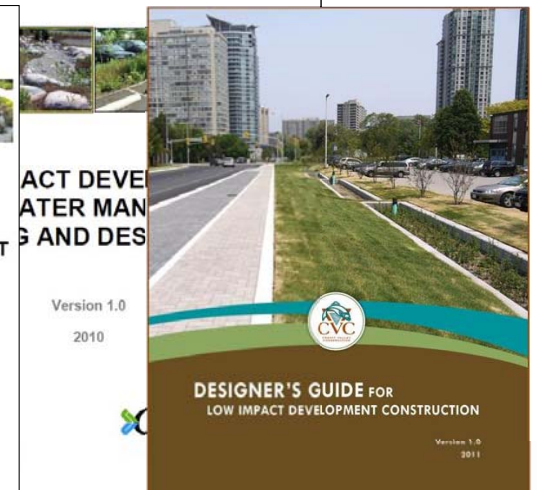
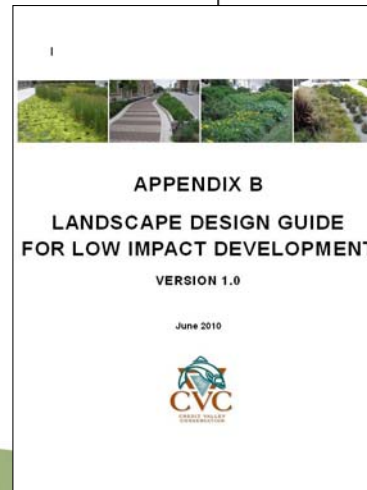


Low Impact Development Construction

Robb Lukes, PE
Credit Valley Conservation



CVC/TRCA LID Design Guide



**Design, Construction, and
Maintenance of LID Practices:
Results from a Field Assessment in
Virginia's James River Watershed**

Center for Watershed Protection 2008 Study



Why do LID Projects Fail?

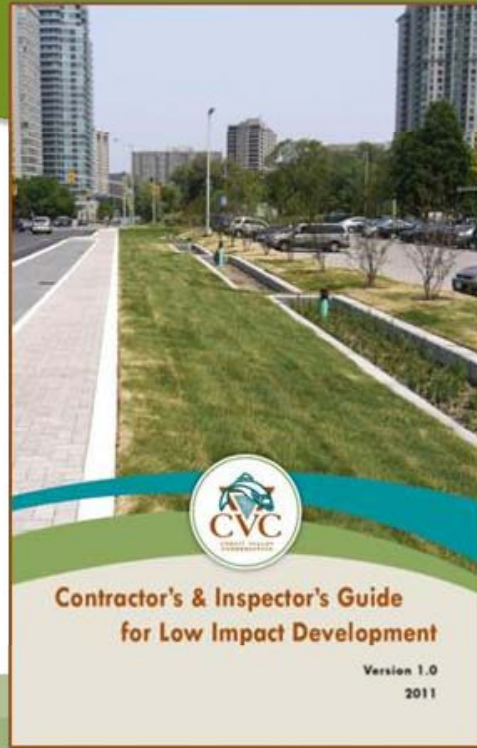
- Plans without enough detail and instruction
- Designers who do not understand the complexities of construction
- Contractors who do not understand the technology or importance of certain procedures
- Lack of effective erosion and sediment control during construction



LID Construction Guide



EOC water
ecology
community



**Contractor's & Inspector's Guide
for Low Impact Development**

Version 1.0
2011

Don't Do what Donny Don't Does



LID Construction Guide Chapters

- Siting & Verification of Design
- Tendering & Ownership
- Clearing & Grubbing
- Perimeter Control
- Mass Grading
- Utility Installation
- Buildings
- Finish Grading
- Materials
- Permeable Pavement
- Permanent Vegetation Establishment
- Overwintering
- Certification
- Avoiding Common Mistakes



Site Verification: geotech!



Site Verification: geotech!



Site Verification: geotech!

