SOURCE TO STREAM 2023 Conference

Canada's Premier Stormwater and Erosion and Sediment Control Conference

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WATER CANADA

HOSTS

Presented by:

Toronto and Region Conservation Authority

In association with:

Lake Simcoe Region conservation authority

Credit Valley Conservation – inspired by nature

Livin' LID: the lessons learned

Brett H. Emmons
Karli McCawley
Emmons & Olivier Resources Canada

Introductions

watersheds and water resources

ecosystem restoration

civil engineering & landscape arch.

Agenda

History

- The evolution of Low Impact Development (LID)

The early days

- Learning from our mistakes

What goes into a good design

- Getting everyone on the same page

Building it

- Passing on what we know through the construction process

Operation and Maintenance

- What we need to pay attention to once it's built

Putting it all together

- Effective Policy and Guidance

History: the solution to pollution is dilution

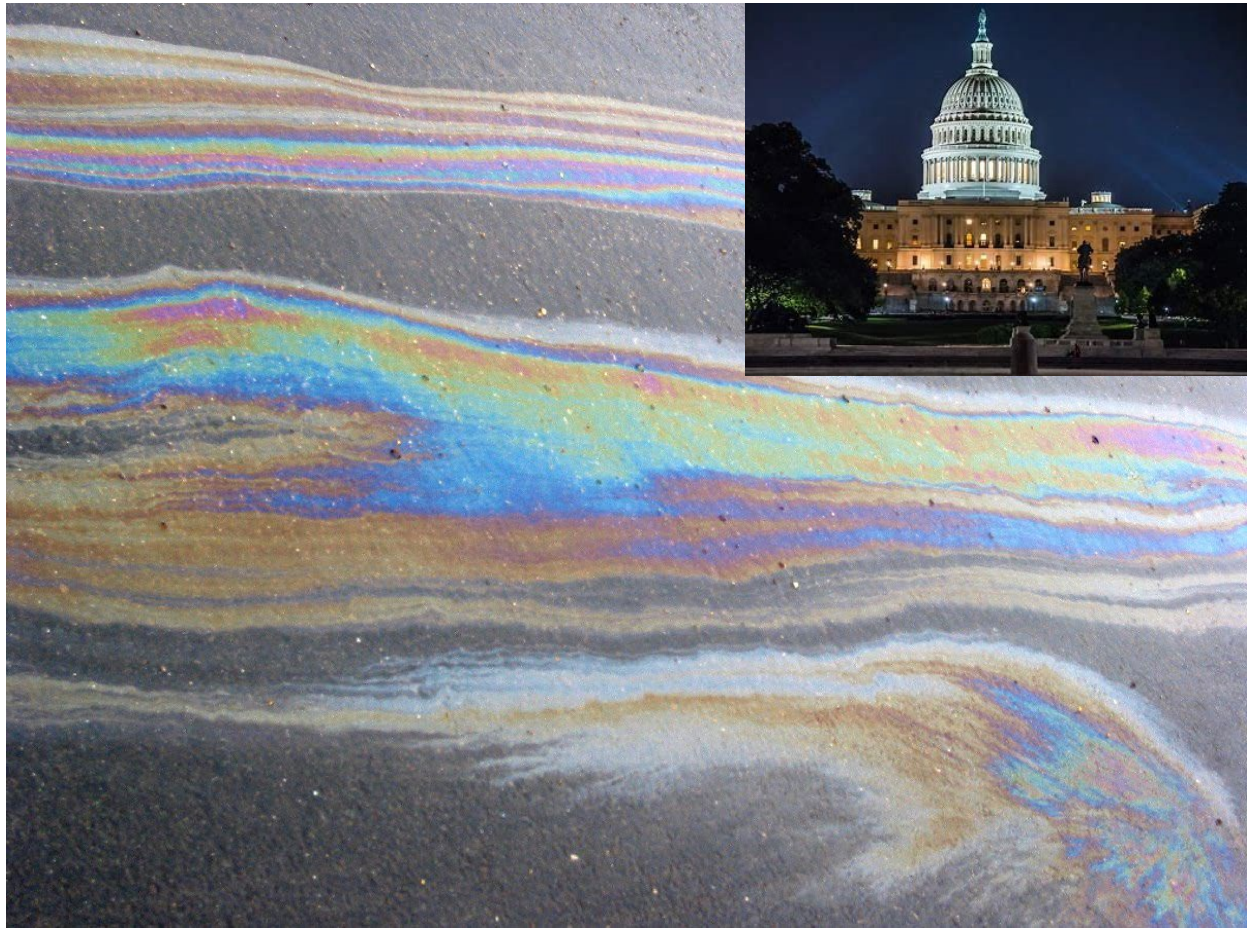
1970's

- Cuyahoga River at Lake Erie is on fire
- Fishing in the Great Lakes is dying a slow death

History: the solution to pollution is dilution

1970's

- Cayuga River at Lake Erie is lighting on fire
- Fishing in the Great Lakes is dying a slow death
- US Congress Enacts the Clean Water Act to make the Waters of the US Fishable and Swimmable
- Act Requires that States set water quality standards and monitor to determine waters are meeting the standards
- **Polluted Runoff is determined the #1 Water Quality Problem in the US by USEPA**

