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Living LID: Lessons Learned
Jay Michels, Emmons & Olivier Resources, Inc.
2015 TRIECA Conference
March 25, 2015







**Polluted Runoff is the #1 Water
Quality Problem in the U.S.***

*** USEPA**























1991

**Long
Lake**

Stillwater

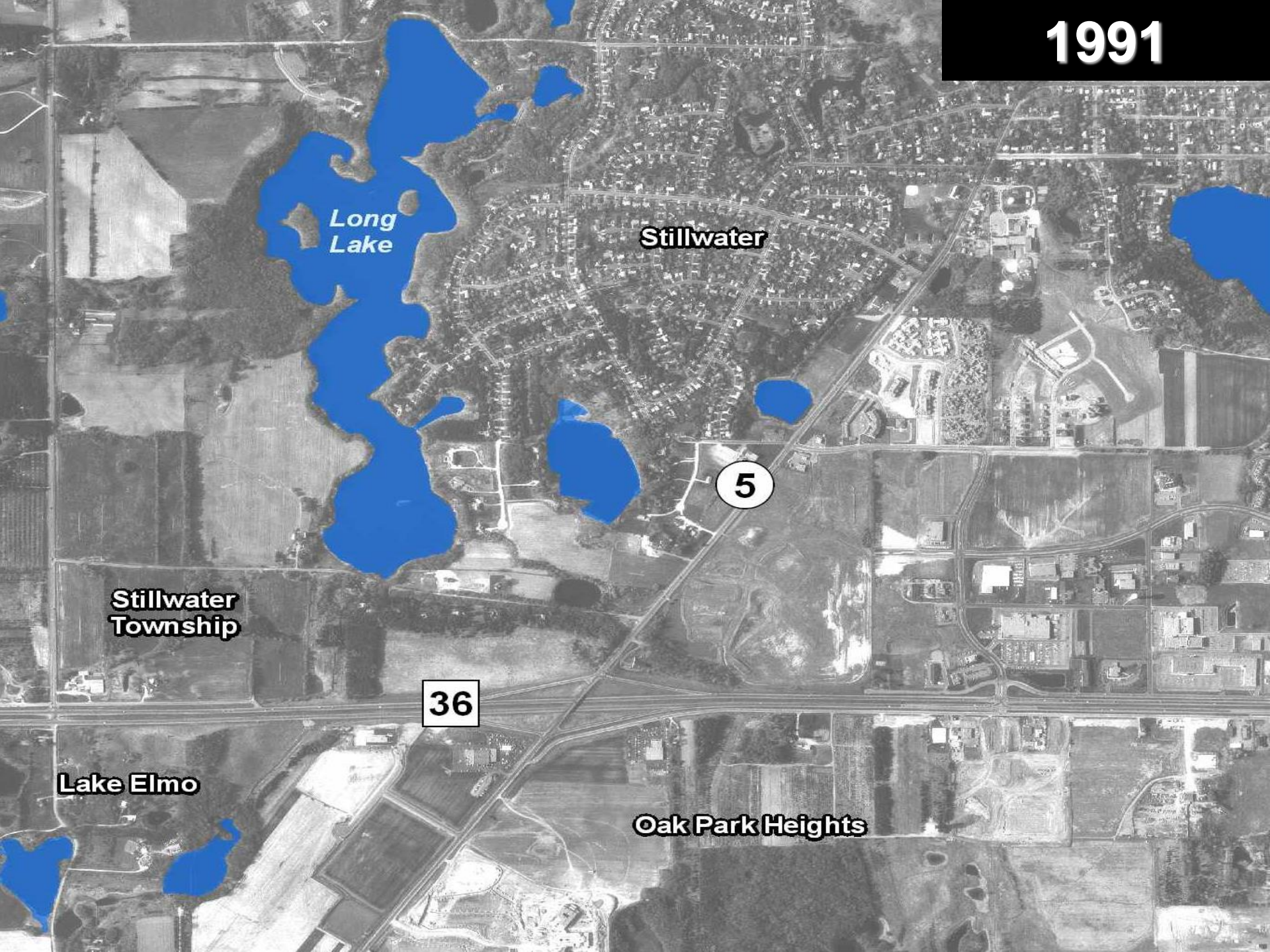
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**Stillwater
Township**

