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Toronto and Region Conservation for The Living City

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WATER CANADA THE COMPLETE WATER MAGAZINE

A Few Things We Know and Don't Know about LID:

Perspectives drawn from over 20 years of stormwater BMP monitoring

Tim Van Seters

TRIECA Conference

March 25, 2015

The Living City Foundation

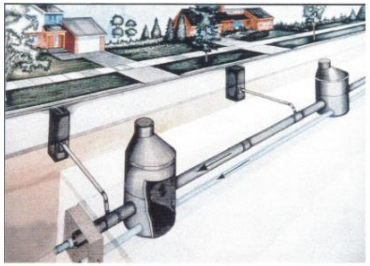
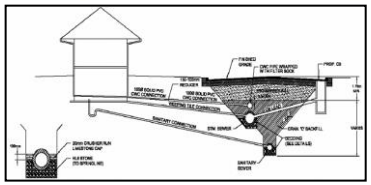
Toronto and Region Conservation for The Living City

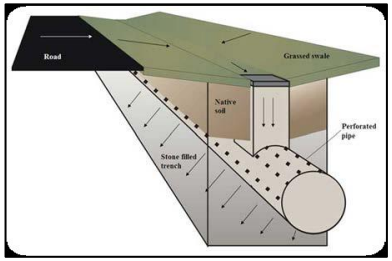
Over 20 years of monitoring

End of Pipe facilities (n = 9)




Conveyance Practices (n = 5)



Source Controls (n = 20)