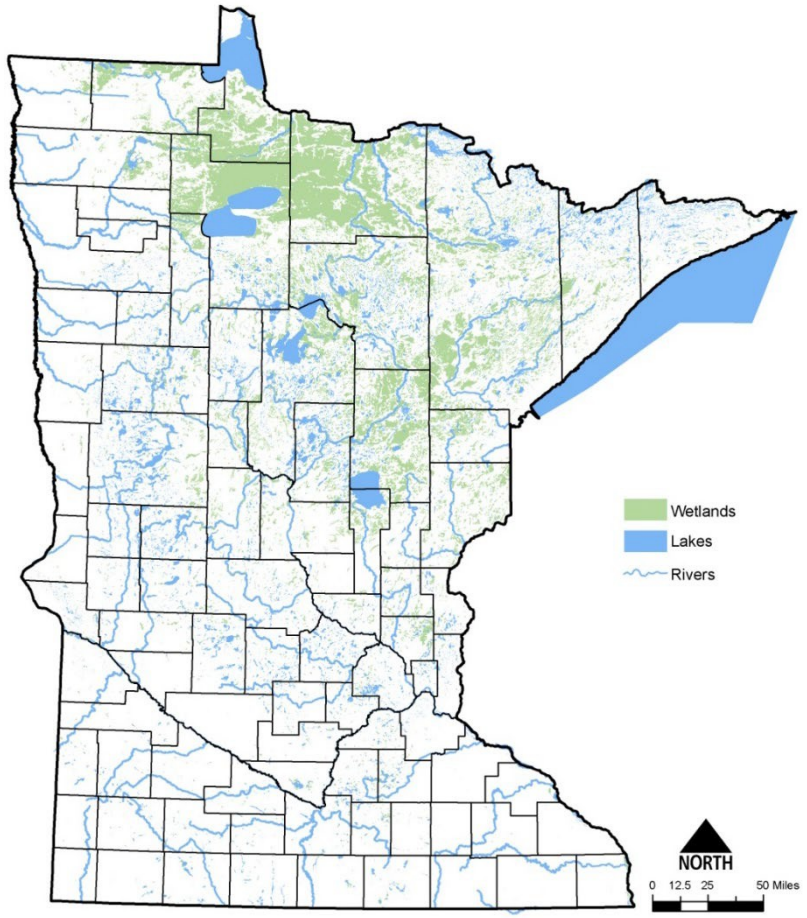


Land of 10,000 Lakes

11,642 lakes > 10 acres

69,200 miles of rivers/streams

9.3 million acres of wetland



Tourism


Boating, fishing, hunting, camping, swimming,
wildlife watching, and more…


$13 Billion


JOBS JOBS JOBS
250,000
JOBS JOBS JOBS

But all is not well…

40% of MN surface waters are impaired

- 2008 Impaired Waters List (303d) → 2,575 impairments
- 2010 Impaired Waters List (303d) → 3,049 impairments
- 2012 Impaired Waters List (303d) → 3,638 impairments
- 2014 Impaired Waters List (303d) → 4,122 impairments
- 2016 Impaired Waters List (303d) → 4,607 impairments
- 2018 Impaired Waters List (303d) → 5,086 impairments
- 2020 Impaired Waters List (303d) → 5,751 impairments
- 2022 Impaired Waters List (303d) → 6,168 impairments

Typical Pre-Development Conditions

background graphic by freepik.com | adapted from EPA

Typical Post-Development Conditions

background graphic by freepik.com | adapted from EPA

Effects of Stormwater Runoff

POLLUTION:

Increased stormwater runoff carries a greater volume of pollutants to our rivers and lakes which contributes to closed lakes and habitat degradation.

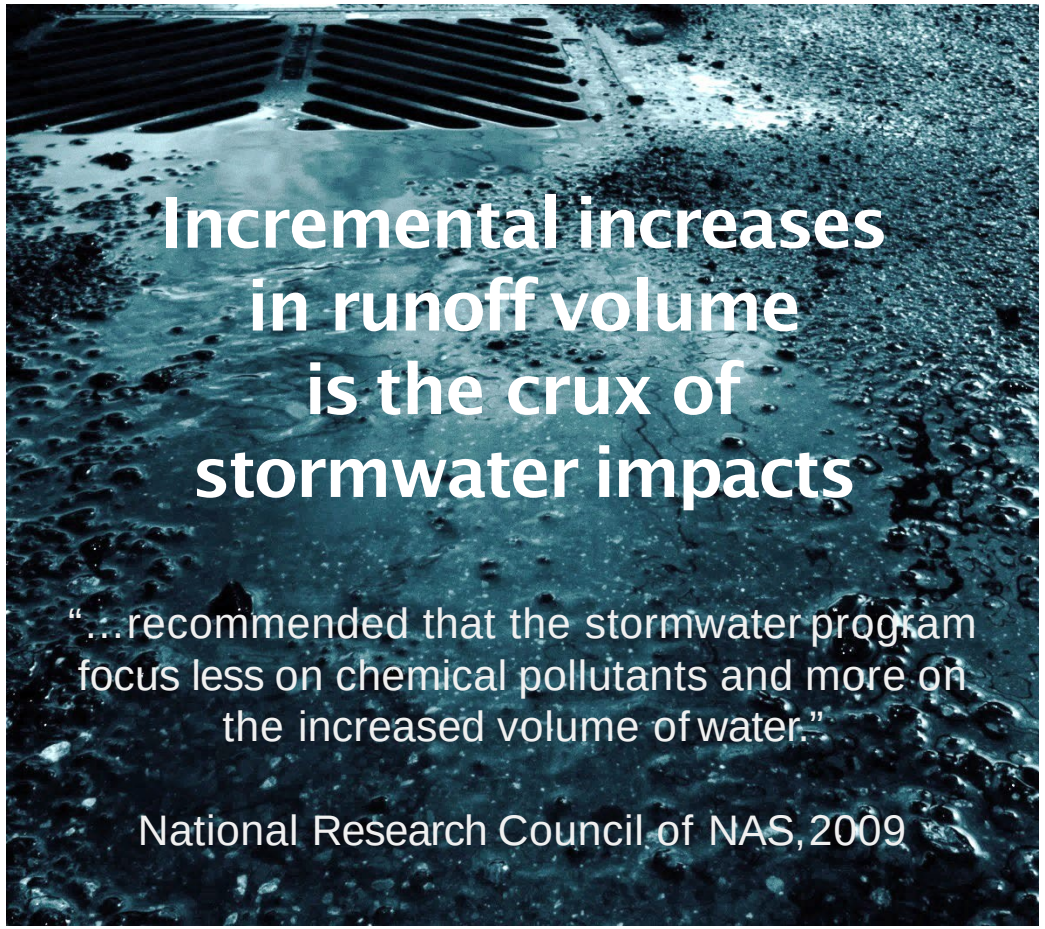
EROSION:

Increased stormwater runoff can accelerate streambank erosion and road washouts.

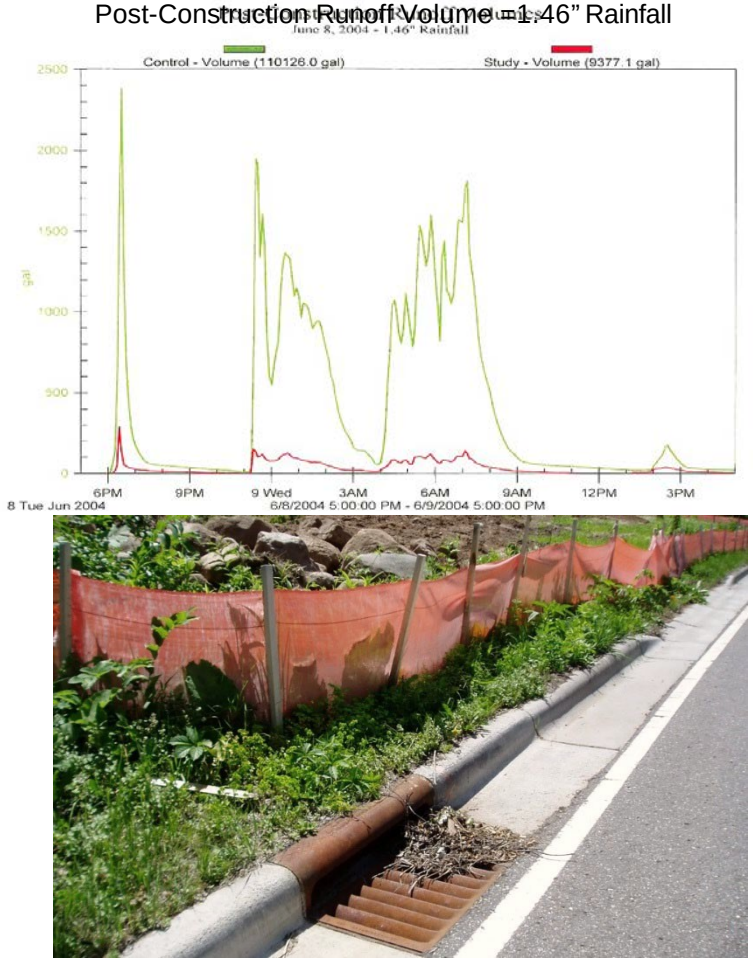
FLOODING:

Excessive stormwater runoff can lead to the flooding of infrastructure.

Stormwater: *Runoff Volume* has Emerged as "The Issue"



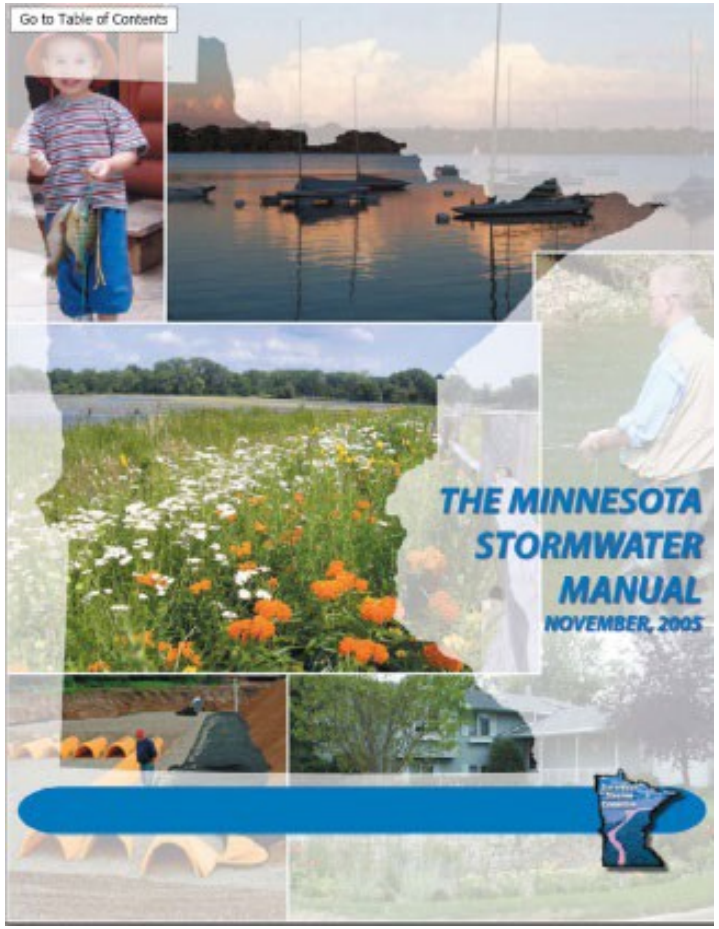
Post-Construction Runoff Volume – 1.46" Rainfall