36

Lake Elmo

Oak Park Heights









2005

**Long
Lake**

Stillwater

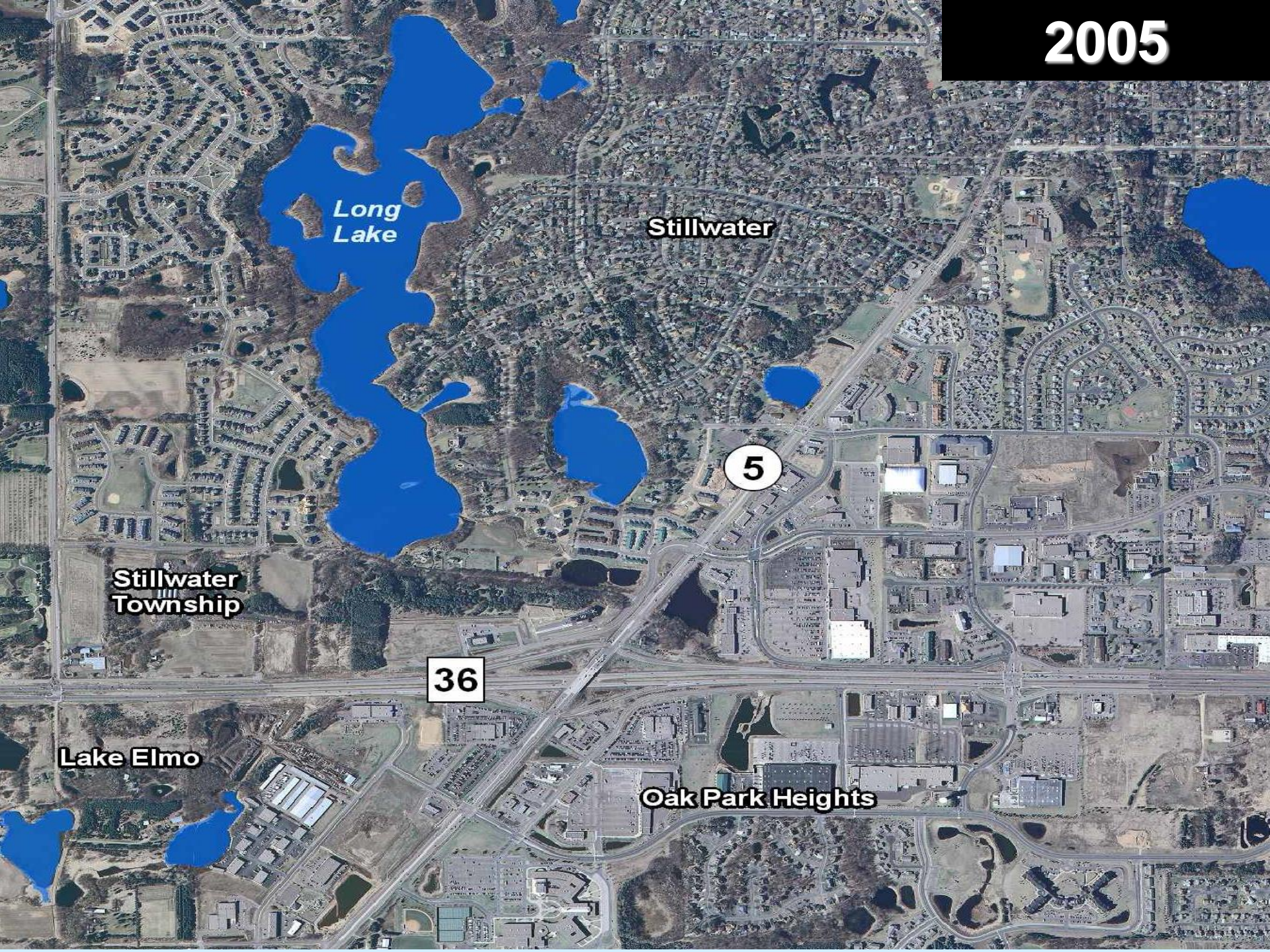
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**Stillwater
Township**

