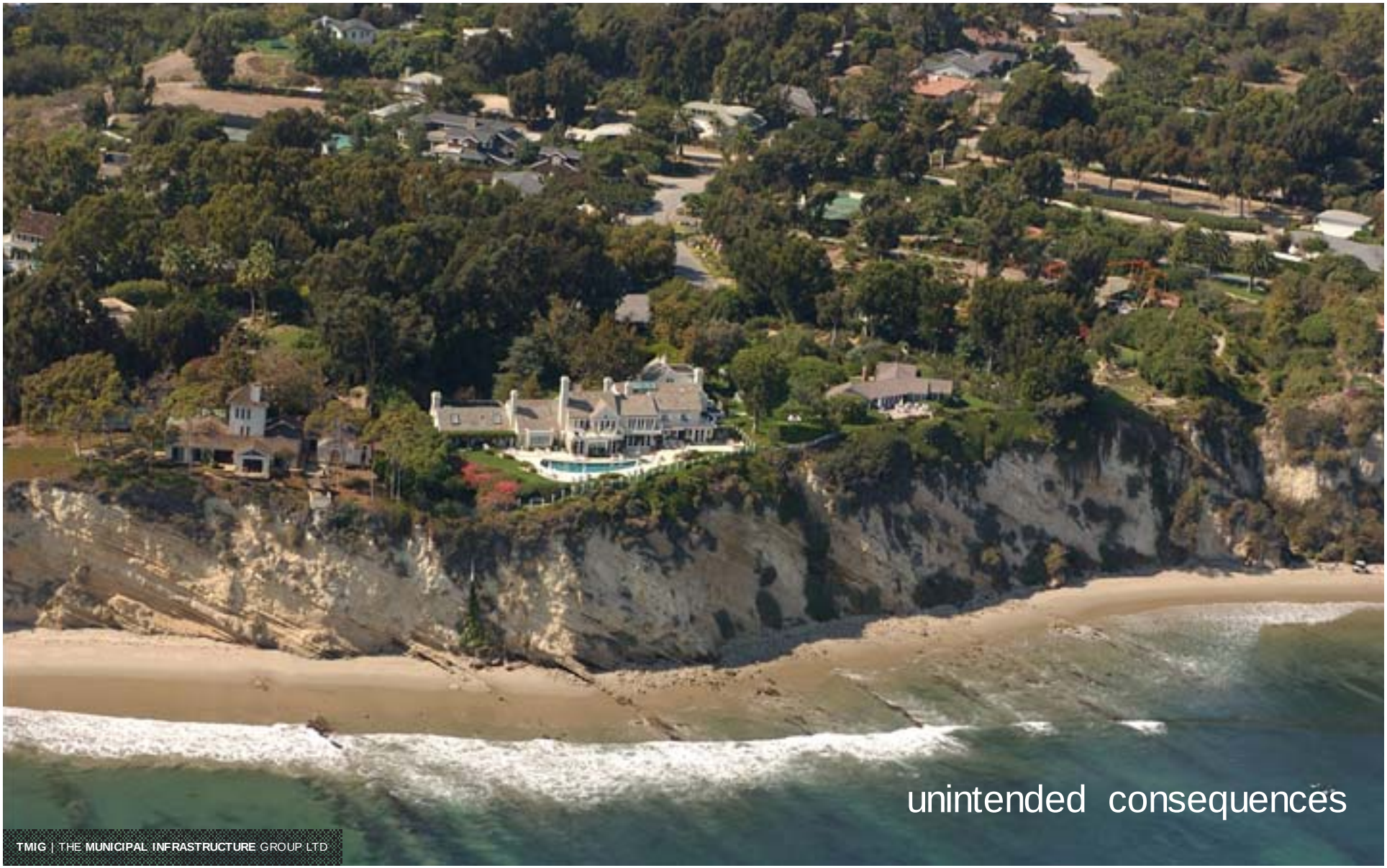
If a new idea comes up for discussion, find a precedent in an earlier idea that didn't work, remind everyone of that bad past experience. Those who have been around a long time know that we tried it before, so it won't work this time either.

5. Stress predictability above all

Count everything that can be counted, and do it as often as possible. Sweep any surplus into master accounts, and eliminate any slack. Favor exact plans and guarantees of success. Don't credit people with exceeding their targets because that would just undermine planning. Insist that all procedures be followed.

7. Act as though punishing failure motivates success

Practice public humiliation, making object lessons out of those who fail to meet expectations. Everyone will know that risk-taking is bad.