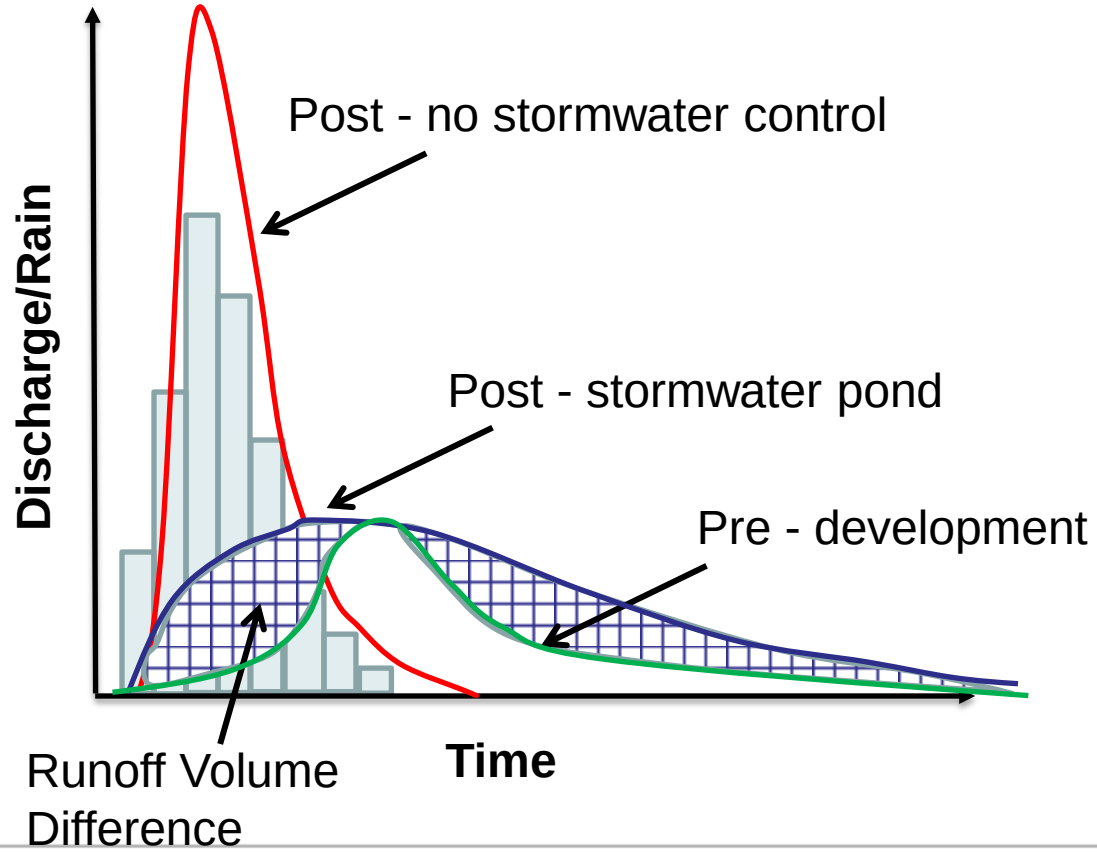





Hydrology

Replicating the Natural Hydrologic Cycle

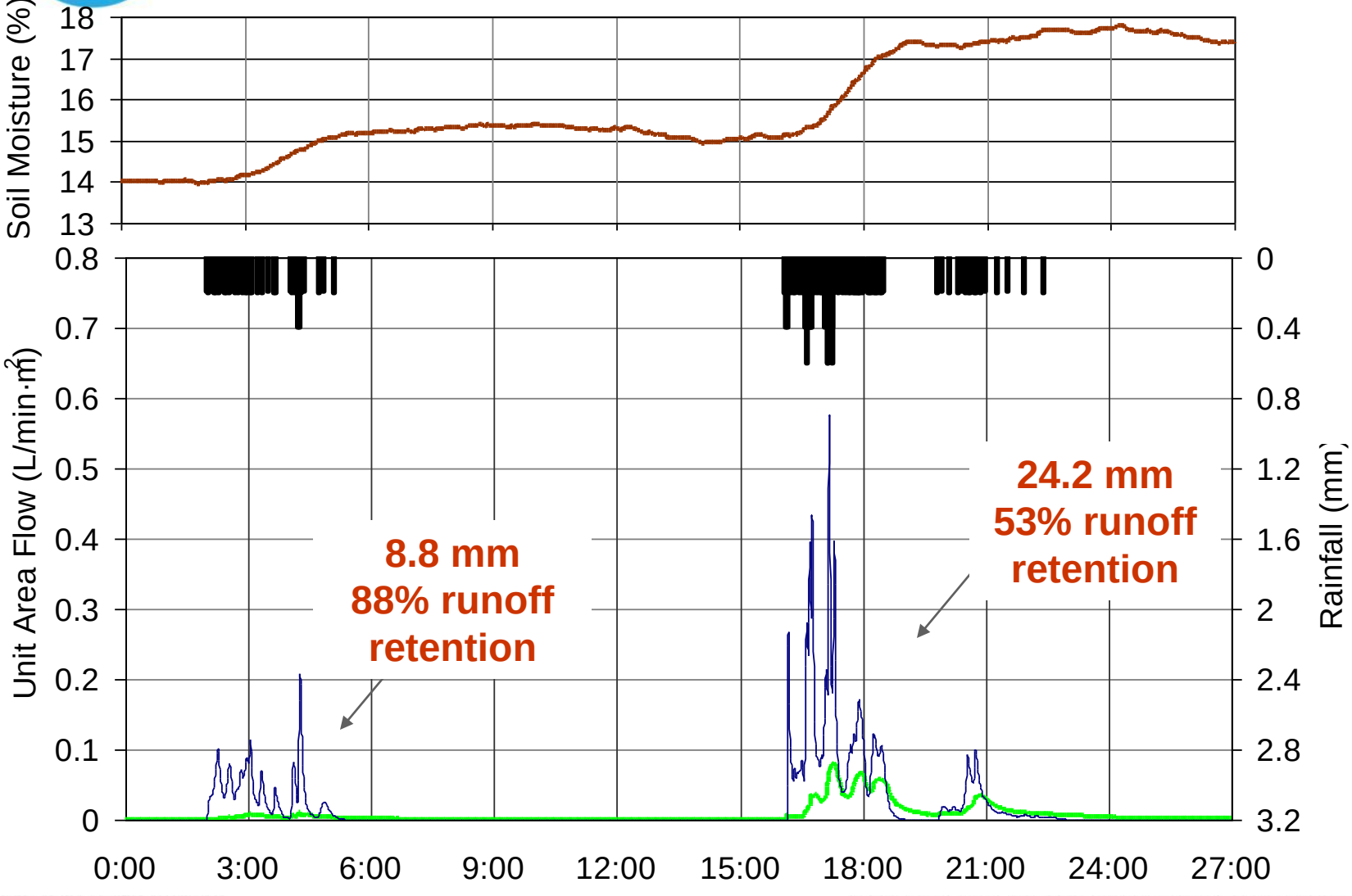
Hydrologic Performance



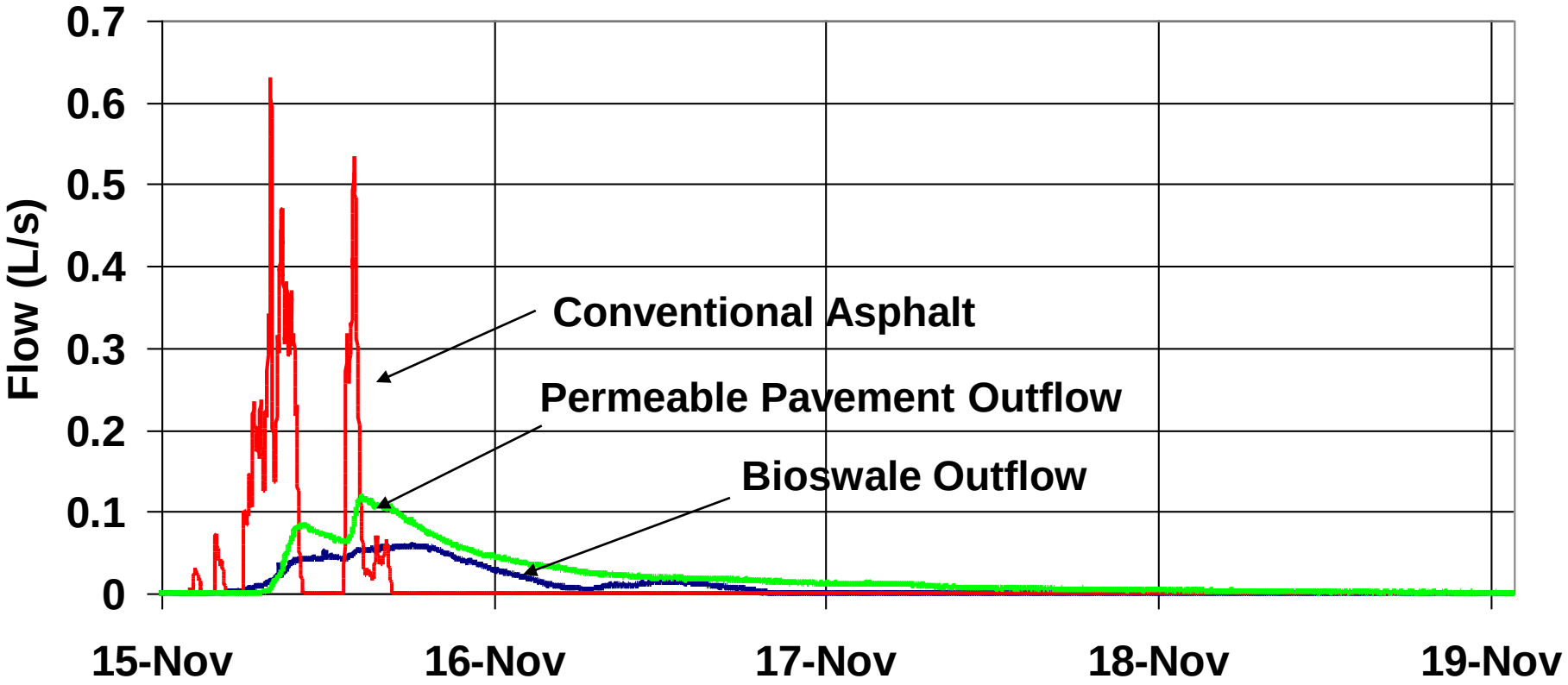
LID Scenario

- Peak flow attenuation
- Delayed release
- No increase in runoff volumes
- Maintains stream baseflows and evapotranspiration

