



Milwaukee's Green Street Program Challenges and Lessons Learned

City of Milwaukee

Milwaukee's Green Streets Program

- Purpose:
 - Help achieve Wisconsin Department of Natural Resources (WDNR) requirements of reducing TSS and future Total Maximum Daily Loads (TMDLs)

- Goals:
 - Reduce polluted stormwater runoff that enters Milwaukee's waterways
 - Decrease peak flows and volumes during storms to reduce surface flooding, basement backups and Combined Sewer Overflows (CSOs)

- Green Infrastructure (GI):
 - Bioretention facilities, permeable pavements/pavers
 - Green Streets Program was started in 2008 in the City of Milwaukee

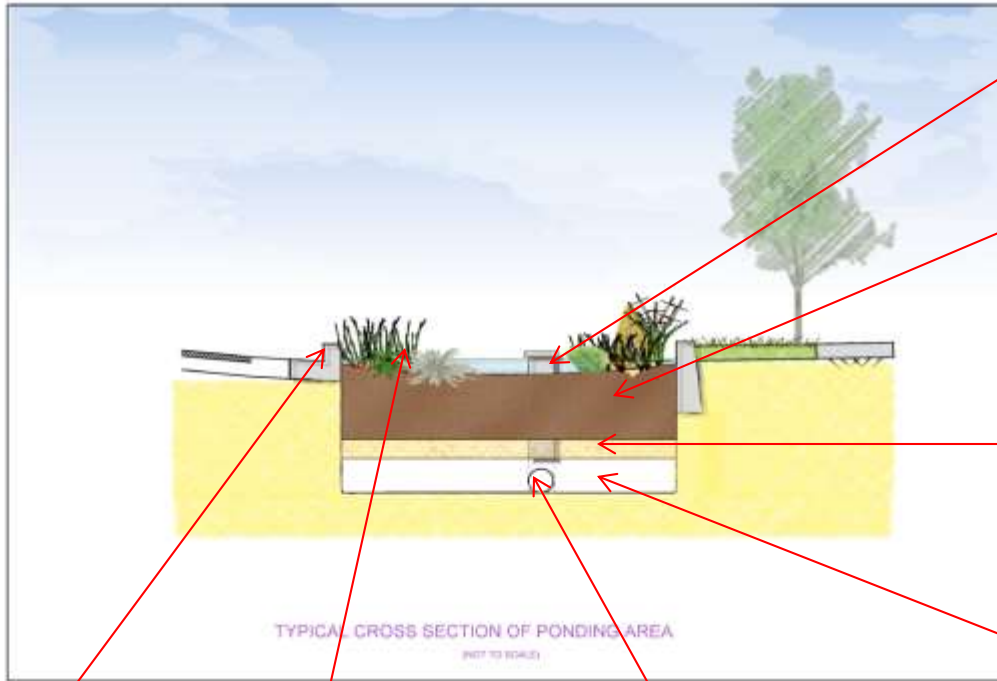
- Bioretention facilities in Milwaukee are:
 - Suitable for small drainage areas such as parking lots, and streets
 - Built as part of resurfacing/paving projects (as retrofits, more expensive) or as part of street reconstruction projects (less expensive)

- How it works:
 - Bioretention facilities reduce stormwater runoff and increase on-site stormwater infiltration
 - Roadway runoff enters the bioretention facilities where native plants filter pollutants and stormwater infiltrates into the ground through engineered soil or evaporates

Design Guidelines:

- Design per WDNR Technical Standard 1004.
- Ponding shall not exceed 12” during a 24-hour rainfall event (vegetation survivability).
- Target bioretention area to be 7-10% of contributing area.
- Bioretention facility shall treat the 1-year storm event (first flush).
- Overflow stand pipe will redirect flow into sewer system once maximum ponding is reached.
- Engineered soil mix used is a combination of 70% sand and 30% compost.