unintended consequences





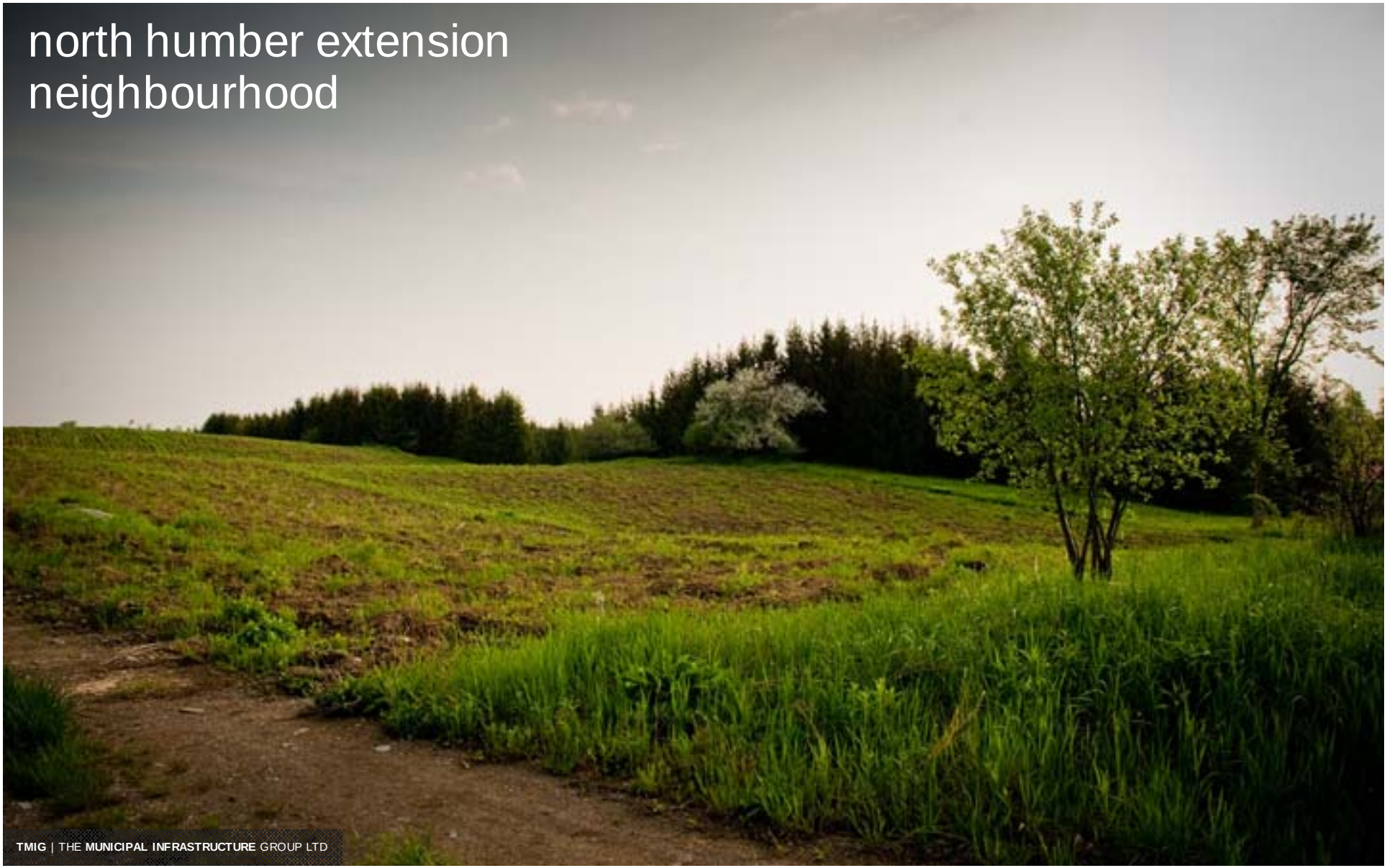

maximize infiltration

maximize evapotranspiration

maximize reuse

minimize impervious cover

north humber extension neighbourhood



North Humber Extension Development
Kleinburg
Functional Servicing Report
City of VAUGHAN

Project File: 07115
June 2008

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City of Vaughan

North Humber Extension Neighbourhood

Low Impact Development Evaluation

Draft • March 2009 • File 09100

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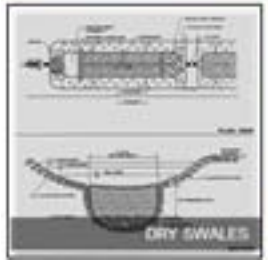
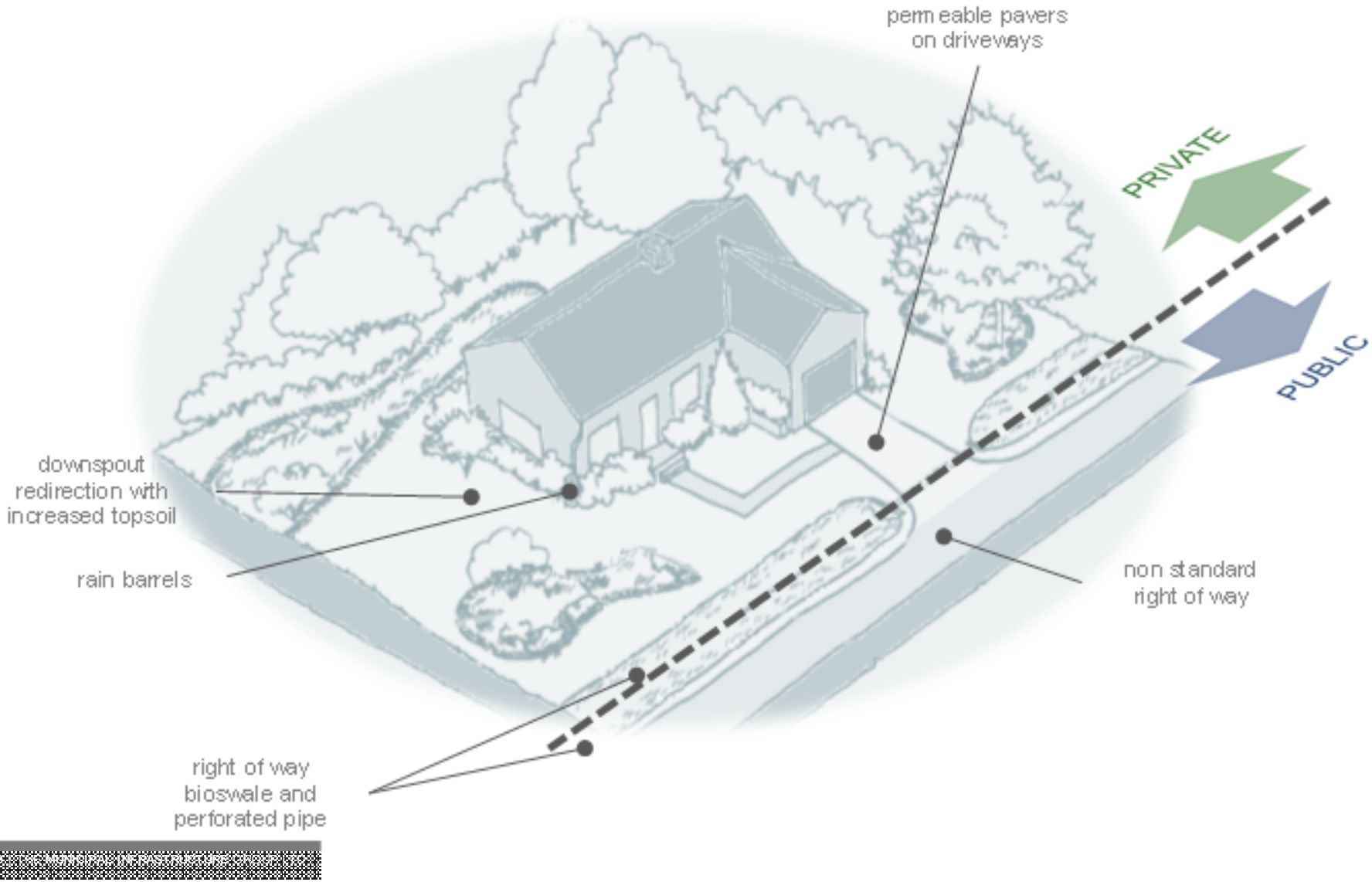
PREPARED FOR:

Environment Canada
Toronto Region Conservation Authority




permeable pavers
on driveways
PRIVATE
PUBLIC
downspout
redirection with
increased topsoil
rain barrels
non standard
right of way
right of way
bioswale and
perforated pipe

overall project estimated as 30% less than conventional design


redundancy


systems spanning
conventional
boundaries

nimbyism

“… I can think of better uses for our funding …”

		conventional	alternative
money	capital costs		
	operating costs		
	maintenance costs		
	replacement costs		
	integrated design **savings**		
not money	improved water / air quality		
	resilience to changing conditions		
	healthy communities		
	liability / risk		
	total ▶ dollars + "quality of life" index	**x**	**y**

The Business Case for Low Impact Development: Where are the Savings?