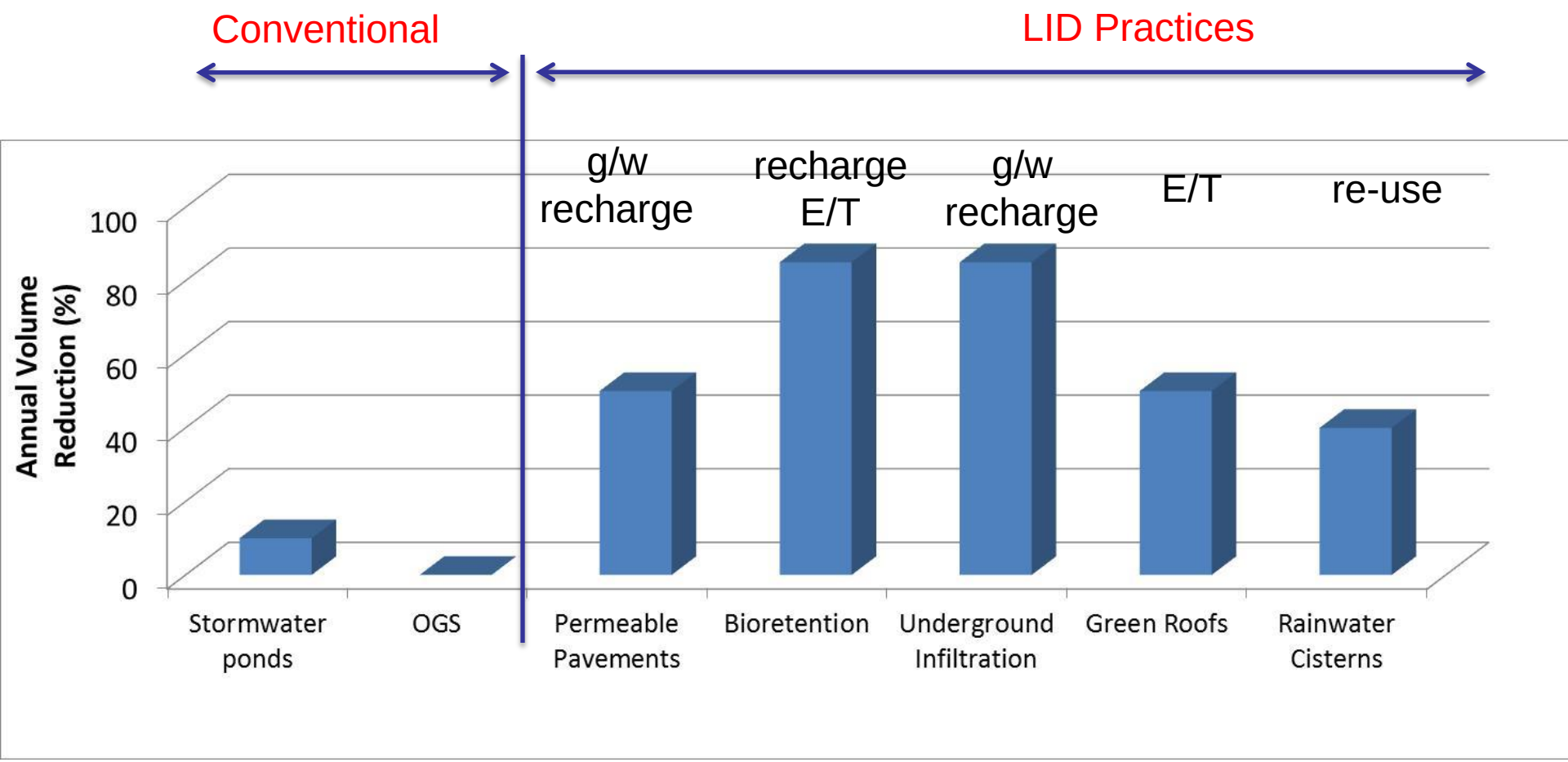
Green Roof, York University



Permeable Pavement and Bioretention, King City: *31 mm rain event*

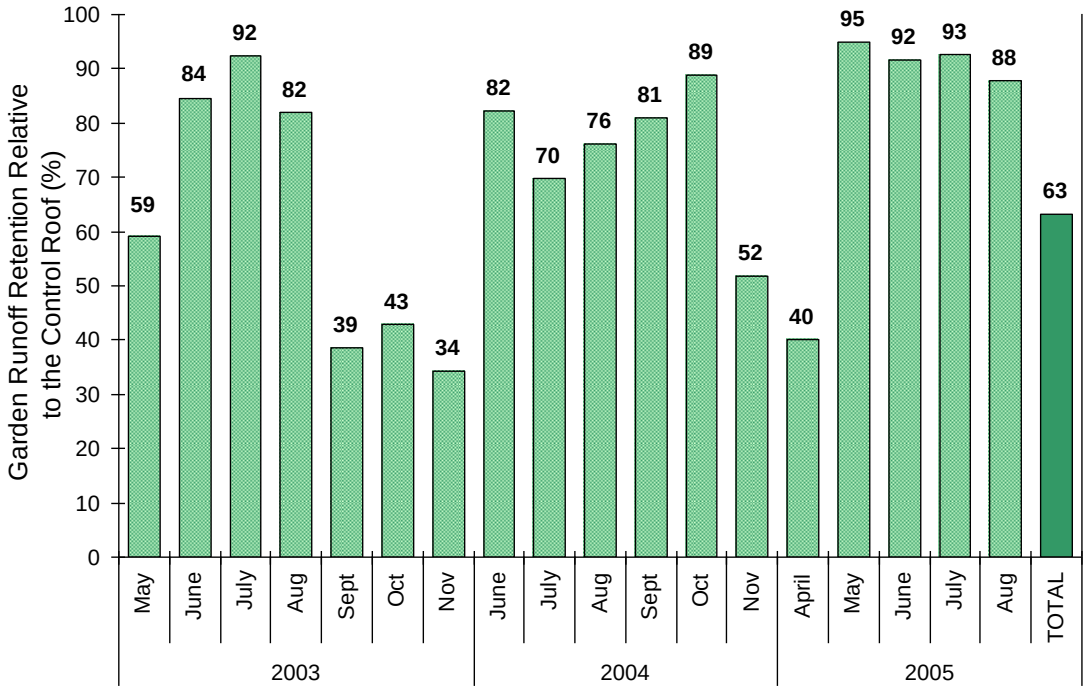


Annual Volume Reductions



Based on STEP/SWAMP study results

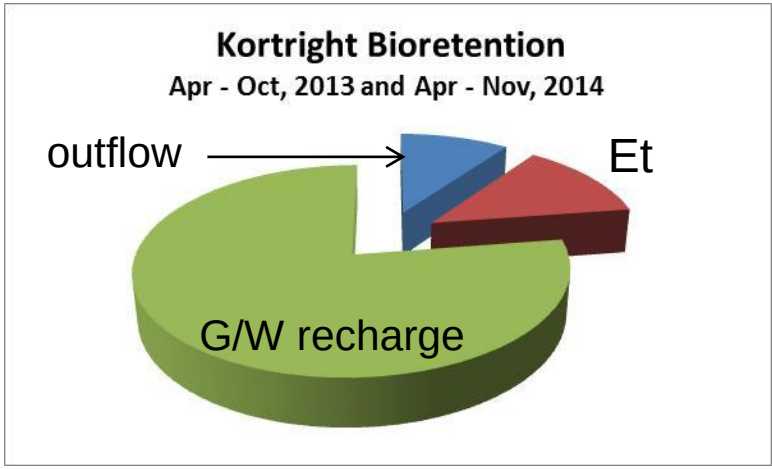
Evapotranspiration

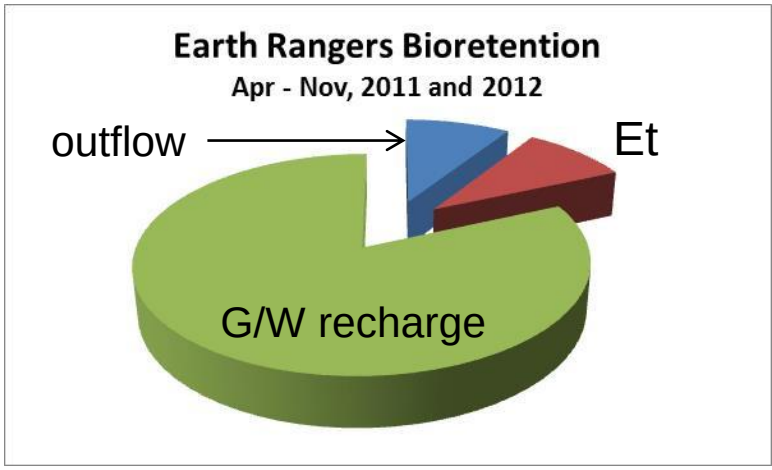


Green Roof: 63% evapotranspired

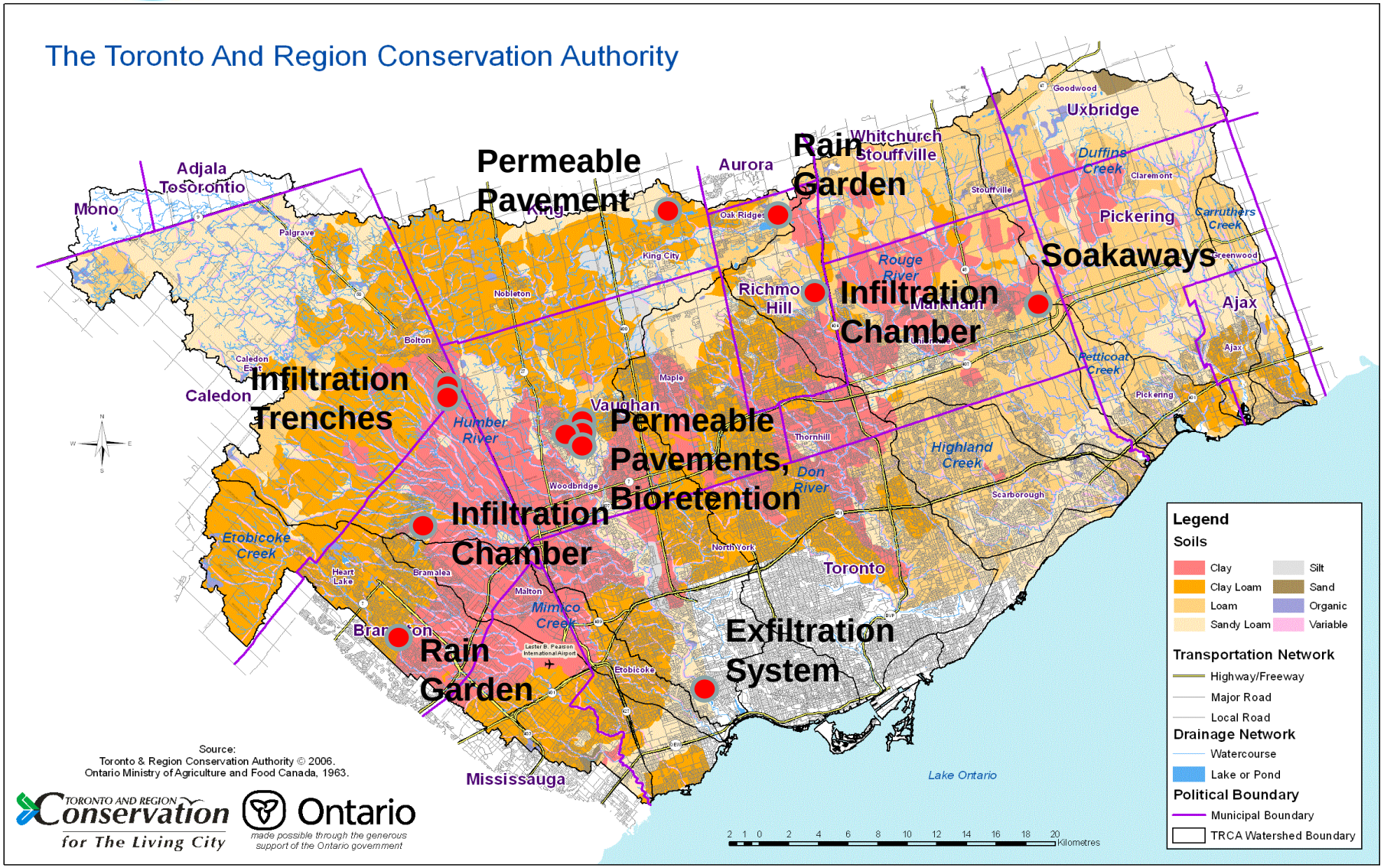
Bioretention

9 -13% runoff evapotranspired





Groundwater Recharge on Tight Soils