A PARADIGM SHIFT

First LID addressed **water quality**, primarily through small event volume control, first flush.

Volume control is being extended to stream stability, flood control, & thermal impact reduction.

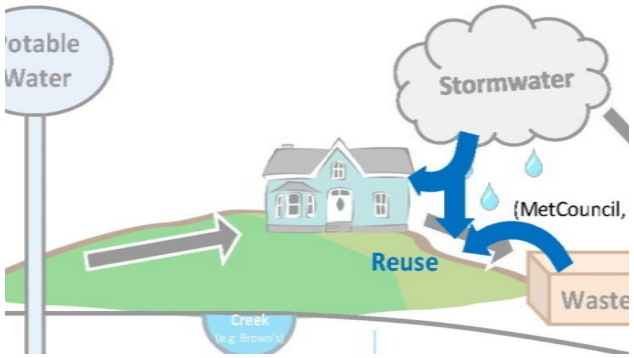


Stormwater Management

Conveyance

Infiltration

Filtration



Harvest & Use/Reuse (ET)

History: LID: The Very Beginning

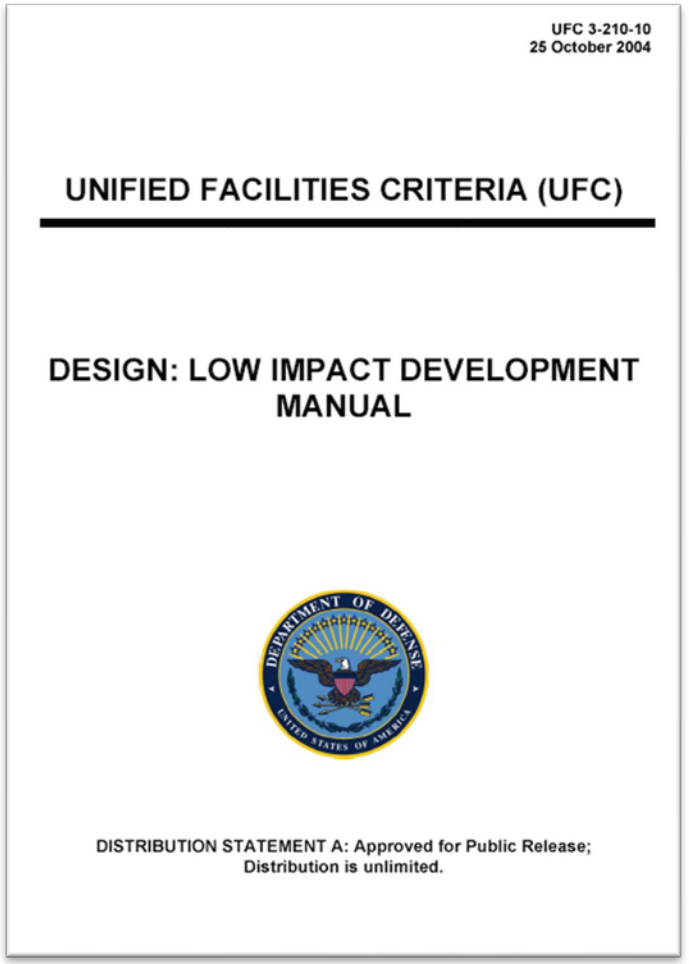
Prince George's County, Maryland

The Founding Fathers:

- Tom Schueler – Center for Watershed Protection, Chesapeake Stormwater Network
- Neil Weinstein – Center for Low Impact Development
- Larry Coffman – Prince George's County, Maryland