Tim Van Seters

TRIECA Conference

March 27, 2013

The Living City Foundation

Toronto and Region Conservation for The Living City

Low Impact Development Approach

- Manage runoff volumes and water quality using decentralized controls
- Preserve or reproduce pre-development water balance
- Preserve natural drainage features
- Simple low tech, low cost practices that detain, infiltrate and evapotranspire

Conventional approach

LID approach

Low Impact Development Practices

Detain - infiltrate - evapotranspire - capture and use

- Reduced impervious surfaces
- Permeable pavements
- Bioretention
- Infiltration trenches
- Swales, terraces, and check dams
- Rain barrels and cisterns
- Green roofs
- Trees and tree boxes
- Amended soils
- etc..

Economic Benefits of LID: Private and Public

LID Function	Property Owner	Community
Stormwater Management	Satisfies Stormwater Policy Requirements Long term effectiveness and O&M	Lower Stream Erosion Reduced Flood Risk Less Infrastructure Damage Fewer Combined Sewer Overflows and Beach Closures Improved Water Quality
Water Conservation	Lower Water Bills through reduced water use	Delays need for expensive water treatment infrastructure expansion Reduces municipal water pumping/treatment costs

Economic Benefits of LID: Private and Public

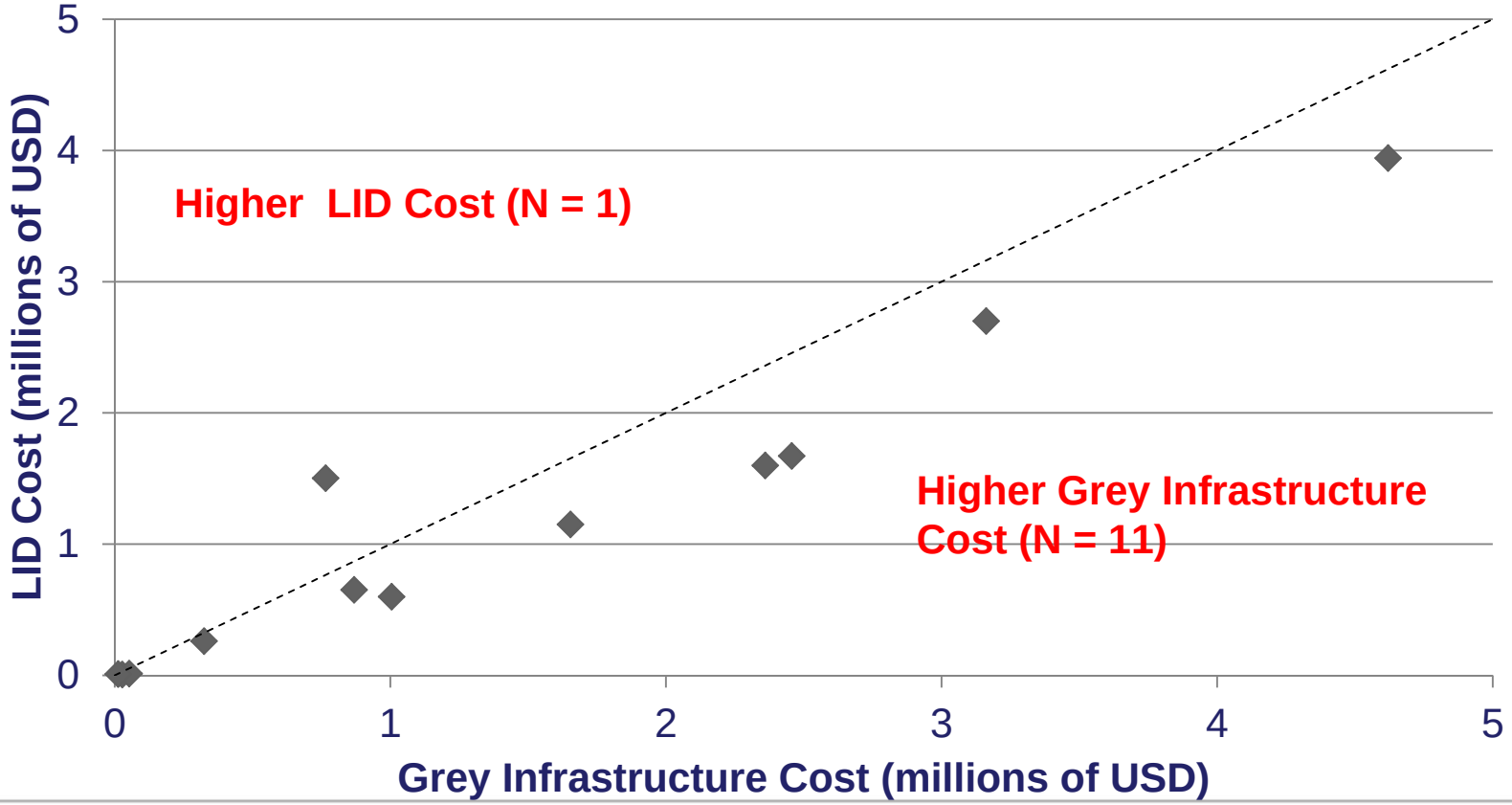
LID Function	Property Owner	Community
Green Roof Insulation Tree shade Tree wind breaks	Lower Energy Costs	Urban Cooling Improved Air Quality Carbon Capture
Naturalized Landscaping Reduced impervious cover	Increased Property values due to improved aesthetics	Improved habitat and biodiversity Improved air quality More green space and recreational opportunities

Grey versus Green: Where are the Savings?