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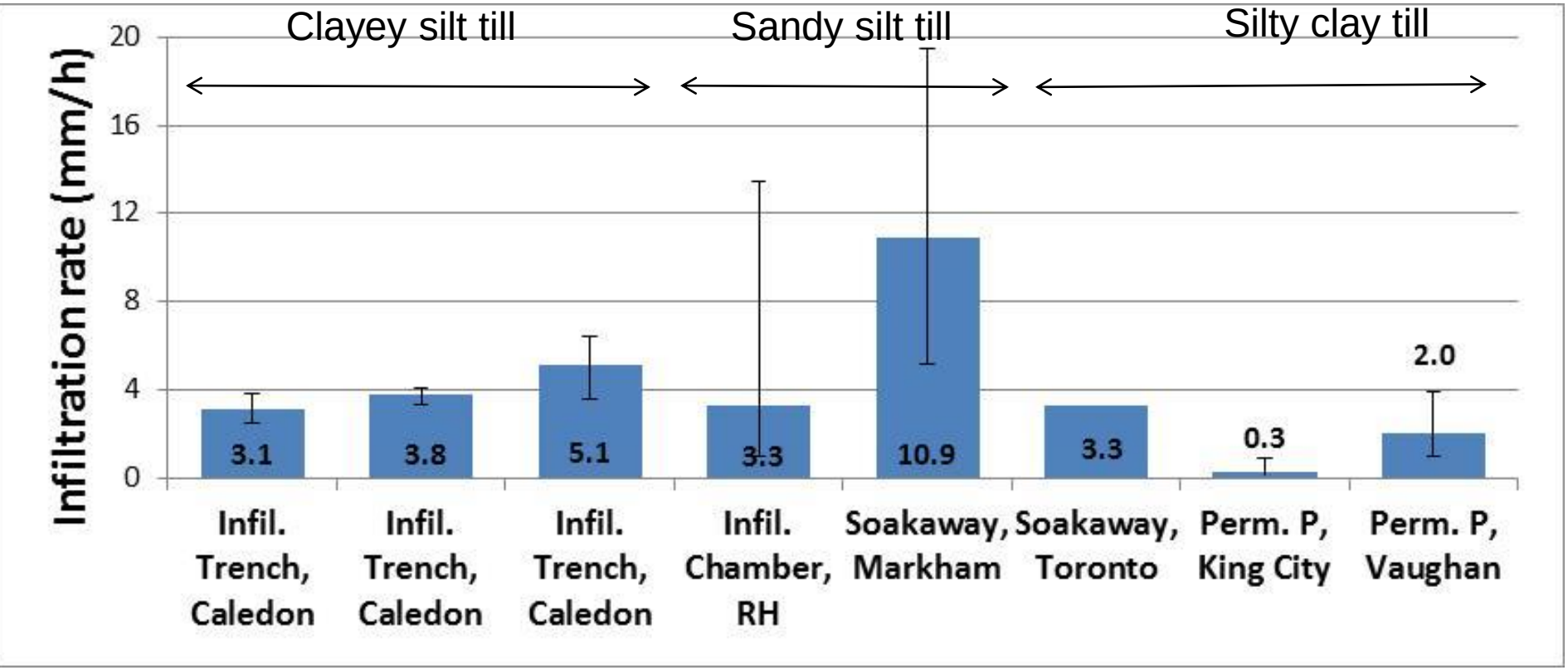
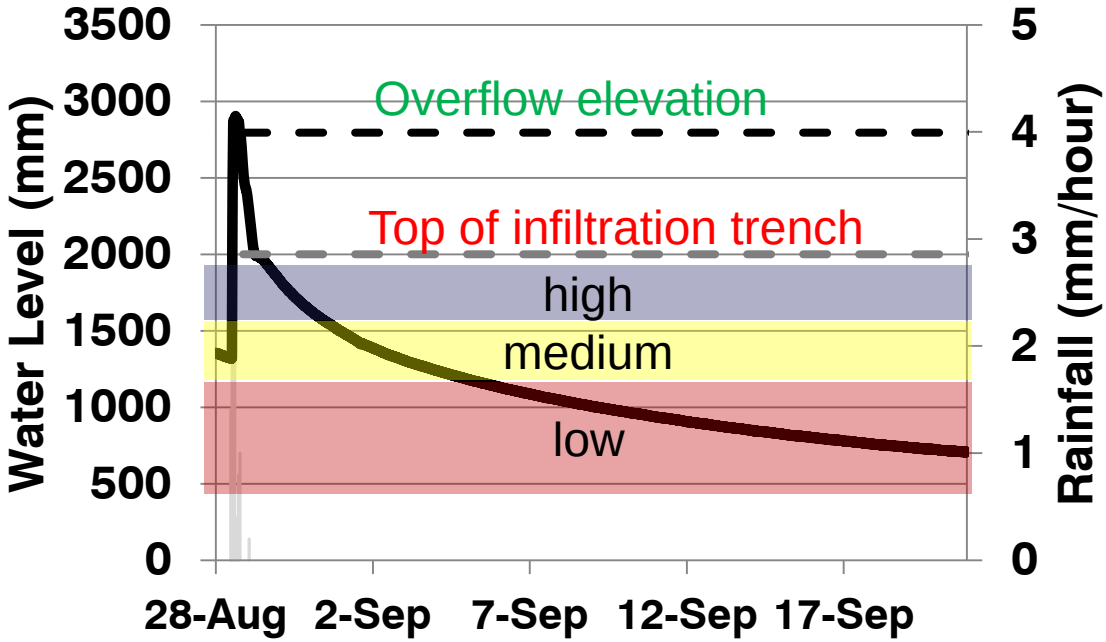
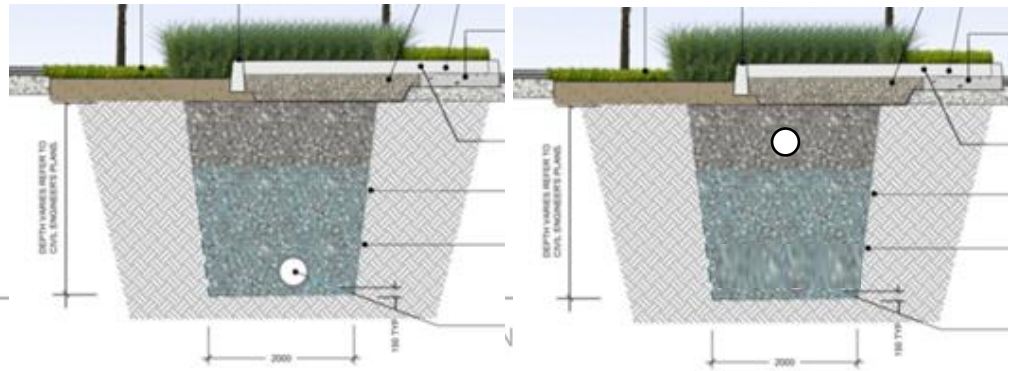


DA:IA ratios	155:1	100:1	64:1	20:1	n/a	n/a	1:1	1:1
Runoff Reduction	16%	~24%	36%	90%	n/a	n/a	99%	44%

Factors Influencing Recharge Rates and Volumes

- Drawdown time
- Underdrain Configuration
- Ratio of impervious drainage area to infiltration footprint
- Vertical:horizontal dimension ratio