Goal: Save Chesapeake Bay

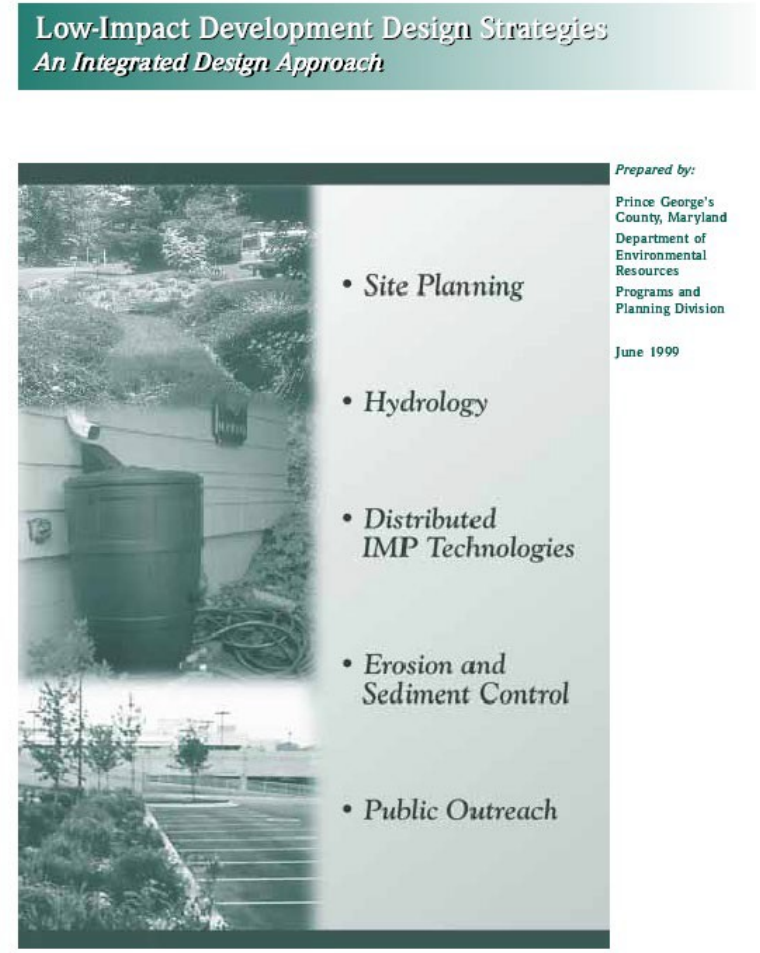
They wrote the book…literally


UFC 3-210-10
25 October 2004

UNIFIED FACILITIES CRITERIA (UFC)

DESIGN: LOW IMPACT DEVELOPMENT MANUAL

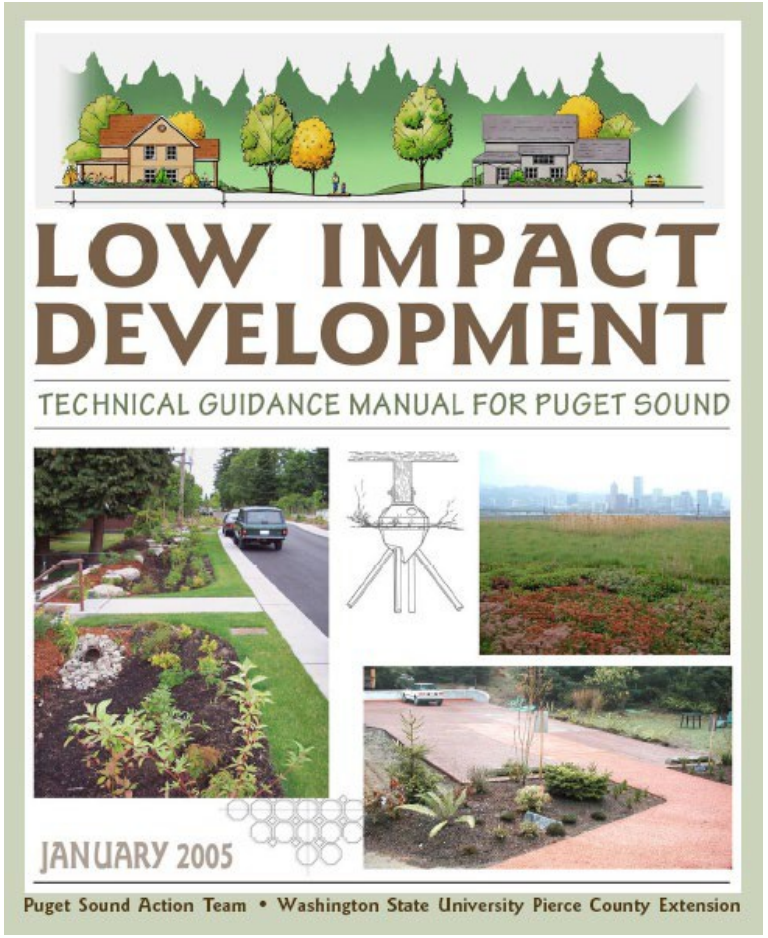
DISTRIBUTION STATEMENT A: Approved for Public Release; Distribution is unlimited.


Low-Impact Development Design Strategies
An Integrated Design Approach

- *Site Planning*
- *Hydrology*
- *Distributed IMP Technologies*
- *Erosion and Sediment Control*
- *Public Outreach*

Prepared by:
Prince George's County, Maryland
Department of Environmental Resources
Programs and Planning Division