- Preserves open space
- Reduces impervious cover
  - Narrower streets, alternative urban form
  - Shorter driveways, smaller parking stalls, etc
- Avoided Costs
  - Less site grading and preparation
  - Eliminate or reduce downstream infrastructure
  - Larger buildable area
  - Fewer pipes and inlets
  - Smaller culverts
  - Less curbs and gutters
  - Less paving
  - Simpler long term maintenance

Potential for Savings is Real

USEPA study in 2007 showed lower LID costs for 11 of 12 projects relative to grey infrastructure



Context will influence potential for savings…

- Retrofit sites where infrastructure already exists
- Stormwater criteria, credit programs and incentives
- Space constraints and cost of buildable area
- Provincial and municipal standards
- Site specific constraints or opportunities

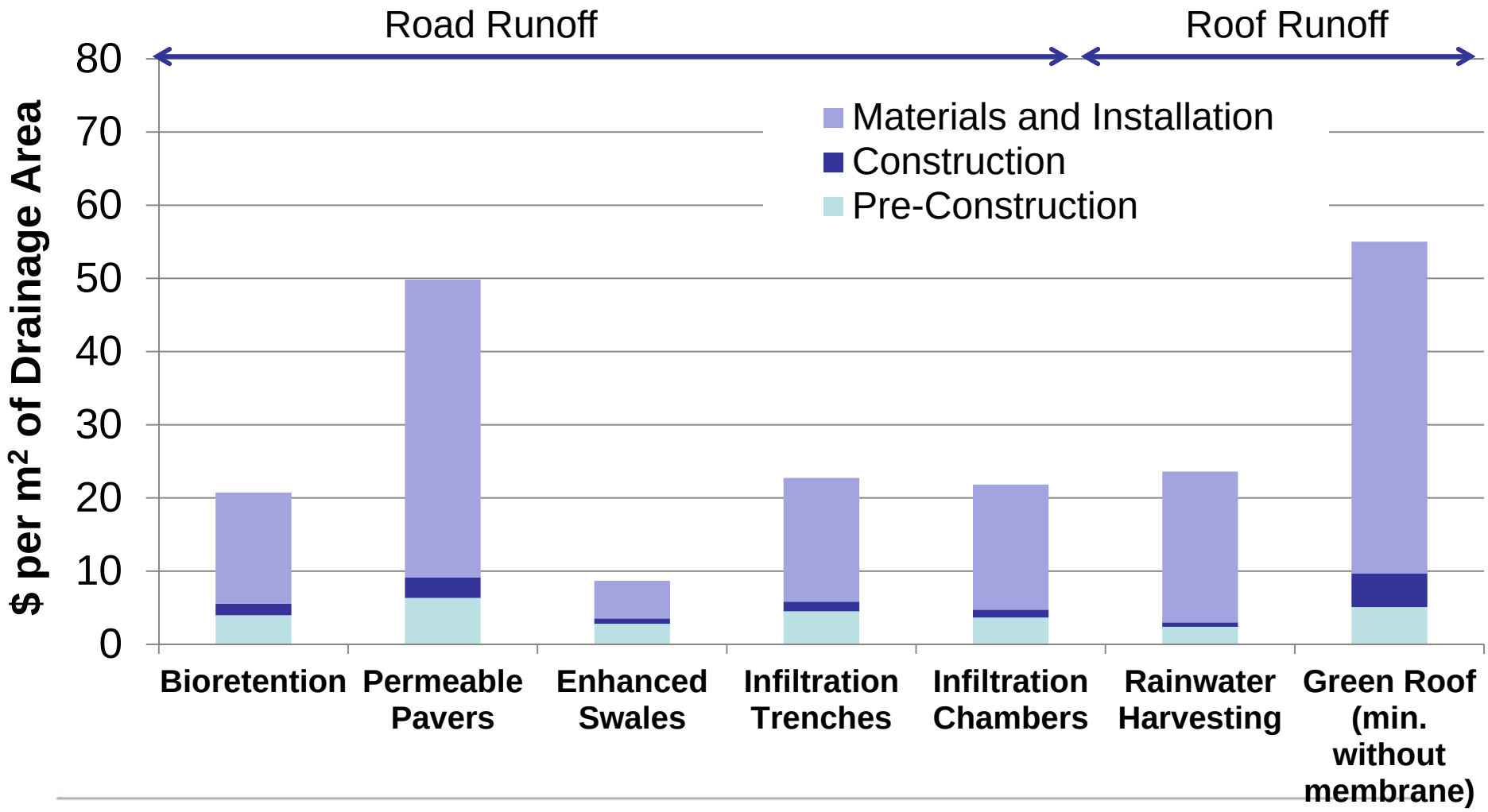
LID Life Cycle Cost Study and Tool

- Collaborative project with University of Toronto
  - Mariko Uda and Chris Kennedy - Civil Engineering Department

- Evaluates **capital** and **life cycle** costs over 50 years based on:
  - Local input costs from RS means and industry surveys
  - Practice maintenance requirements in Ontario
  - LID designs from local guides