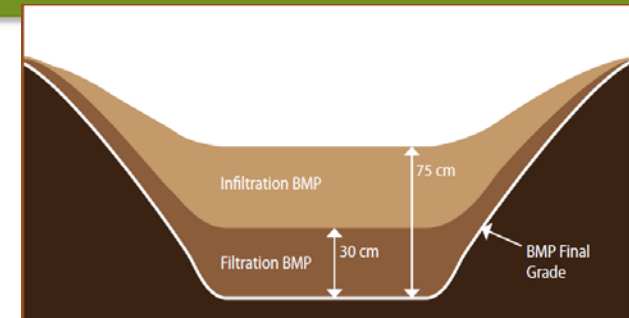


Site Verification: geotech

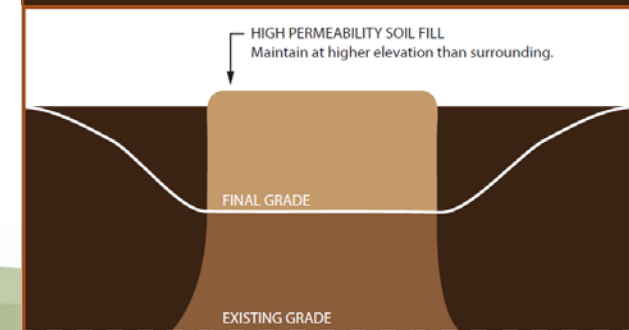
DEPTH IN FEET	SURFACE ELEVATION: 904.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN	FIELD & LABORATORY TESTS
							WC DEN LL PL 14-#200
	4.25" Bituminous pavement	FILL		F	SU		
1	5" Base aggregate-gravelly silty sand, tan		33	F/M	SS	13	
2	FILL, mixture of silty sand and clayey sand, a little gravel, brown						
3	FILL, poorly graded gravel with silt and sand, apparent cobbles and boulders, light brown		51	M	SS	7	
4							
5			25	M	SS	8	5.7
6							
7	GRAVELLY SILTY SAND, fine to coarse grained, apparent cobbles and boulders, brown, moist, medium dense (SM) (possible fill)	COARSE ALLUVIUM OR FILL	25	M	SS	0	
8							
9							
10	SAND WITH SILT AND GRAVEL, fine to coarse grained, apparent cobbles and boulders, light brown, moist, dense (SP-SM)	COARSE ALLUVIUM	45	M	SS	4	
11							
12	SAND, fine to medium grained, a little gravel, light brown, moist, medium dense, apparent cobbles and boulders (SP)		15	M	SS	7	
13							
14							
15	SAND WITH SILT, fine to coarse grained, a little gravel, brown, moist, medium dense, apparent cobbles and boulders (SP-SM)		17	M	SS	5	
16	END OF BORING						

Mass Grading: Cut & Fill

Infiltration
grading for
cut areas



Infiltration
grading for
fill areas



Grading: Scarification



Rip underlying soils 30 cm to 50 cm deep to avoid soil stratification.