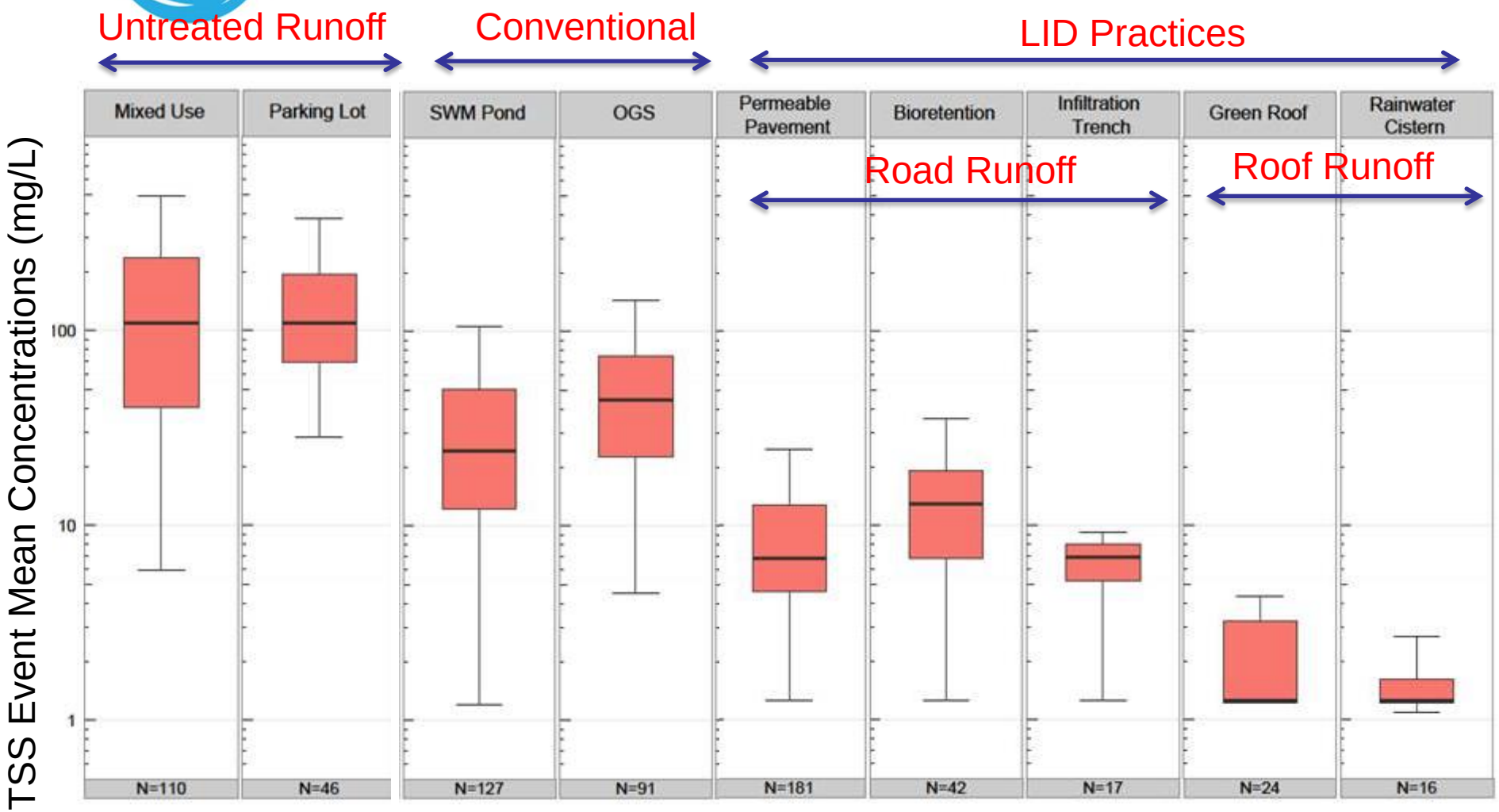


Water Quality

Retaining pollutants




Water Quality Concentrations

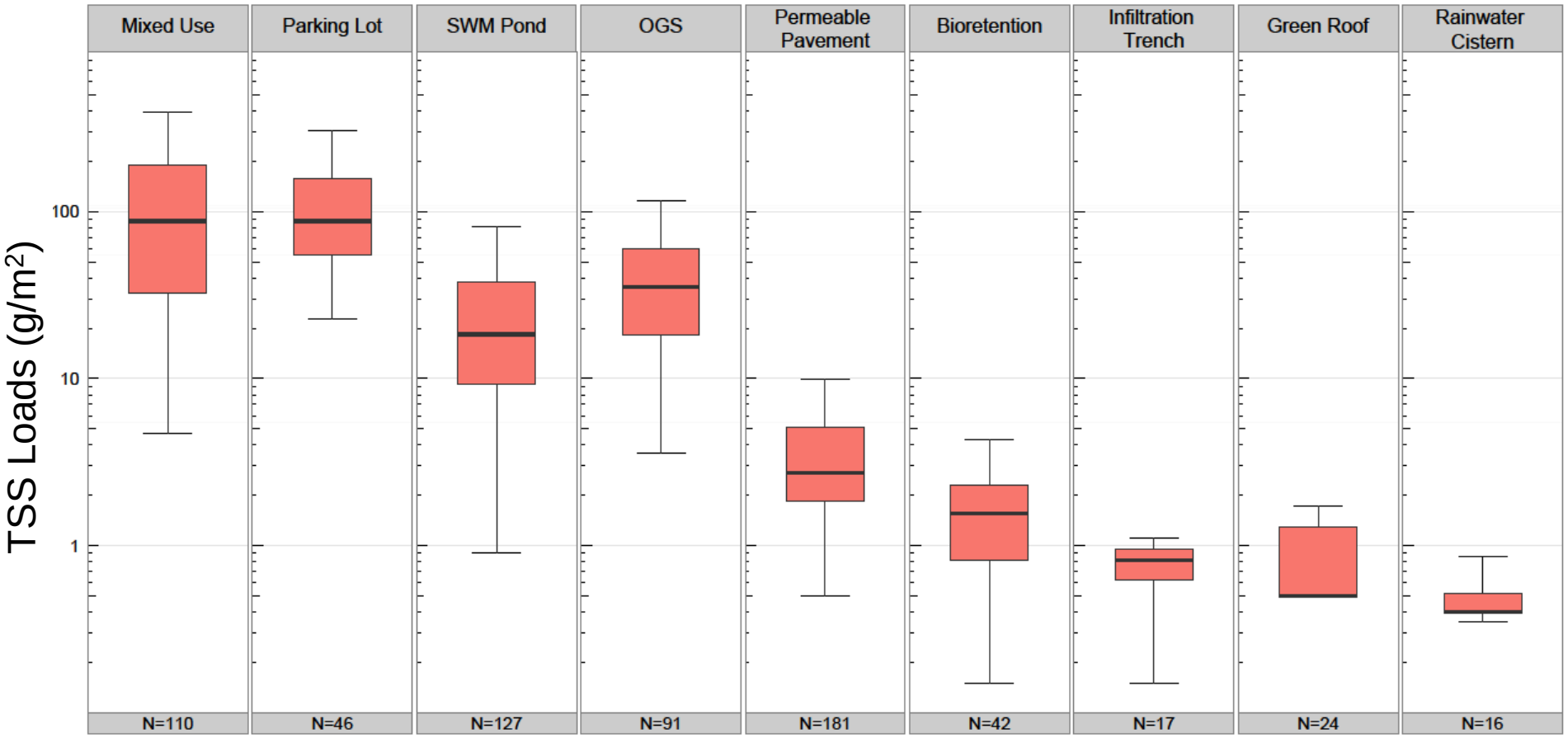


Hypothetical Loads

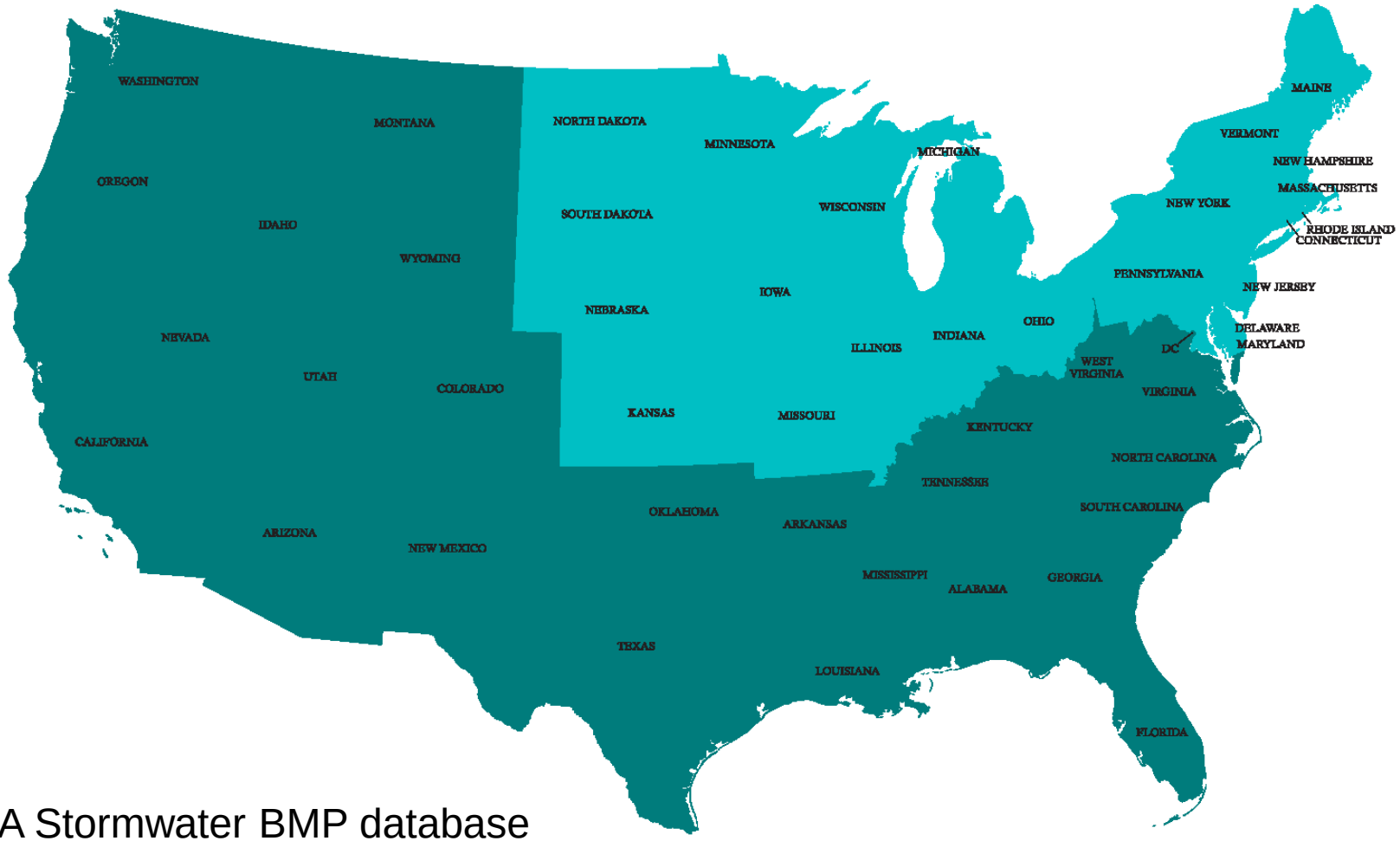
Untreated Runoff

Conventional

LID Practices

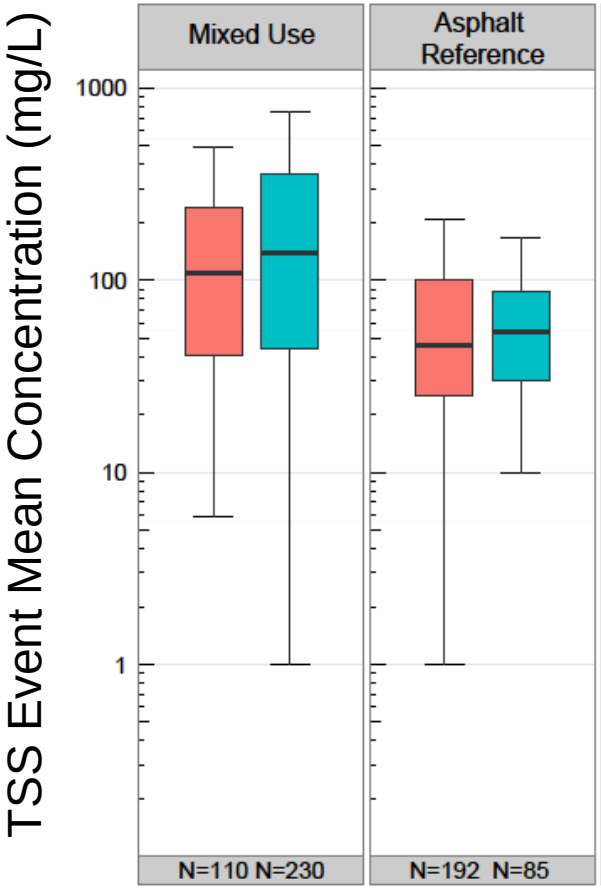