- LID Capital and **Life Cycle Costing Tool** for preliminary scoping

LID Practice Capital Costs

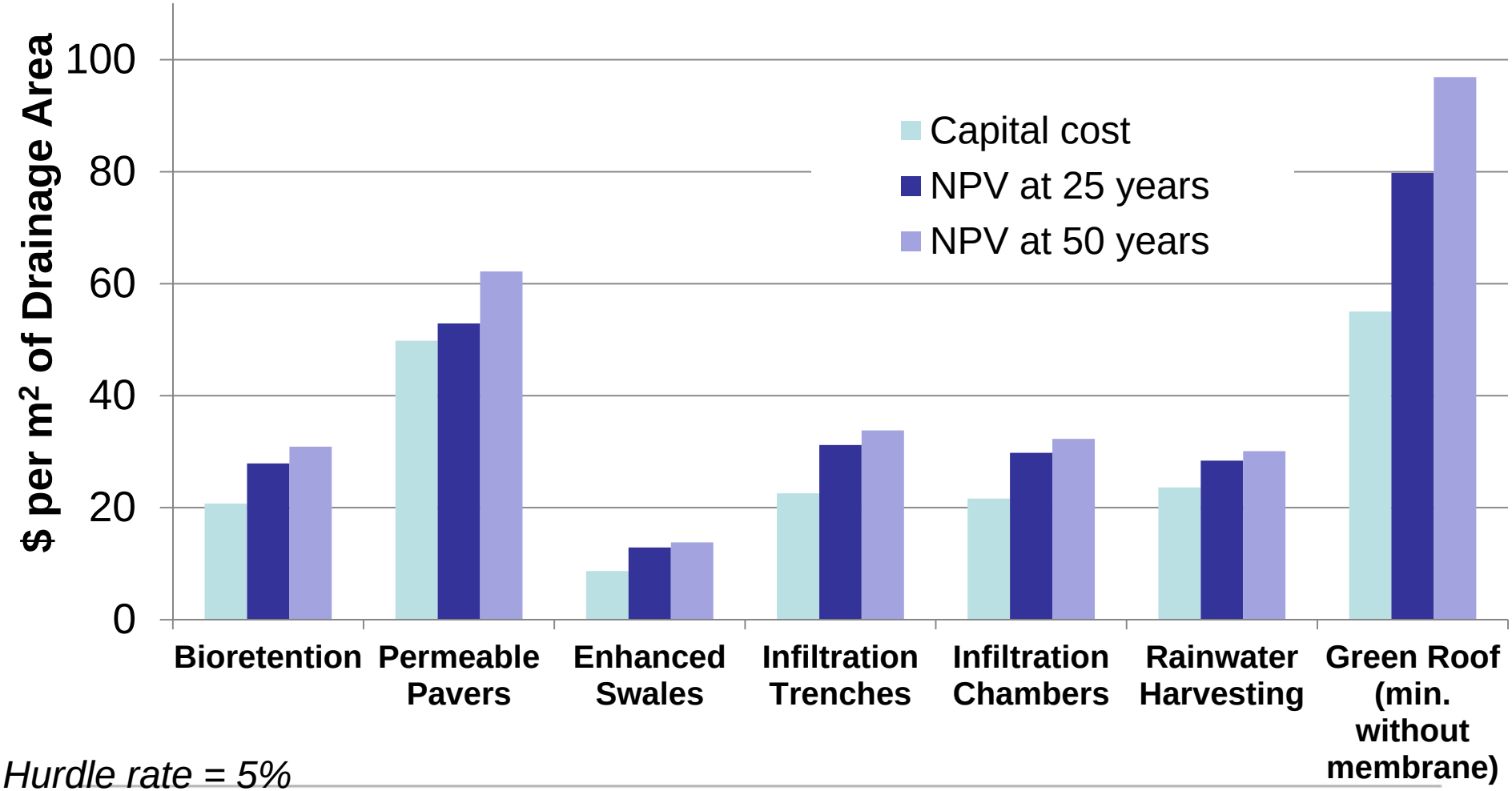


Life Cycle Operation, Maintenance and Rehabilitation Costs

- Typical routine activities: *inspection, sediment removal, vegetation maintenance, mowing, watering, vac. clean out etc …*
- Higher **initial establishment** costs for vegetative practices
- Periodic **rehabilitation** or replacement costs

	Operation, Maintenance and Rehabilitation Costs										Total PV
Bioretention	$$$$$$	$$$$$	$$$$$	$$$$	$$$$$$	$$$$$	$$$$	$$$$	$$$$	$$$$	$28,670
Perm. Pavers	$$$$	$$$$	$$$$	$$$$	$$$$	$$$$$$$	$$$	$$$	$$$	$$	$41,819
Enhanced Swale	$$$$$	$$$$	$$$$	$$$	$$$	$$	$$	$$	$$	$$	$10,292
Infil. Chamber	$$$$$	$$$$$	$$$$$	$$$$$	$$$$$	$$$$$	$$$$	$$$$	$$$$	$$$$	$30,563
Infil. Trench	$$$$$	$$$$$$	$$$$$	$$$$$	$$$$$	$$$$$	$$$$$	$$$$	$$$$	$$$$	$32,276
Rain Water H.	$$$	$$$$$$	$$$	$$$$$	$$	$$$$$	$$	$$$$	$	$	$18,851
Green Roof Min	$$$$$$$	$$$$$$	$$$$$	$$$$$	$$$$$	$$$$$	$$$$$	$$$$$$$	$$$$$	$$$	$182,228
	5	10	15	20	25	30	35	40	45	50	
					Years						