June 1999


LOW IMPACT DEVELOPMENT

TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND

JANUARY 2005

Puget Sound Action Team • Washington State University Pierce County Extension

History: The Minnesota Story

1998

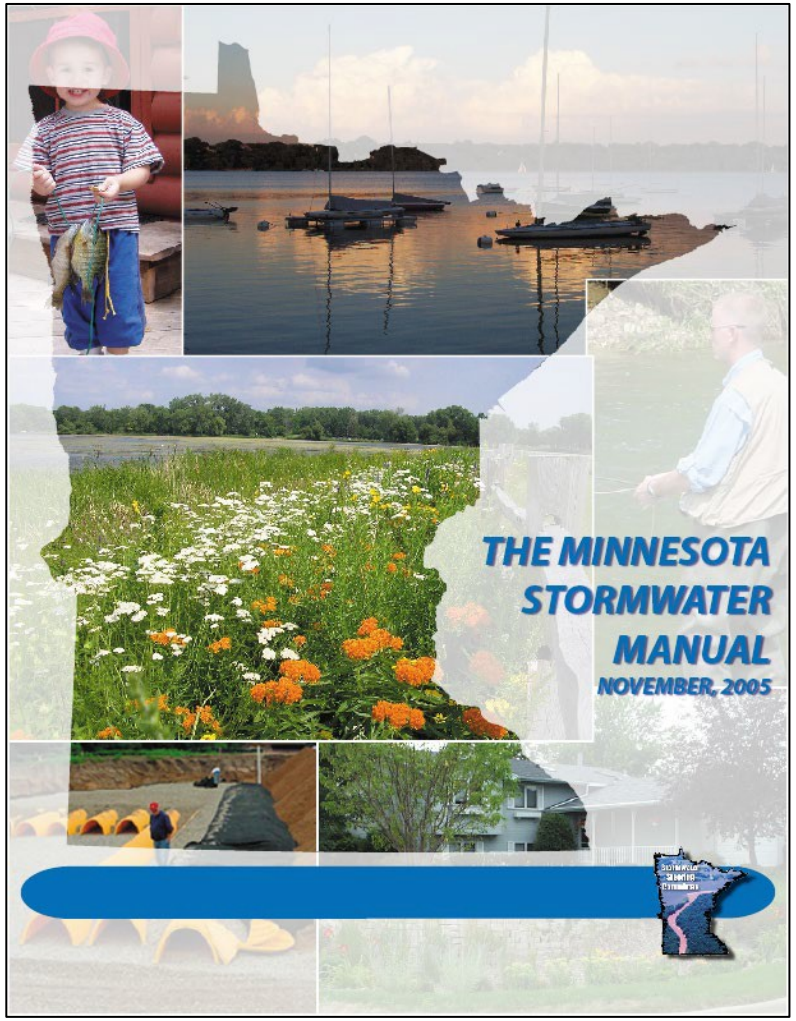
- Minnesota becomes **1st State in US to implement LID** through NPDES Construction Permit Requirements

2005

- EOR Authors the **Minnesota Stormwater Manual** in partnership with Tom Schueler and the Center for Watershed Protection. The first **"cold climate"** manual; deemed by USEPA to be the best stormwater manual in the county.
- **Continual Updates (On-line)** - $350K/yr budget

2012

- Minnesota's Minimal Impact Design Standards (MIDS) and EOR authors Community Assistance Guidance
- **Cities & Watershed Districts** often **exceed** MIDS
- Becomes the backbone of **LSRCA Phosphorous Offset** Program and current **MOECC Stormwater Policy**




CHANGE
IS GOOD
you go first!

And off we go….

- Soils/Geology
- Compaction
- Soil Media Mix
- Bedrock?
- Contamination
- “Mining” site’s sand

And off we go….

Paradigm shift…

- Short circuiting
- Not all mulch is same
- Inlet sloping/tipping
- Curb cut blocked
- Inlet erosion
- Sump Maintenance

Why do LID Projects Fail?