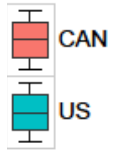
Comparing Canada to the US



US EPA Stormwater BMP database

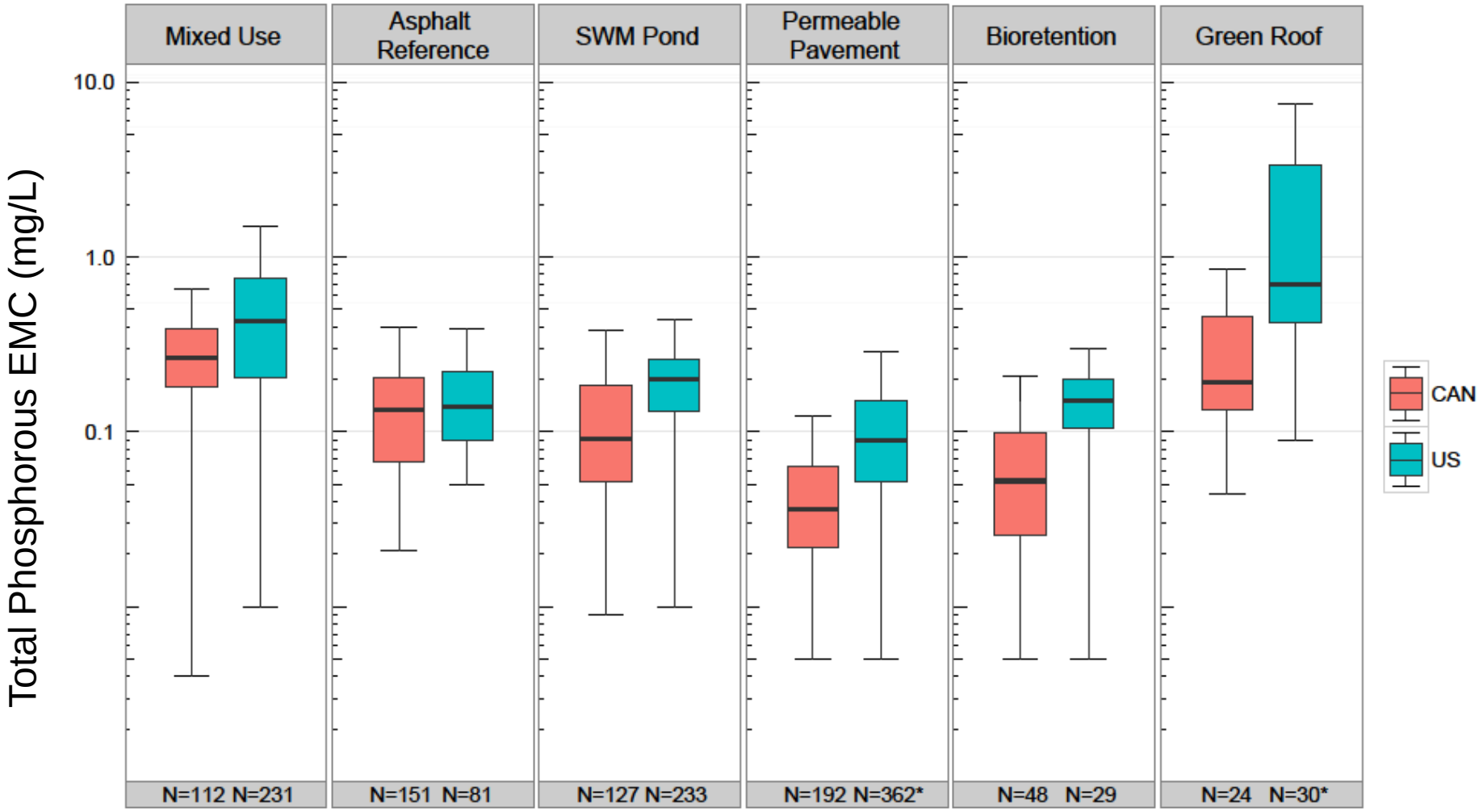
Comparing Canada to the US: TSS



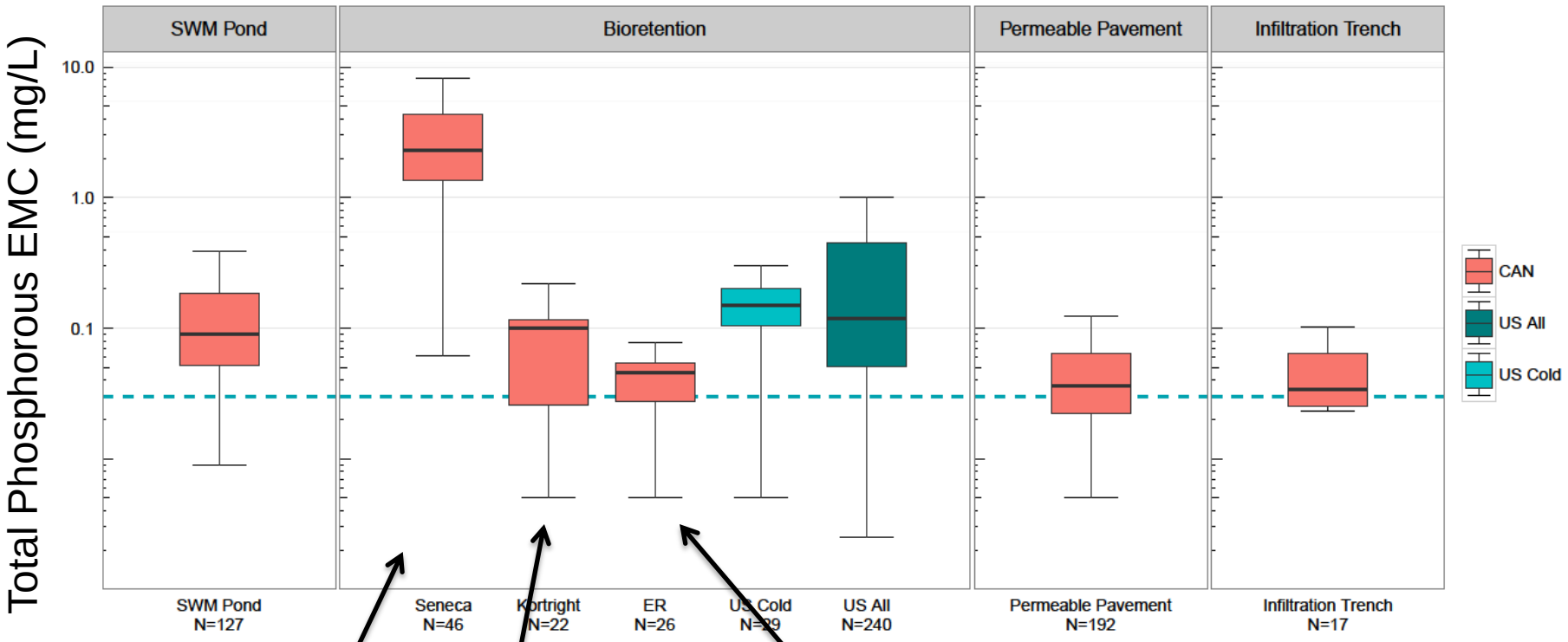


Note: US data from 'cold climate' states in the USEPA BMP database; PP and GR from all sites