BIORETENTION CROSS-SECTION



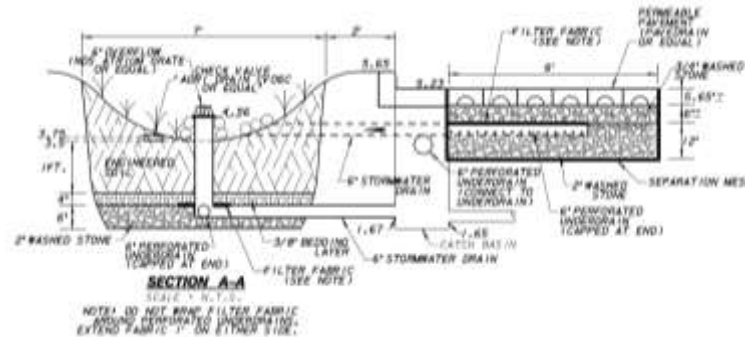
- Curb Cut
- Vegetation
- Perforated Drain Tile
- Overflow Riser
- Engineered Soil (18" typical)
- 3/8" Bedding Chips(4")
- Crushed Stone Layer (18-24")



Green Street Projects

2014 Projects

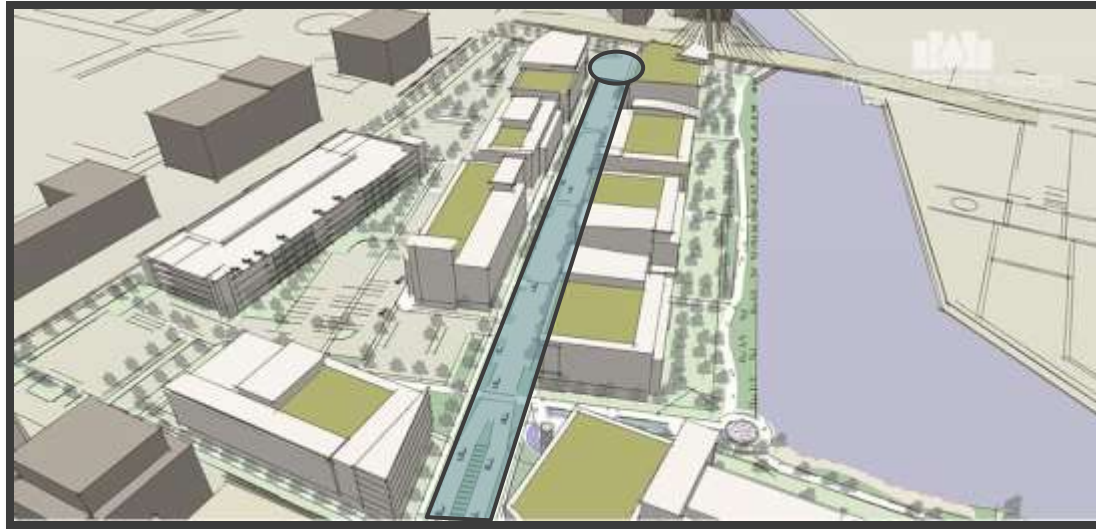
- East Greenfield Avenue – C&NW Railroad to Kinnickinnic River
 - 8 bioswales in terrace areas (1,757 square feet, 21,500 square feet of tributary area)
 - Pervious pavement parking lanes
 - Multiple green infrastructure technologies - permeable pavers and bioswales work in conjunction



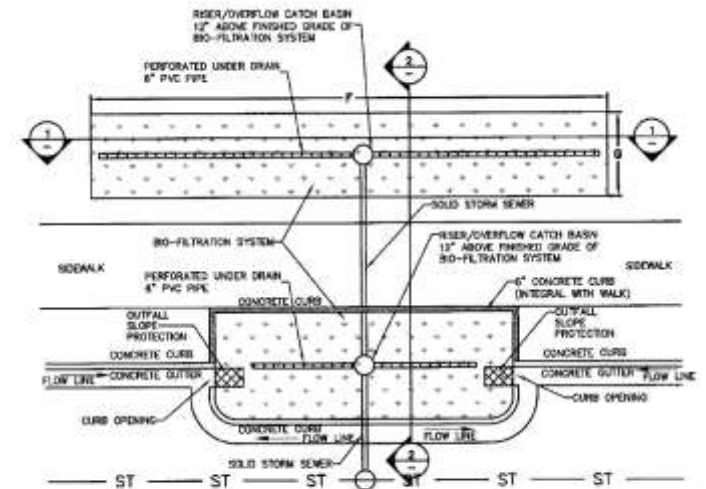
- Redesign of North 27th Street – West Capitol Drive to West Roosevelt Drive
 - 14 bioswales
- West Hampton Avenue - North Green Bay Avenue to North Teutonia Avenue
 - 7 bioswales in medians (4,716 square feet, 52,400 square feet of tributary area)
- South 27th Street - West Howard Avenue to West Oklahoma Avenue
 - 9 bioswales in medians (6,600 square feet, 73,000 square feet of tributary area)
- North Sherman Boulevard - West Auer Avenue to West Congress Street
 - 12 bioswales in medians (9,000 square feet, 90,000 square feet of tributary area)