Design & Siting

Installation

Operation and Maintenance

October 18, 2007

April 15, 2008

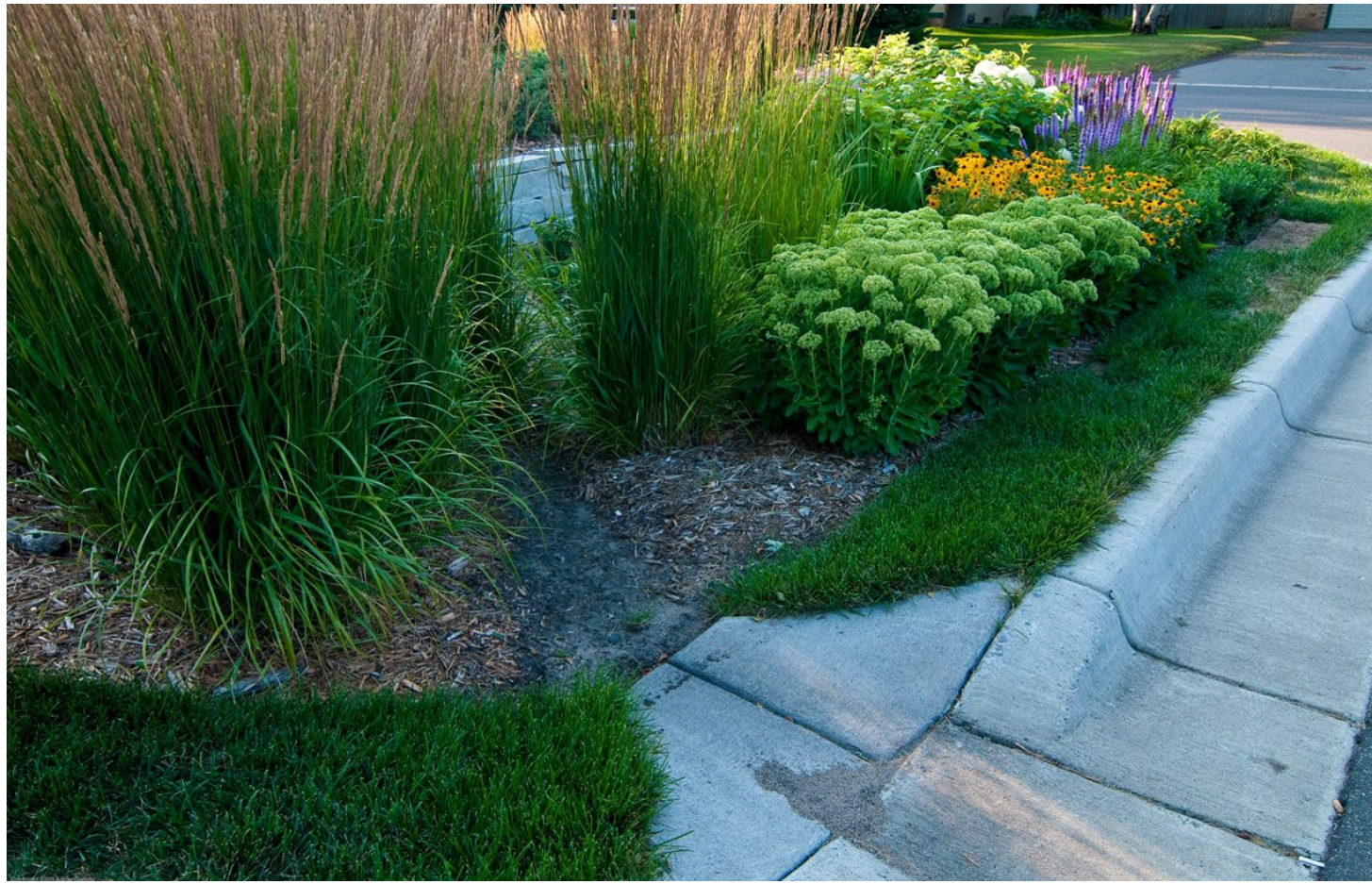
June 8, 2008

Bioretention Design: Off Line Design

Bioretention Design: Off-Line Design

Off-Line Design decreases:

- Soil Scour
- Mulch Displacement
- Plant Damage
- And invasive weed establishment



Pretreatment Strategies The Early Days

Gravel diaphragms

Stone splash pads

Pretreatment Strategies Vegetation

Turf strip pretreatment

Pretreatment Strategies Proprietary Devices

Underground storage and pretreatment

Oil and Grit Separator

Pretreatment Chambers

Pretreatment Strategies Nonproprietary Devices

Erosion and Sediment Control

- ESC Control is critical to the success of the project throughout the life of the project
- **Phasing** - Do not excavate the final three feet (one m) to subgrade until the entire site is stabilized
- Plan should be a living document that is updated and reviewed by all contractors and subcontractors before construction begins and at weekly project meetings

LID Construction Guide

Acknowledgements/Team:

- Credit Valley Conservation Authority
- CVC Steering Committee
- Emmons & Olivier Resources, Inc.
- Sabourin Kimble & Associates, LTD

Installation

- Experienced Contractors are at a premium
- Most projects require pre-bid qualification & bonding
- Designer, contractor, reviewer and inspector education and certification programs are critical
- Communication is critical

Materials

Bioretention soil media, or filter and/or soil media, is an engineered soil mixture that provides:

- Storage for runoff
- Allows runoff to be infiltrated
- Allows runoff to be filtered to an underlying draintile system
- Is a growth medium for vegetation
- Allows chemical and biological processes to occur to help remove pollutants and nutrients

Permanent Vegetation Establishment

- Native plants are preferable over non-natives because they generally require fewer inputs and are adapted to our climate and soils
- Most facilities are designed to draw down within 48 hours so aquatic wetland vegetation is generally not suitable
- A planting plan should include species that **tolerate extremes**
- Most riparian plants do well in bioretention cells

Permanent Vegetation Establishment

Permanent Vegetation Establishment

- Plants or seedlings establish much faster than seed - **seeding is riskier**
- Larger plant sizes (1 gallon pots) are recommended for facilities that will be online immediately after planting
- **Plugs** are more economical, but are more susceptible to inundation, covering by mulch and predation by wildlife
- Many plants used are warm season species that lack interest in spring months –plants should be selected to **bloom across the entire growing season**

Underground Storage

Permeable Pavements

Permeable Pavements

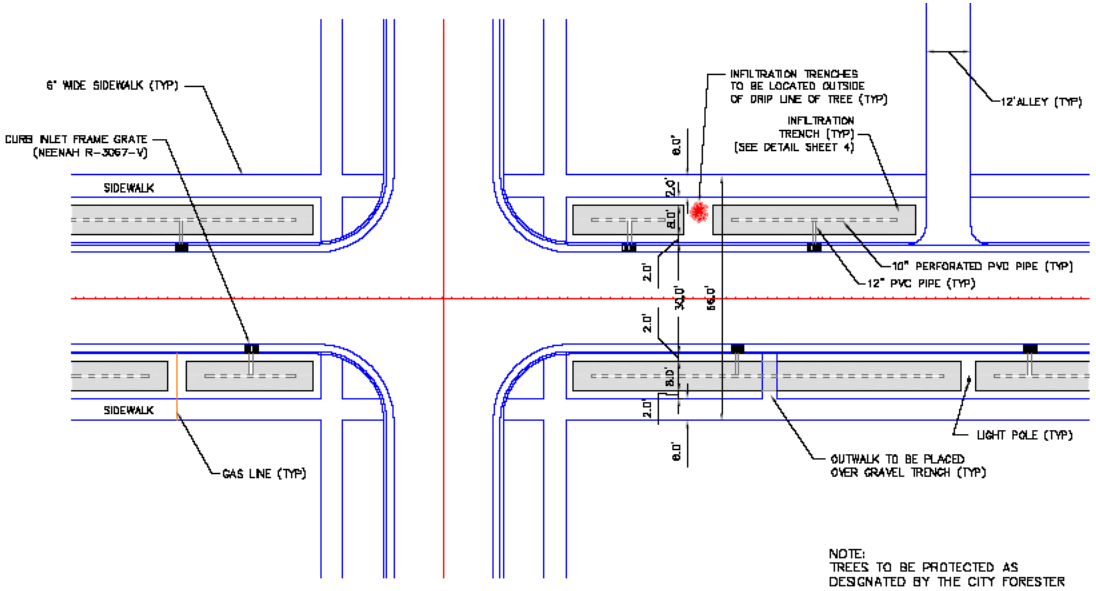
Maintenance of permeable pavements is critical