Comparing Canada to the US: TP



Effluent Total Phosphorus Comparison



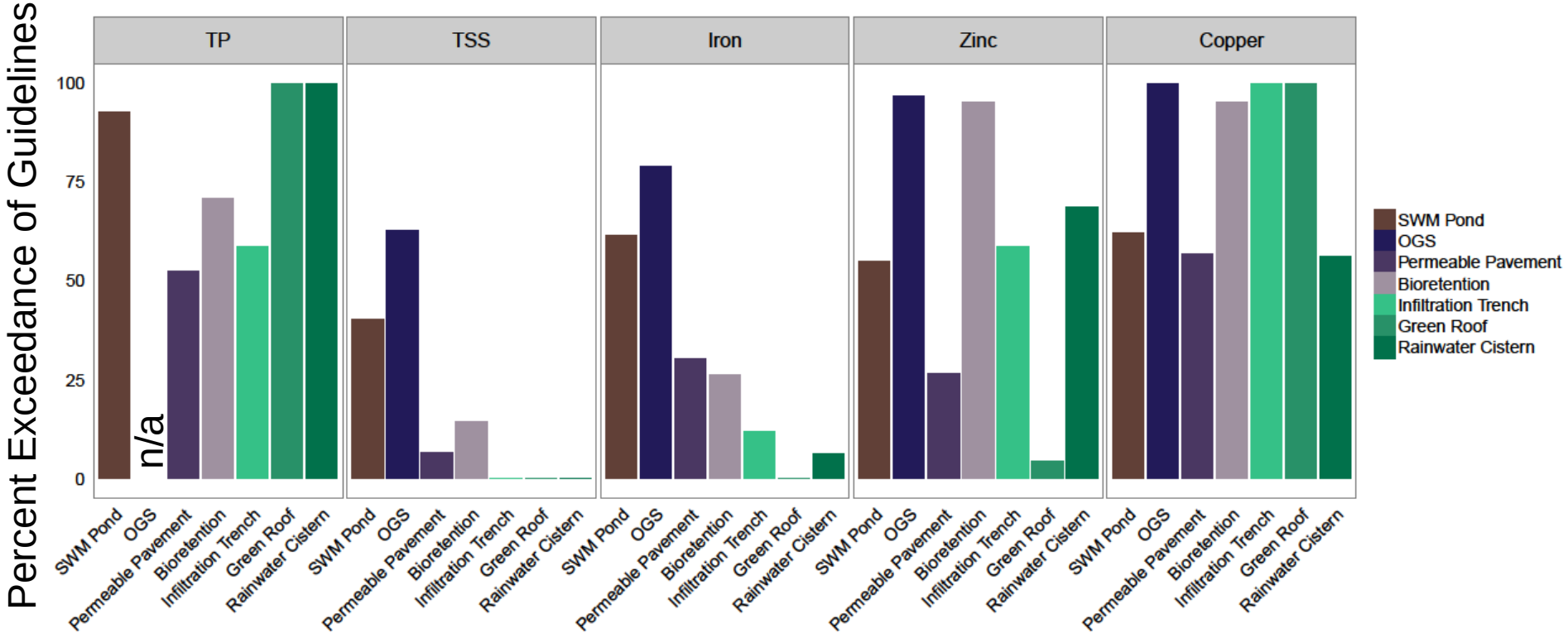
Garden soil

Specially mixed filter media

We are still learning!

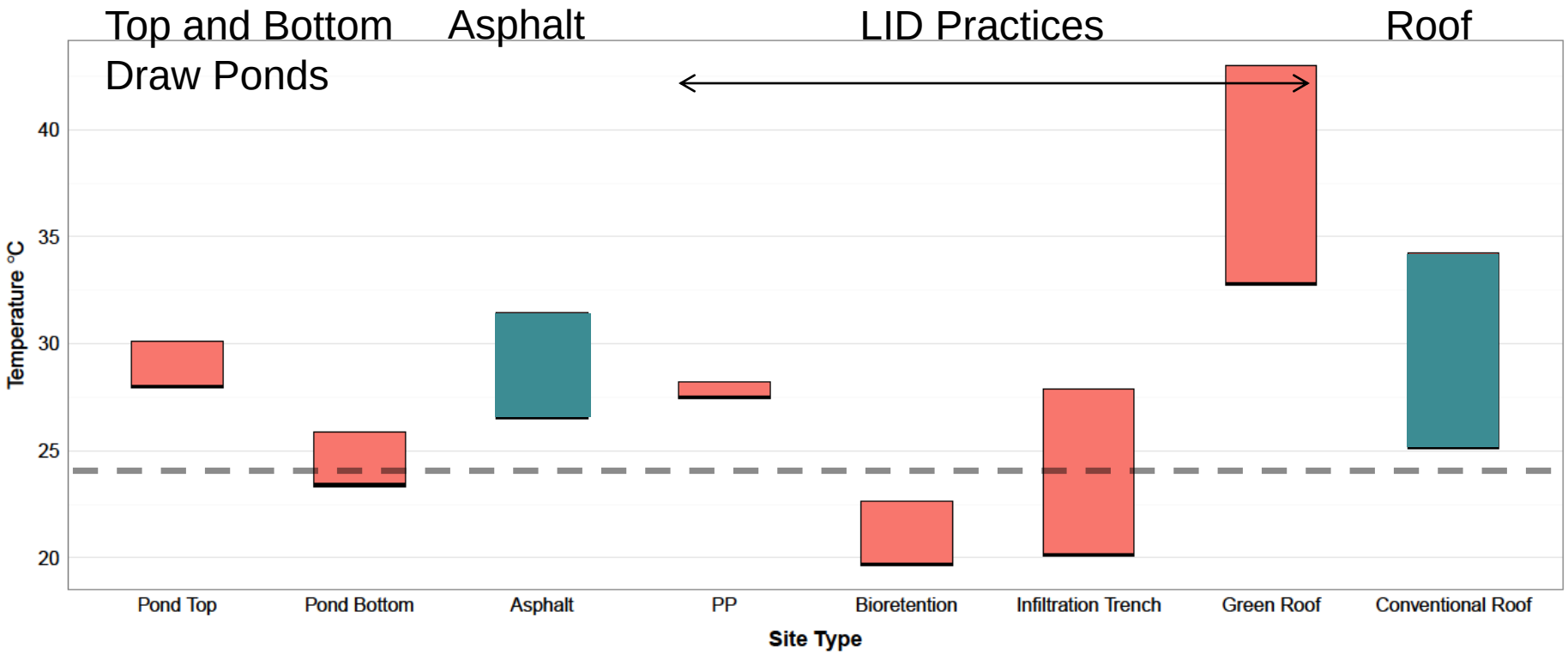
Does Effluent from LID Practices meet Provincial Receiving Water Guidelines?