Grading: Avoiding Compaction

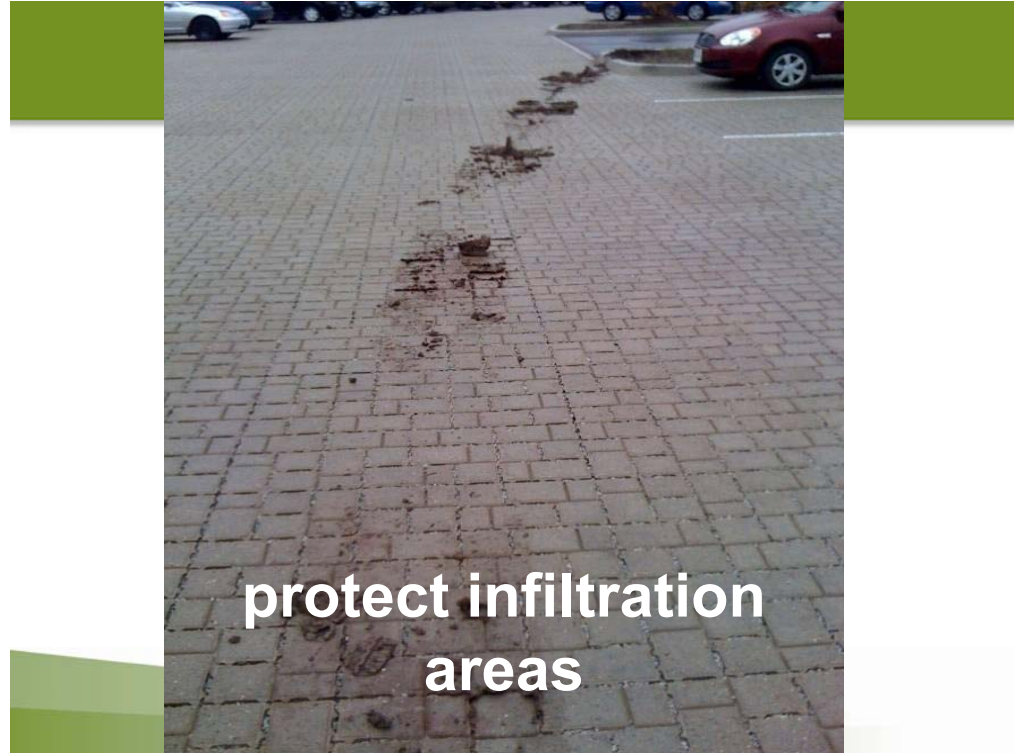


Locate Utilities - Excavation Limits Marked

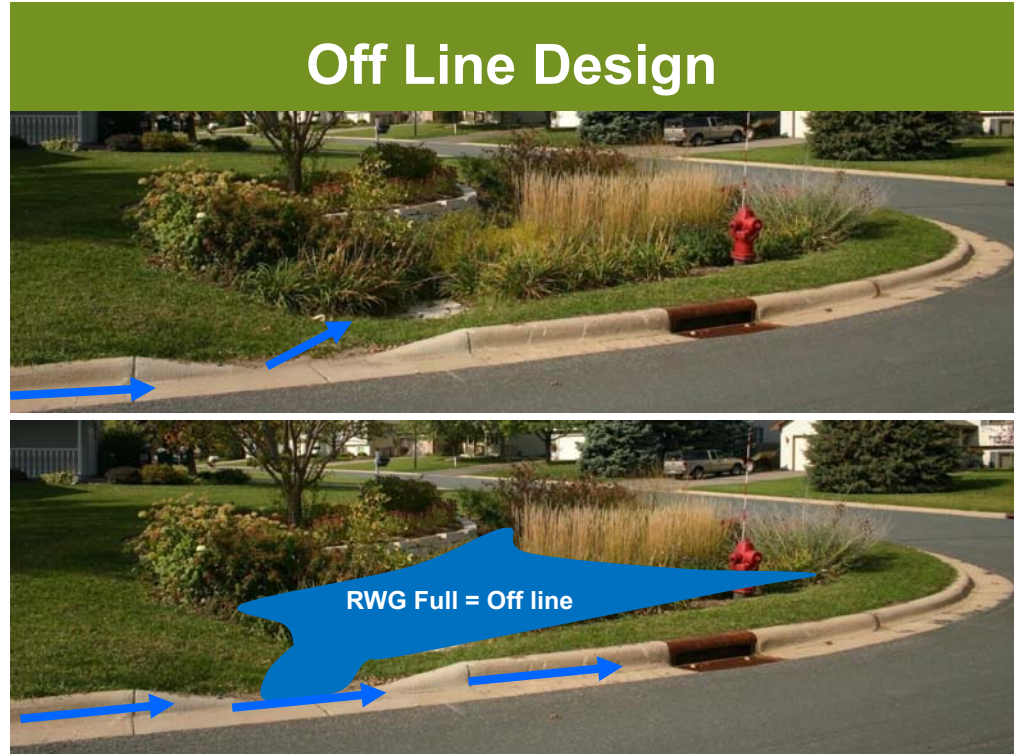


Utilities: avoiding surprises









Off Line Design

Off Line Design Decreases:

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



Off Line Design

Easy Stormwater Bypass During Construction



Inlets and Pre-treatment



Inlets and Pre-treatment

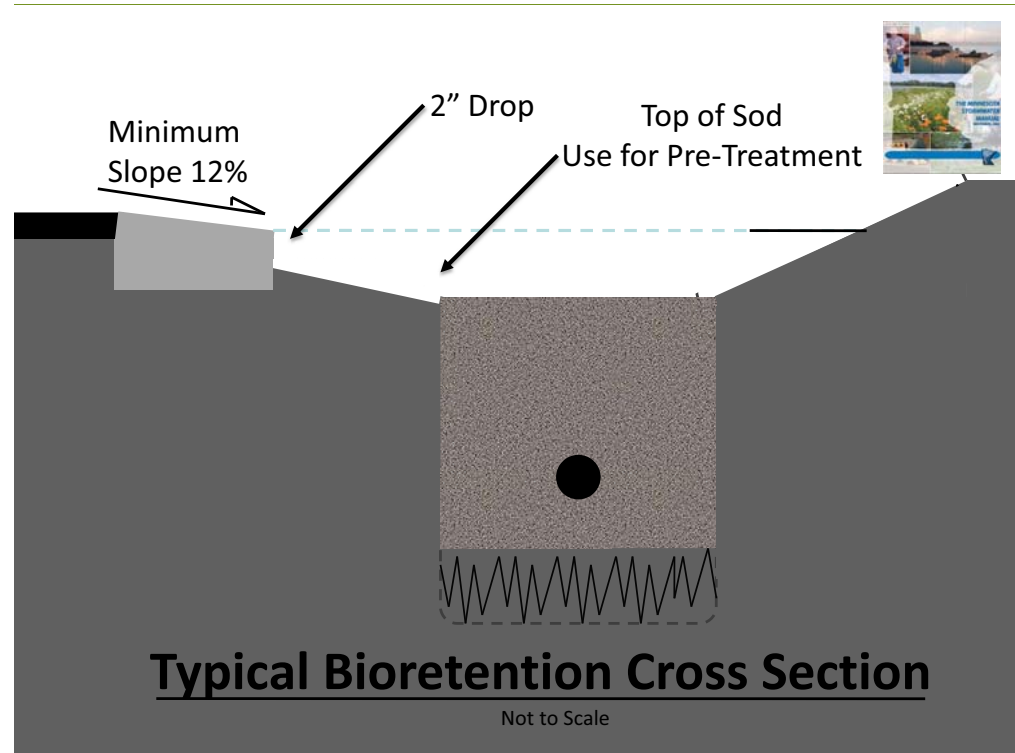


Inlets and Pre-treatment



Inlets and Pre-treatment

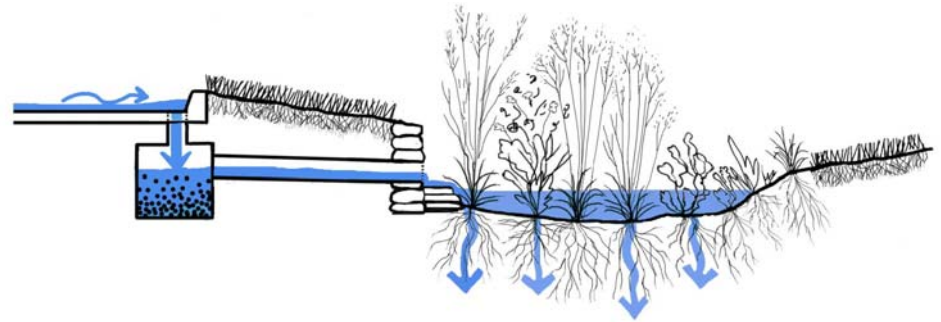




Inlets and Pre-treatment



Inlets and Pre-treatment



Outlet Elevations



Materials: soils, soils, soils



Materials: soils, soils, soils



Materials: soils, soils, soils



Materials: communicating the specification



Materials: Geotextile





**The right
geotextile for
the right
place**



Materials: Mulch

Mulch (when required)

Shredded Hardwood Mulch
(fibrous stands will mat together)



Why is Vegetation Important to LID?