Life Cycle Costs



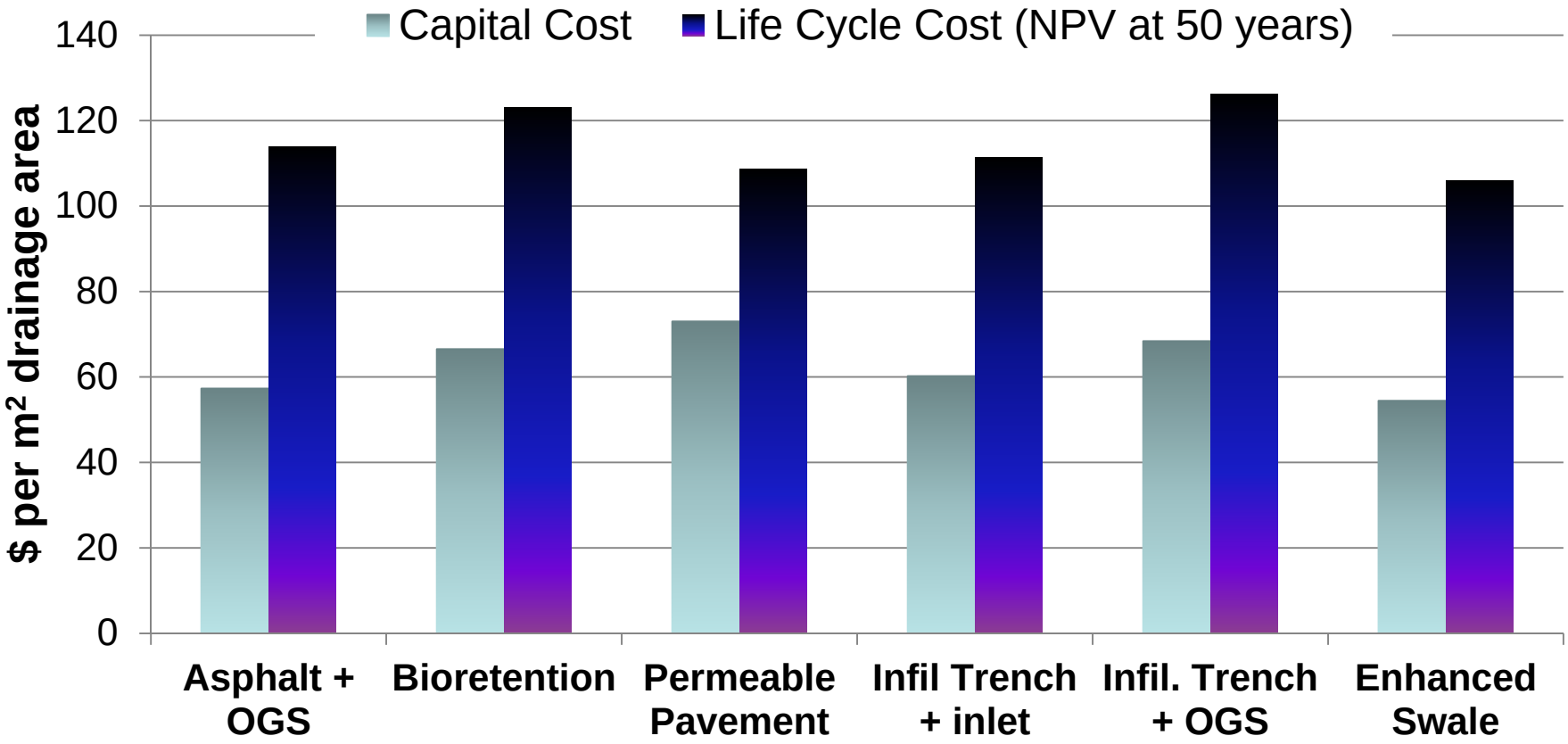
Hurdle rate = 5%

Scenarios

- **Asphalt with:**

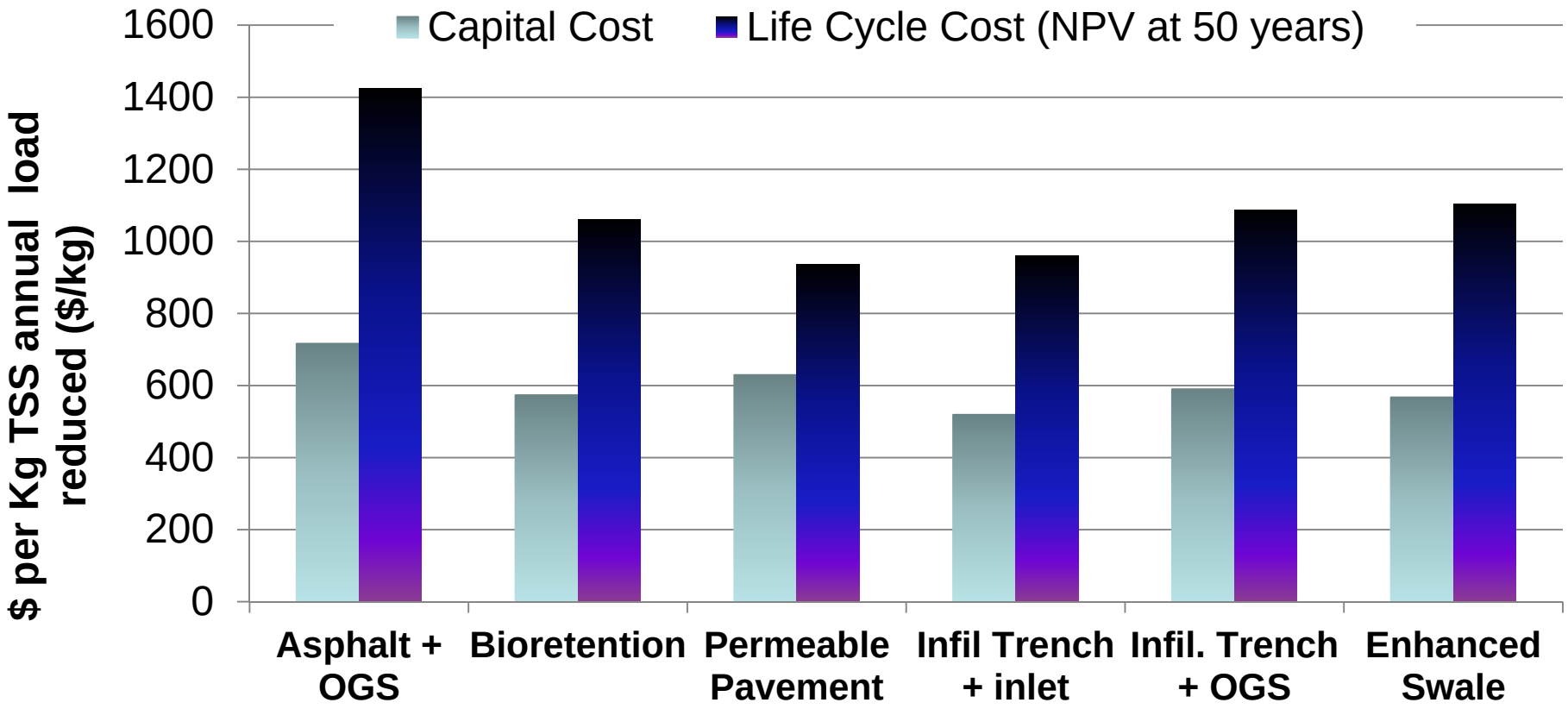
1. **Oil Grit Separator** treatment
2. **Bioretention** with underdrain
3. **Permeable Pavement** (50% of drainage area)
4. **Infiltration trench** with pretreatment via **gravel inlet**
5. **Infiltration trench** with pretreatment via **OGS**
6. **Enhanced swale**