36

Lake Elmo

Oak Park Heights



Overview of Stormwater Management

National Urban Runoff Program

1983



- Technical studies that compiled data about urban runoff
- Resulted in treatment recommendations and easy to apply standards for design and review
- Led to proliferation of ponds





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

MAY 2005

and Action Team • Washington State University Pierce County Extension



LOW IMPACT DEVELOPMENT

TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND





Conventional

**Low
Impact
Development
(LID)**



Nonstructural LID Tools

Planning/ Design

Cluster Development, Conservation Design

Minimize total disturbed area

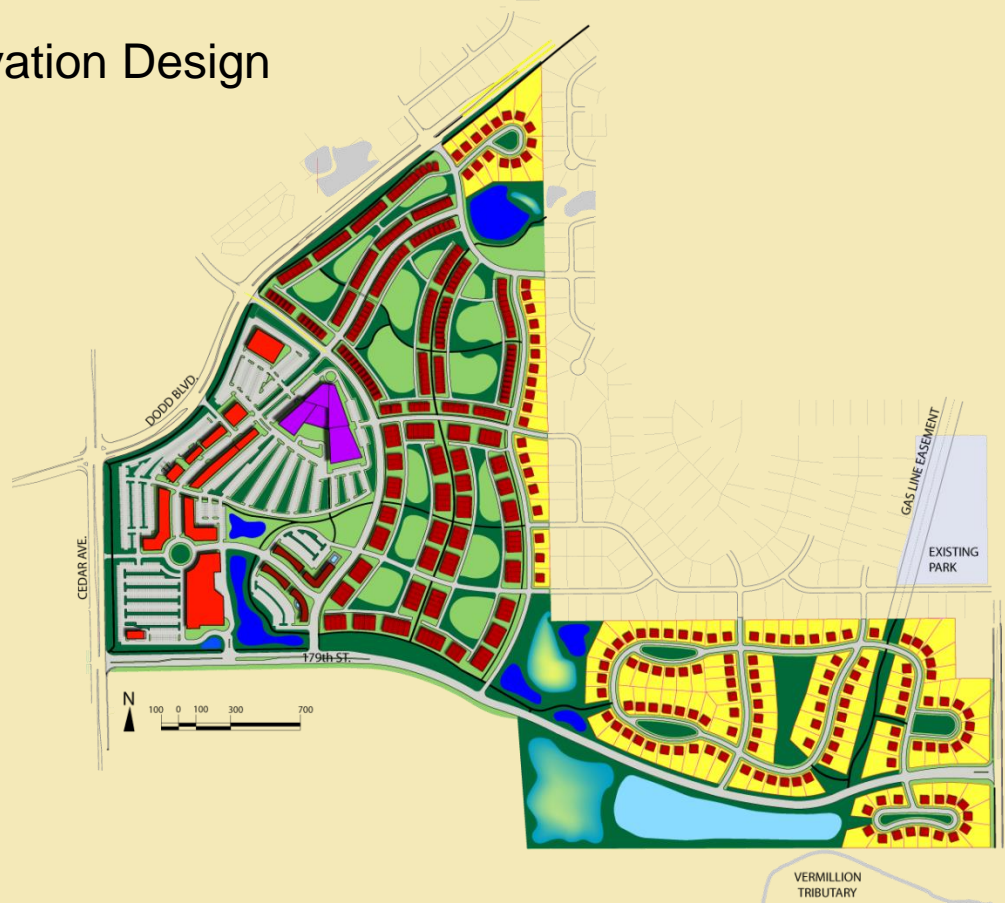
Protect natural flow pathways

Protect riparian buffer areas

Protect sensitive areas

Reduce impervious areas

Impervious disconnection



LID Structural BMPs

Infiltration practices

Bioretention (rain gardens, urban forestry)