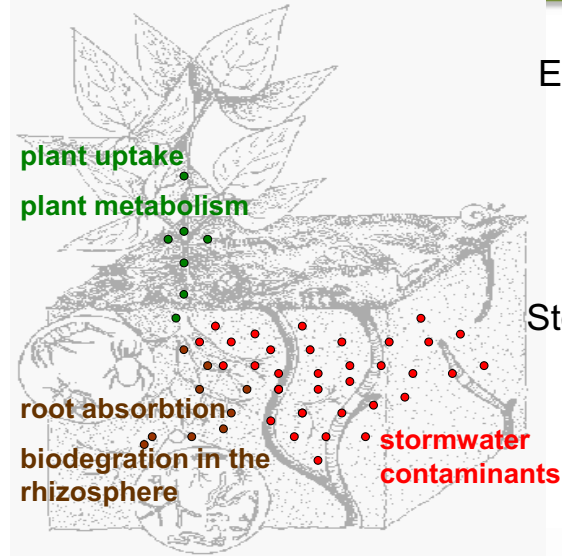
Function



Public
Acceptance

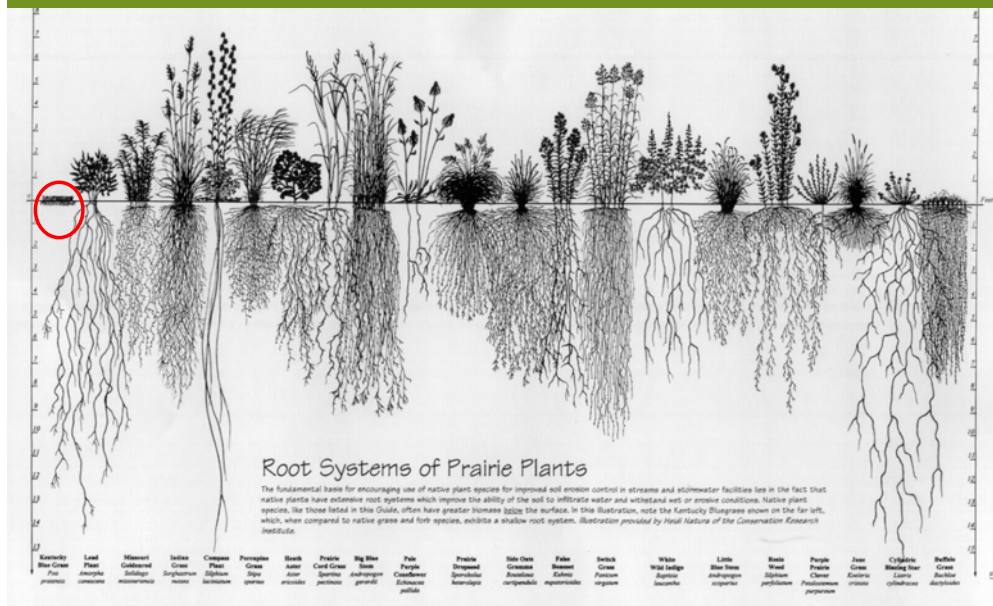


Pollutant Removal Mechanisms



- Chemical
 - Electrostatic / ion exchange within Humic / clays / silts
- Biological
 - Phytoremediation
 - Bioremediation
 - Storing and cycling nutrients
- Physical
 - Sedimentation
 - Filtration
 - Adsorption
 - Precipitation

Native vs. Non-Native



Vegetation

Evaluation of Turf-Grass and Prairie-Vegetated Rain Gardens in a Clay and Sand Soil: Madison, Wisconsin, Years 2004–08