Scenario Cost Estimates



….But conventional treatment does not reduce runoff volumes

Costs by TSS Load Reduced

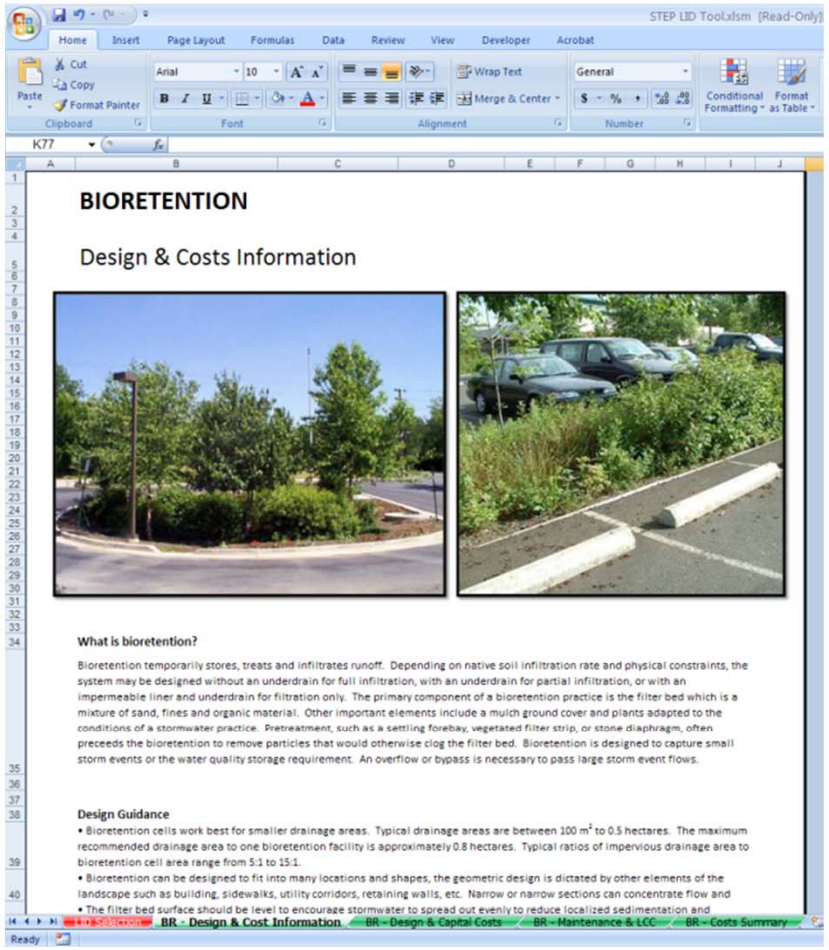


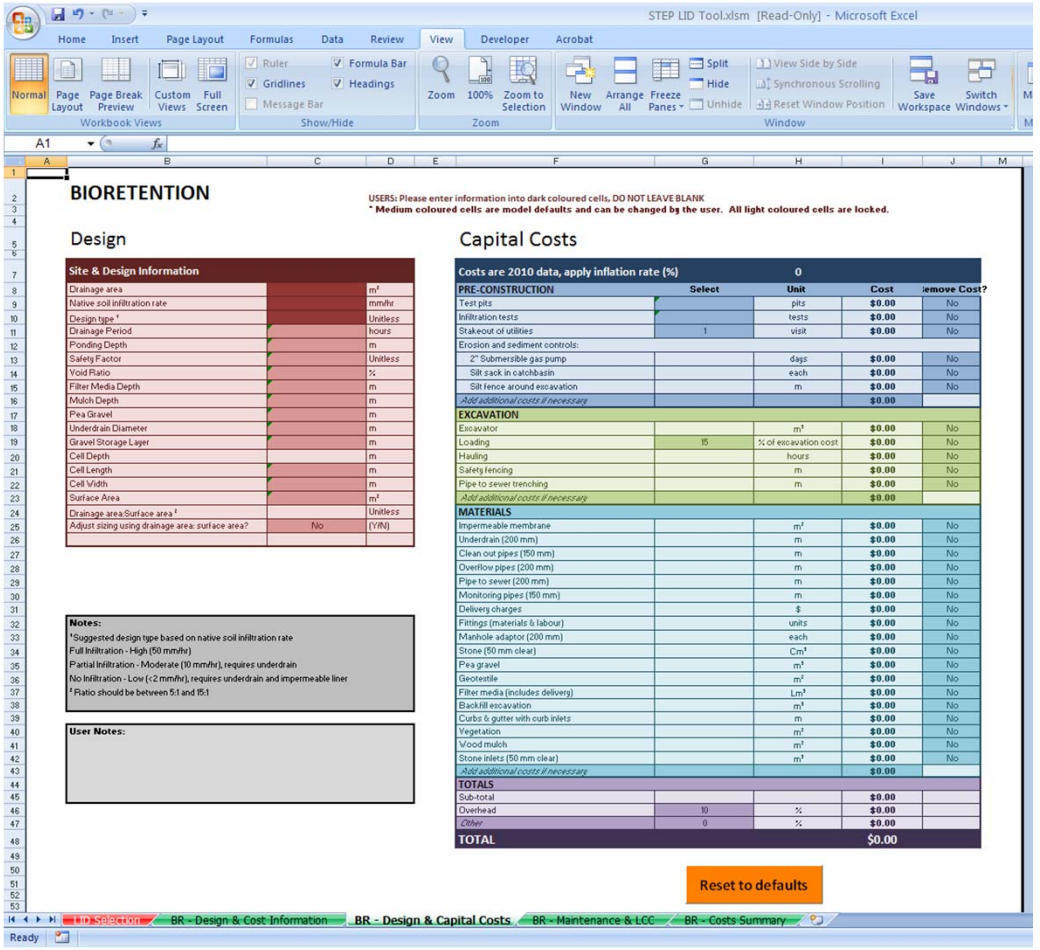
For simplicity, assumes annual rainfall of 800 mm, all practices reduce influent TSS (200 mg/L) by 50%, runoff volume reductions as per LID Guide

Life Cycle Costing Tool

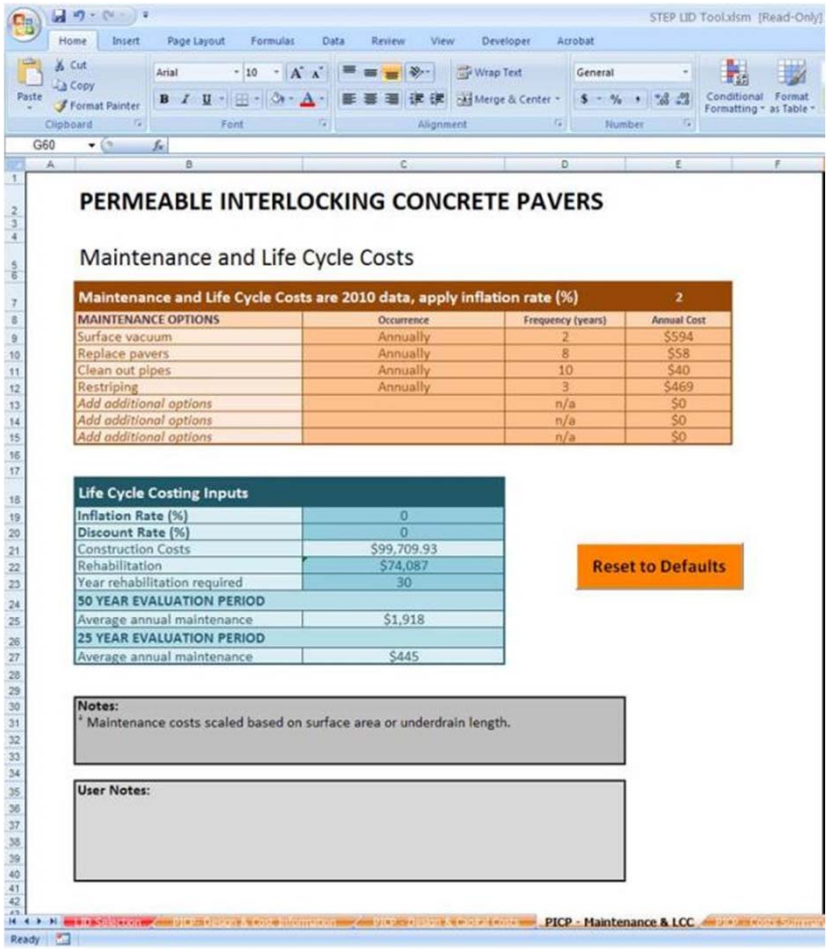
- Spreadsheet decision support tool
- Facilitate selection of LID practices
- User enters site characteristics, and can modify default practice design and maintenance parameters
- Tool provides capital, maintenance and life cycle costs
- Inflation factor can be applied to update costs to current year