Infiltration trenches

Detention basins with infiltration design

Vegetated swales, filter strips, biofiltration

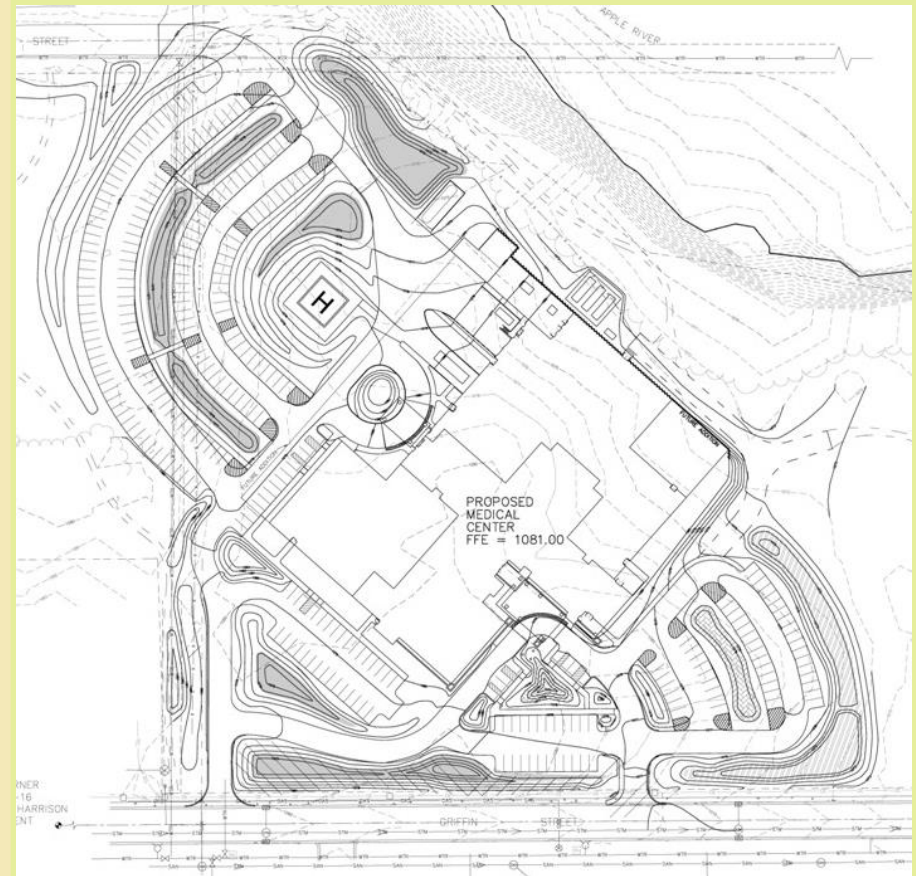
Vegetation: native landscaping, trees (uptake and evapo-transpiration)

Green Roofs

Capture / Reuse (cisterns, rain barrels, ponds)

Permeable hard surfaces (pavers, roads, parking, driveways, sidewalks)

Landscaping Soil Quality: protection or restoration (amendments, de-compaction)