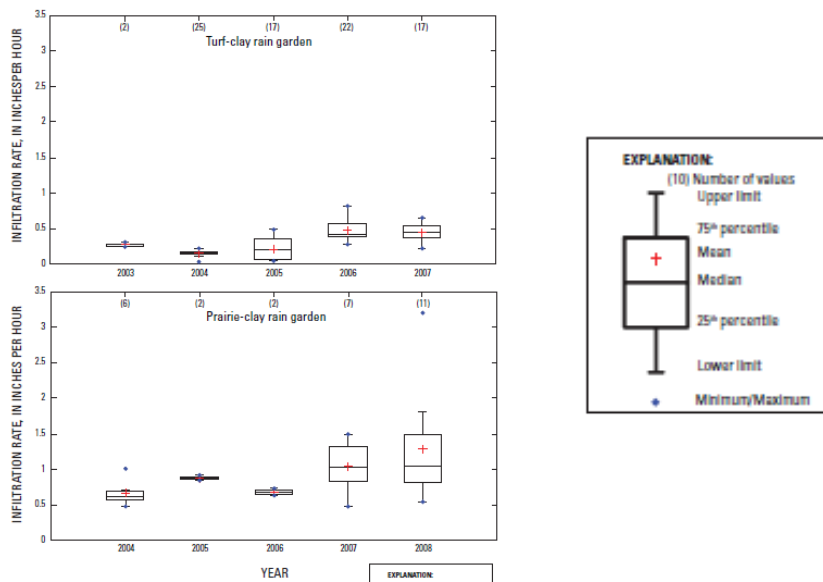
Maximum
Ponding Depth
= 6 inches

of Plants=
16 species

Plant Density =
1 plant per
square foot

USGS Scientific Investigations Report 2010–5077

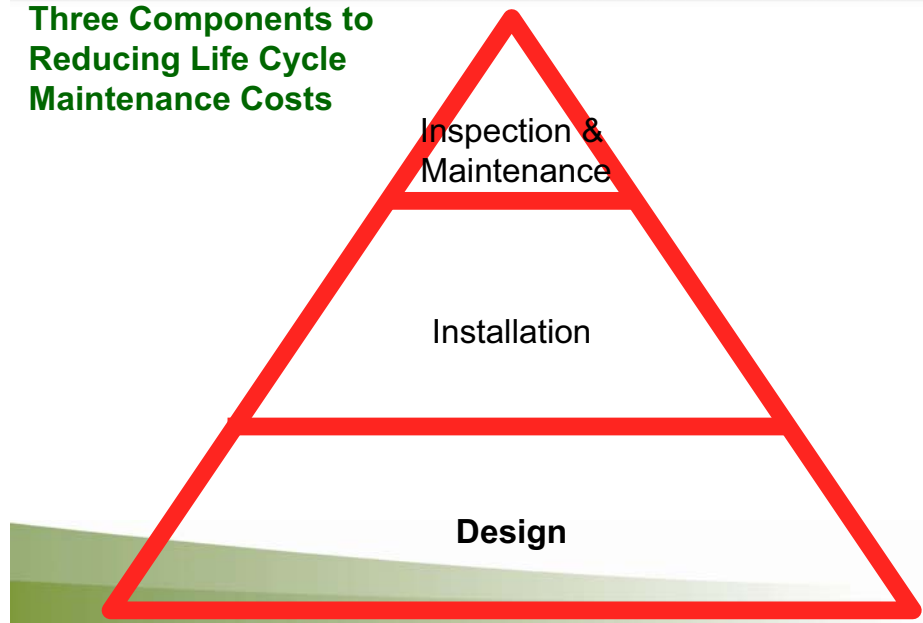
Vegetation



USGS Scientific Investigations Report 2010–5077

Designing and Installing for Maintenance

Three Components to Reducing Life Cycle Maintenance Costs





designing for the client



designing for the client



plant density and plant location

Image Source: LID Center



to seed, plug, or sod



Avoiding Common Mistakes

- Underground Utility Surprises**
- Unforeseen Soil Conditions**
- Excessive Soil Compaction**
- Inexperienced Contractor (Bidding and Construction)**
- Limited Details in Plan**
- Proper Excavation Equipment and Technique**
- Perimeter Fencing**
- Construction Sequencing**
- Finish Grading**
- System Not Offline**
- Severe Storm Events and Siltation**
- Lack of Construction Supervision**
- Lack of Installation Responsiveness**



Questions?



Downloadable from the
CVC website:

<http://www.creditvalleyca.ca/>

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