Design Information and Capital Costs





Maintenance and Life Cycle Costs



PERMEABLE INTERLOCKING CONCRETE PAVERS

Maintenance and Life Cycle Costs

Maintenance and Life Cycle Costs are 2010 data, apply inflation rate (%)			2
MAINTENANCE OPTIONS	Occurrence	Frequency (years)	Annual Cost
Surface vacuum	Annually	2	$594
Replace pavers	Annually	8	$58
Clean out pipes	Annually	10	$40
Restriping	Annually	3	$469
Add additional options		n/a	$0
Add additional options		n/a	$0
Add additional options		n/a	$0

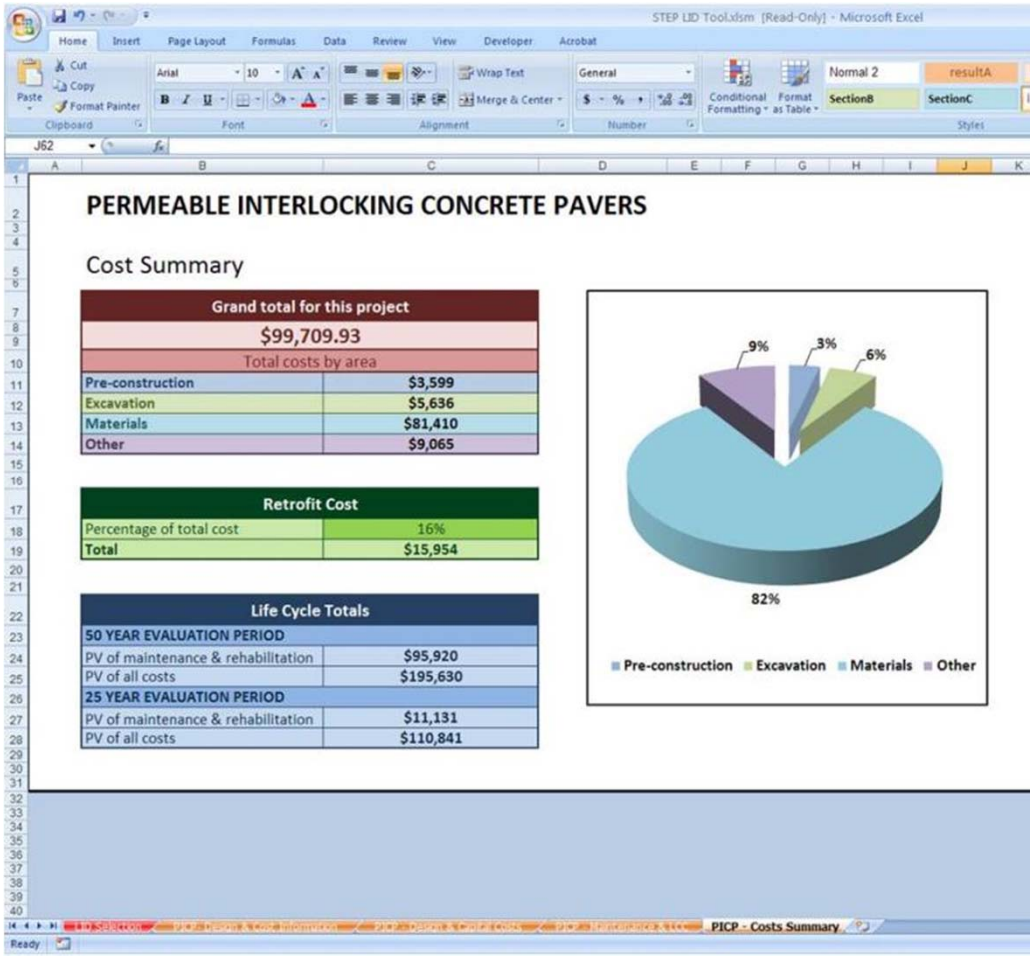
Life Cycle Costing Inputs	
Inflation Rate (%)	0
Discount Rate (%)	0
Construction Costs	$99,709.93
Rehabilitation	$74,087
Year rehabilitation required	30
50 YEAR EVALUATION PERIOD	
Average annual maintenance	$1,918
25 YEAR EVALUATION PERIOD	
Average annual maintenance	$445

Reset to Defaults

Notes:
* Maintenance costs scaled based on surface area or underdrain length.

User Notes:

PICP - Maintenance & LCC



PERMEABLE INTERLOCKING CONCRETE PAVERS

Cost Summary

Grand total for this project	
$99,709.93	
Total costs by area	
Pre-construction	$3,599
Excavation	$5,636
Materials	$81,410
Other	$9,065

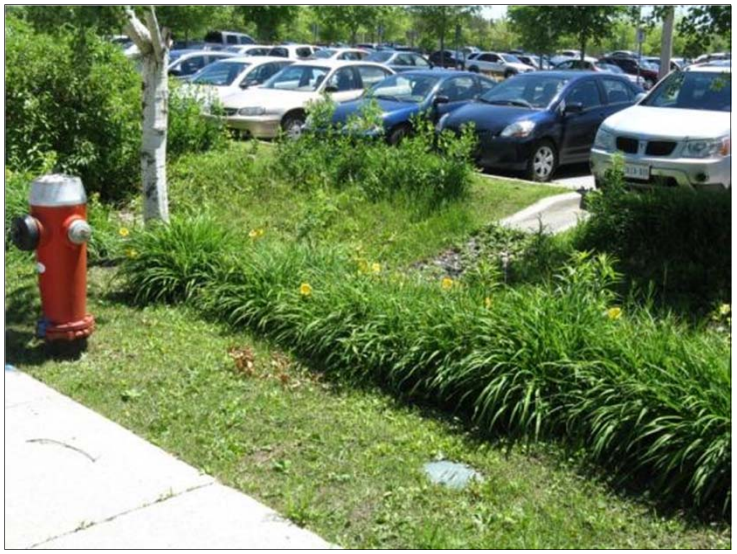
Retrofit Cost	
Percentage of total cost	16%
Total	$15,954

Life Cycle Totals	
50 YEAR EVALUATION PERIOD	
PV of maintenance & rehabilitation	$95,920
PV of all costs	$195,630
25 YEAR EVALUATION PERIOD	
PV of maintenance & rehabilitation	$11,131
PV of all costs	$110,841

PICP - Costs Summary

Next Steps

- Final Report and Tool will be available in April at:
  - www.sustainabletechnologies.ca
- Modifications will be made based on user feedback



Rainwater Cistern in Parking Garage

Project Partners

- Government of Canada's Great Lakes Sustainability Fund
- City of Toronto
- York Region
- Region of Peel
- University of Toronto
- National Science and Research Council Industrial Postgraduate Scholarship

Thank You

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STEP website:
www.sustainabletechnologies.ca

Innovatve Stormwater Interactive Map
www.iswm.ca

Toronto and Region Conservation for The Living City

Sustainable Technologies Evaluation Program