Functional Sustainable Landscape





**THE MINNESOTA
STORMWATER
MANUAL**
NOVEMBER, 2005



**CHANGE
IS GOOD.**

**you go
first!**







LID Construction Guide



CVC/TRCA LID Design Guide

I



APPENDIX B LANDSCAPE DESIGN GUIDE FOR LOW IMPACT DEVELOPMENT

VERSION 1.0

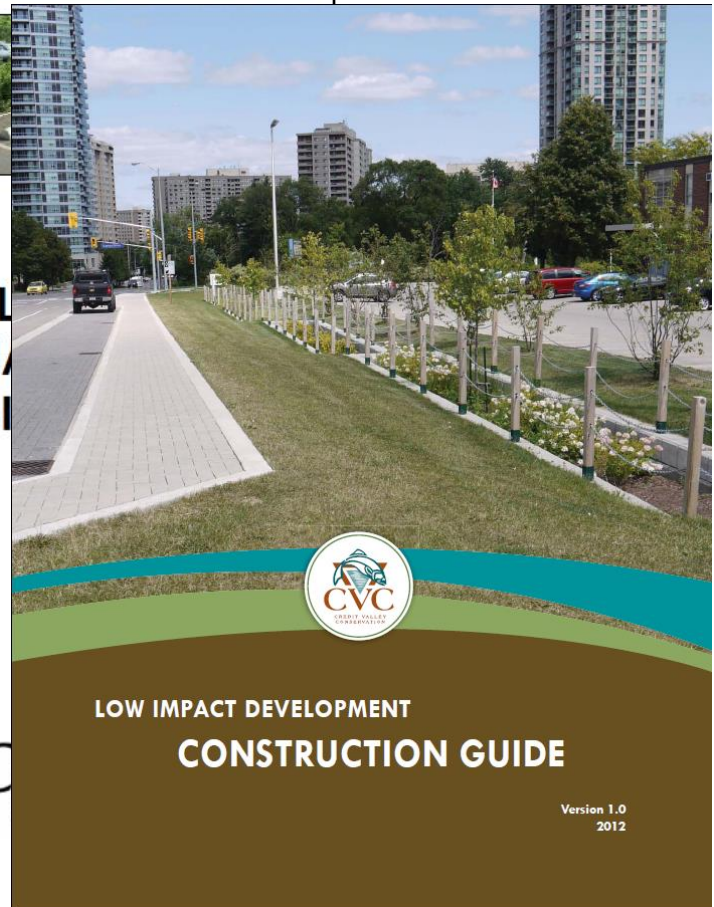
June 2010



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Version 1.0

2010



Why Do LID Project Fail?

- Design
- Installation
- Operation and Maintenance

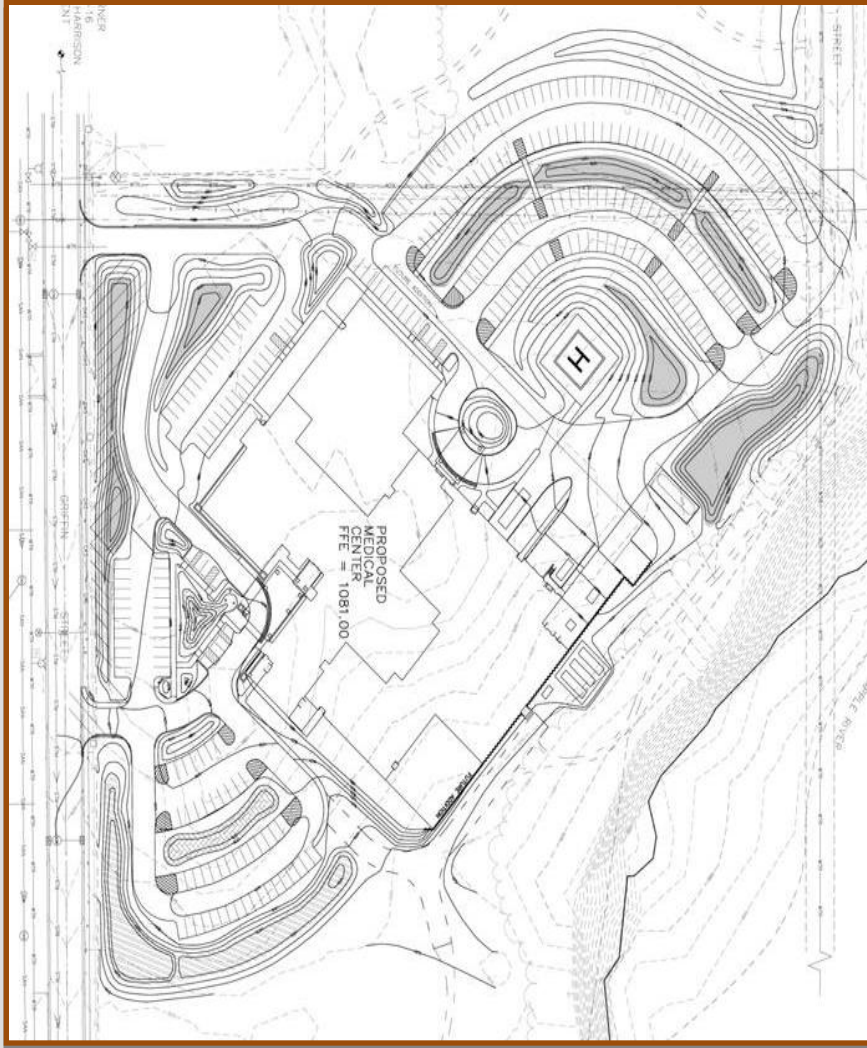


Diverse team:

- Developer/Community Buy In
- Landscape Architects
- Engineering
- Soil Scientists/Geologist
- Erosion & Sediment Control
- Community & Regulatory Agency Involvement/Approval
- Community Buy In/Concept Marketing
- Contractors/Sub Contractors
- Project Management/Implementation
- Maintenance



The Design Process



- Watershed Evaluation
- Site History
- Topographic Information
- Soils Information
- Wetland Delineation – Field Tile Mapping
- Stream & Receiving Waters Protection
- Tree Protection
- Pretreatment strategies
- Inline vs. offline protection during construction

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 – Integrated Infrastructure



Gravel diaphragms



Stone splash pads

Pretreatment Strategies - Vegetation

Turf strip pretreatment

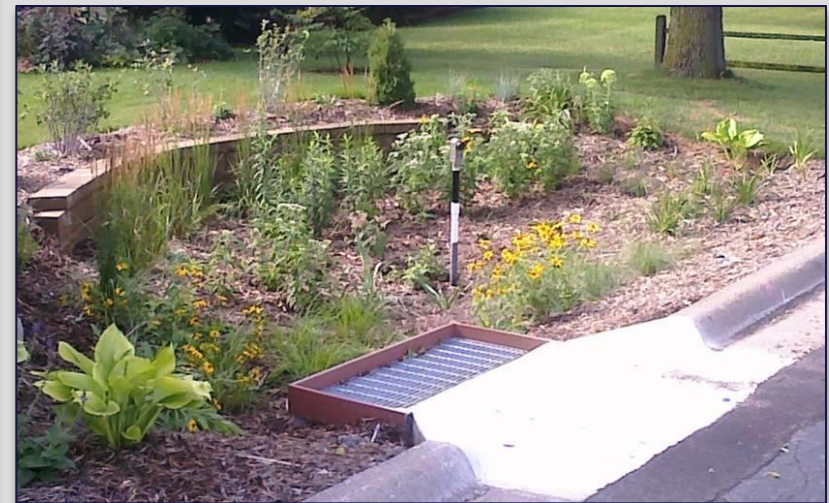


Pretreatment Strategies – Proprietary Devices

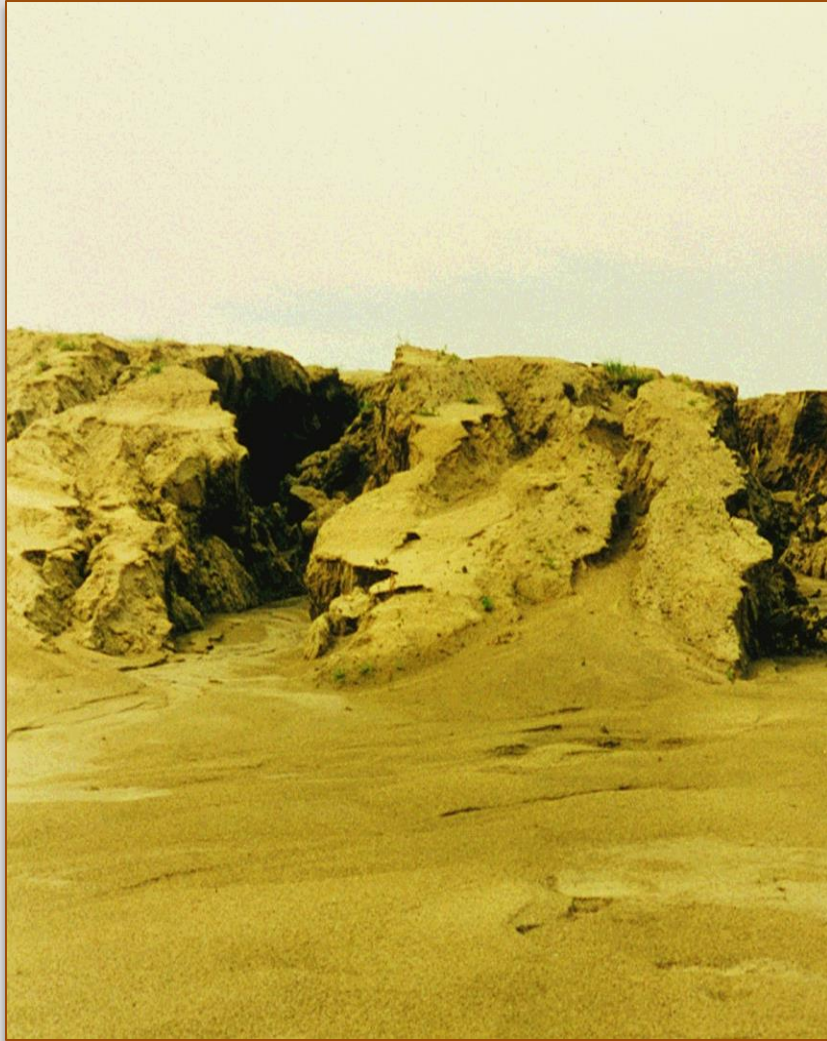
Underground
Storage Pretreatment



Oil and Grit Separator



Pretreatment Chamber



- ESC Control is critical to the success of the project throughout the life of the project
- Plan should be a living document that is reviewed by all contractors and subcontractors before construction begins and at weekly project meetings
- Plan should be updated as necessary