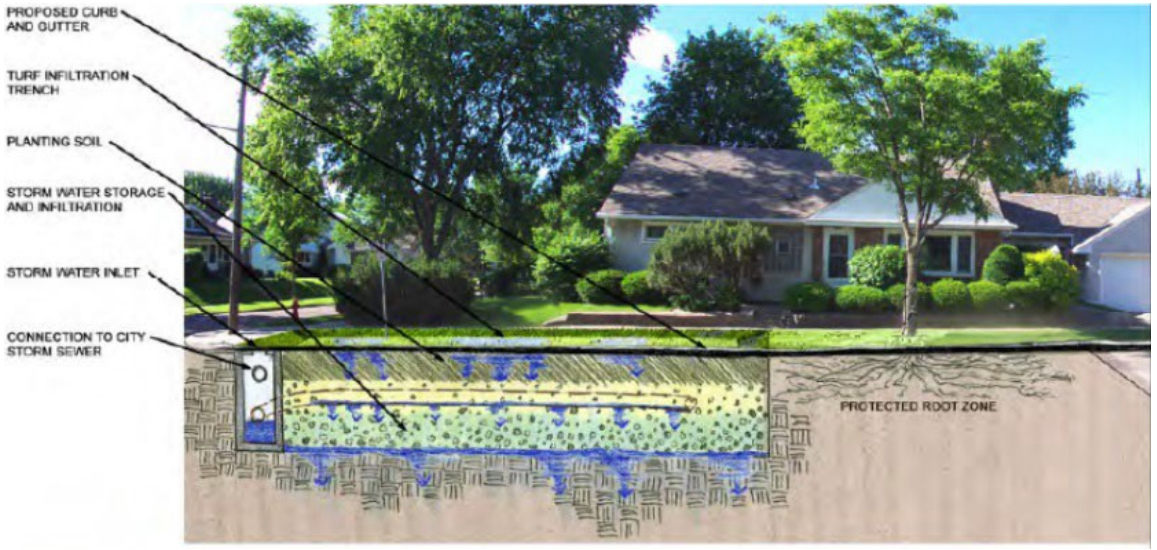
A **maintenance plan** must be developed for every project – many times project specific

Proper maintenance will increase the lifespan of porous surfaces

The Secret ToSuccess

- Proper DESIGN/SITING (soils, *geology*, inlets, sizing, vegetation-hydrology match, etc.) – Choose correct for BMP for that situation.
- Effective PLANS ANDSPECIFICATIONS

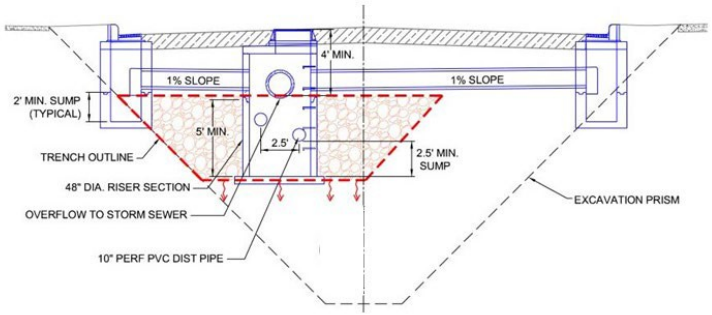




- Originally designed as boulevard trenches, yet limited space for open trench
- Reviewed to underground boulevard location, yet utilities in the way
- An under-the-road (UTR) infiltration trench was the final solution

The Secret ToSuccess

- CONTRACTOR UNDERSTANDING of the technology and importance of following procedures
- Using the right MATERIALS and equipment



Final Design: Under – the - road infiltration trenches

Before

After

The Secret ToSuccess

- TIMELY EROSION AND SEDIMENT CONTROL throughout the life of the project + PHASING
- PRETREATMENT INLETS – Sumps, Easy O&M

The Secret ToSuccess

- Timely inspections and MAINTENANCE
- Local BUY-IN and Involvement
- COMMUNICATION

Secrets to Success – "Big-Picture" Lessons Learned

- LID/GI Capacity is Under Valued/Appreciated
  - Actual Performance often Exceeds Design
  - Higher Standards (>25 mm) are Attainable
  - Reliable >> Cities include LID in infrastructure sizing
- Flood Control Benefits are Real & Often Overlooked
  - Resiliency in a Changing Climate
- Community-Building – Co-Benefits
  - Add Green Amenities & Character to Urban Life
  - Fits Small, Underutilized Spaces
- Cost Effective – Cost Savings

Thank you

visit us at: www.eorinc.com

EOR water ecology community

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