TP = 0.03 mg/L TSS = 30 mg/L Iron 300 µg/L Zinc 20 µg/L Copper 5 µg/L



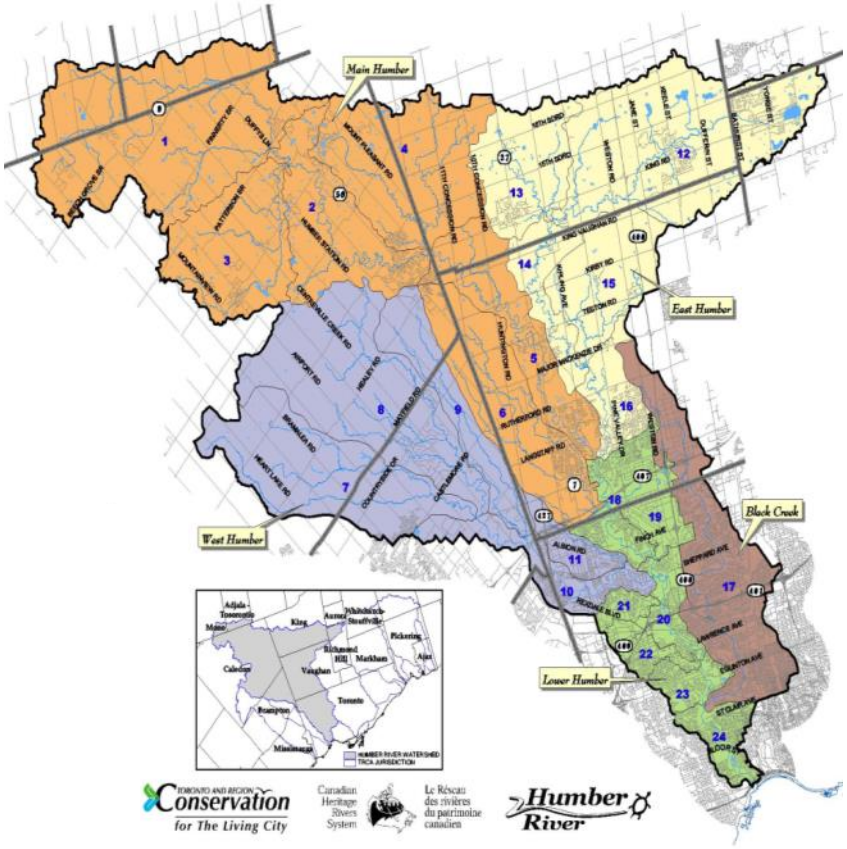
Runoff Temperature Comparison

95th percentile to maximum



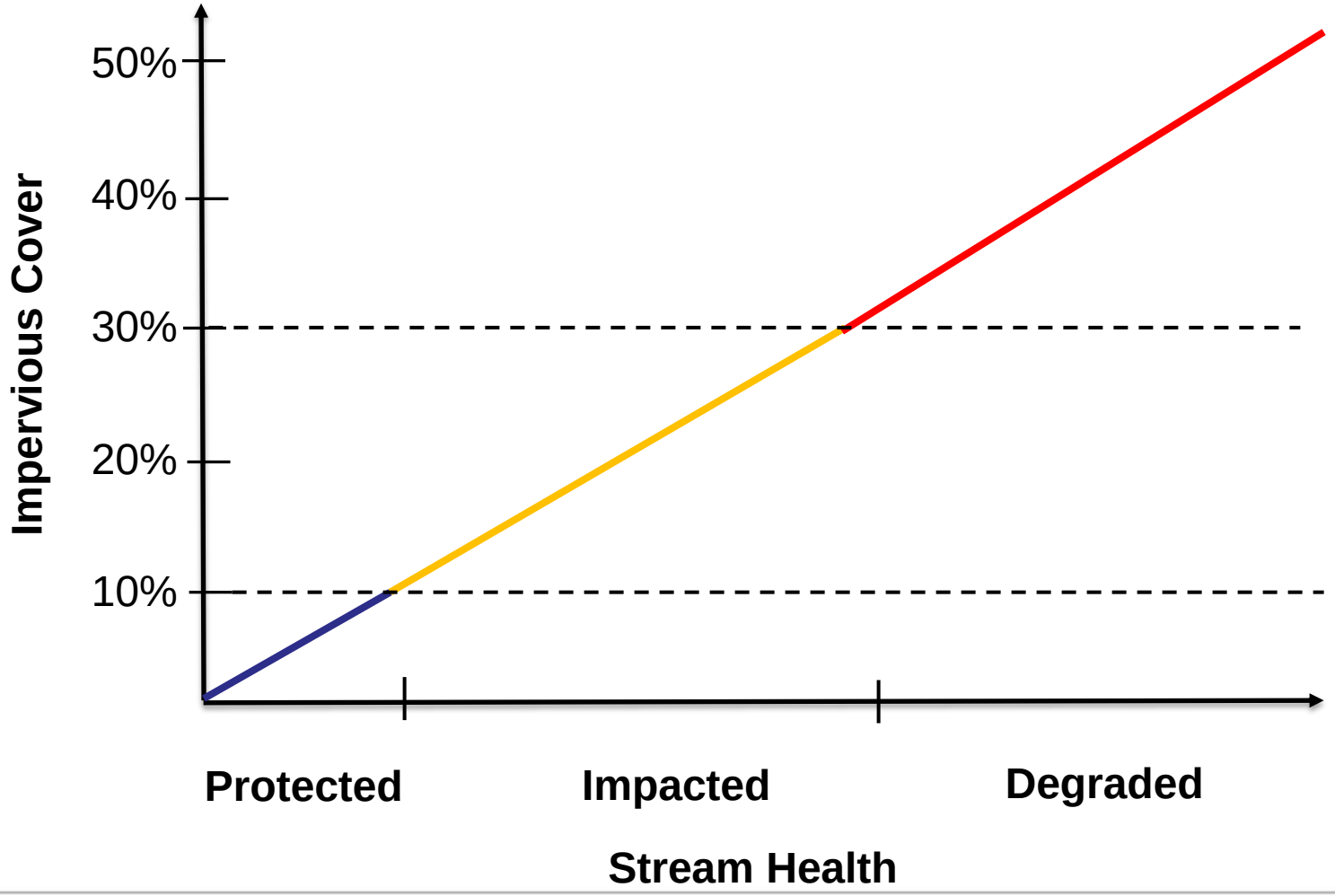
A few things about LID about which we still have more to learn

The Issue of Scale



Site ⟷ **Catchment** ⟷ **Watershed**

Can LID create new relationships?

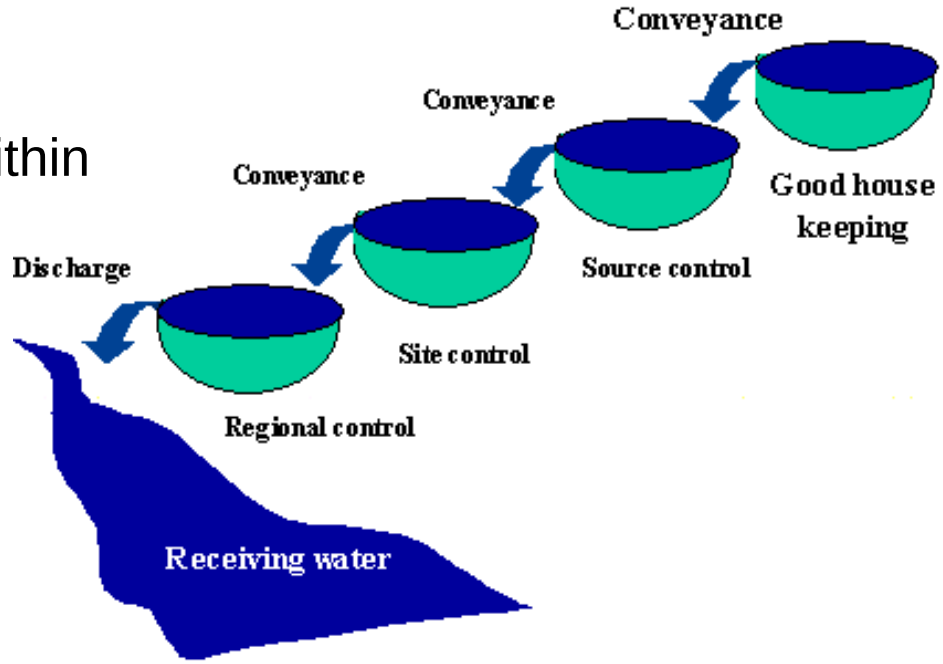


Long Term Operation and Maintenance of LID

- How long will LID facilities last?
- When will they need to be replaced or undergo rehabilitation?
- How will aged systems be restored, and at what cost?
- How can the practices be designed to reduce long term maintenance?
- Can municipalities find a way or the will to enforce maintenance of privately owned LID facilities?
- Demonstrating and evaluating low cost LID maintenance options

Treatment Trains

- Combining practices to maximum effect
- Coupling LID with dry ponds for stormwater control
- Tools for predicting outcomes within different contexts



Source: UNEP

Groundwater Impacts

- Finding the right balance between the protection of groundwater and receiving water systems
- Addressing road salt impacts

In Sum

- We know a great deal about LID
- More information needed on:
  - effect of scale and linkages to receiving waters
  - full cycle of protection measures from development design to land stripping to construction to long term O&M
  - how the different treatment measures function together as a unit to protect the environment
  - host of other specific BMP design questions

Green Infrastructure Resources

- Low Impact Development Stormwater Management **Planning and Design** Guide
- Guides on LID **Inspection and Maintenance** (coming soon) & **Soil Management**
- Greening your Grounds: A **Homeowners Guide** to Stormwater Landscaping
- LID Life Cycle **Costing Tool**
- Technical briefs, case studies, research, fact sheets, training and more at:

www.sustainabletechnologies.ca

Thank You

Tim Van Seters
Phone: 289-268-3902
Email: tvanseters@trca.on.ca

STEP website:
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Toronto and Region Conservation for The Living City

STEP Sustainable Technologies Evaluation Program