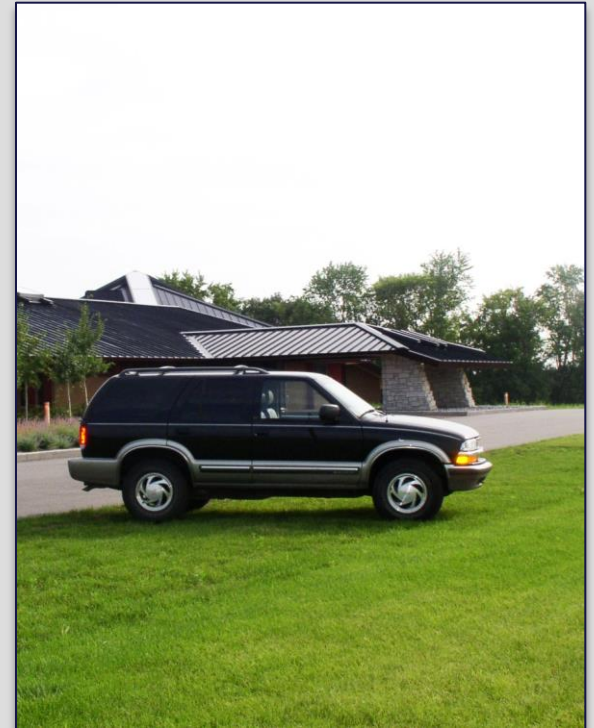
- Experienced Contractors are at a premium
- Most projects require pre-bid qualification & bonding
- Training & Certification programs are being developed



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 drain tile system
- Is a growth medium for vegetation
- Allows chemical and biological processes to occur to help remove pollutants and nutrients

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

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



- Plants or seedlings establish much faster than seed - seeding is generally not recommended
- 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

Maintenance





- Many times maintenance which goes on years after construction is completed becomes a problem
- Separate specifications and contract for installation, establishment and maintenance is beneficial
- Contract generally runs for 3-5 years

The Secret to Success

- ✓ Proper design
- ✓ Effective plans and specifications
- ✓ Contractor understanding of the technology and importance of following procedures
- ✓ Using the right materials and equipment
- ✓ Timely erosion and sediment control throughout the life of the project
- ✓ Timely inspections and maintenance
- ✓ Communication