2013: Freshwater Way (South 3rd to South 6th Streets), AKA: Reed Street Yards

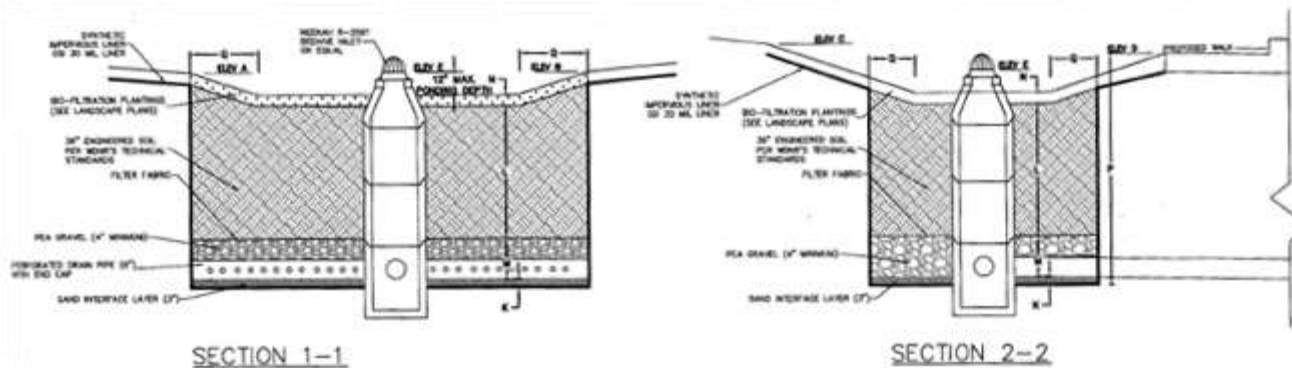
8 Bioswales



<http://www.watertechnologypark.com/visuals/>



PLAN VIEW



TYPICAL SOUTH BIO-FILTRATION 1,2,3 DETAILS

2012: West Grange Avenue (South 18th to South Howell Ave)

□ 13 Bioswales (in the medians)



2011: South 6th Street (West Howard to West Grange Avenues)

19 Bioswales



2010: West Grange Avenue (South 26th to South 18th Streets)

- 9 Bioswales (in the medians)



2009: North 91st /92nd Street (West Capitol Drive to West Good Hope Road)

☐ 20 Bioswales (In the medians)



2008: North 27th Street (West Capitol to West Roosevelt Drives)

☐ 14 Bioswales



BIORETENTION PROJECTS SUMMARY

<u>Project Year</u>	<u>Project</u>	<u>Status</u>	<u>Contributing Area (sqft)</u>	<u>Bioretention Area (sqft)</u>	<u>% Bioretention Area vs Area Treated</u>	<u>TSS Removal</u>	<u>LandUse</u>
2008	N. 27th St. (Roosevelt to Capitol)	Constructed	28,000	1,700	6%	75%	Res/Indus
2009	N. 91 St. and N. 92nd St.	Constructed	166,000	15,800	10%	79%	Res
2010	W. Grange Av. (S. 27th St. to S. 17th St.)	Constructed	56,000	7,300	13%	93%	Res
2011	S. 6th St. (Howard to Howell)	Constructed	92,000	8,400	9%	83%	Res/Comm
2012	W. Grange Av. (S. 15th St. to Howell)	Constructed	93,000	8,700	9%	98%	Res
2013	West Freshwater Way (S. 3rd St. to S. 6th St.)	Constructed	42,000*	2,200	5%	80%	Comm
2014	W. Sherman Blvd (Auer to Congress)	Design	90,000	8,900	10%	97%	Res
2014	S. 27th St. (Howard to Oklahoma)	Design	73,000	6,600	9%	80%	Comm
2014	W. Hampton Ave. (Greenbay to Tautonia)	Design	52,000	4,600	9%	80%	Res/Comm
2014	E. Greenfield Ave. (C&NWRR ROW to KK River)	Design	18,000*	1,800	10%	100%	Indus/ Inst

* - Entire roadway drains to permeable pavers on the parking lanes on both sides of the streets. Once stone storage is full, the runoff will flow into the bioretention facilities.

Challenges

- Finding suitable drainage areas
- Existing utilities in medians or terrace areas
- Native clay soil hinders timely infiltration
- Long term maintenance after construction
 - ▣ first two years are performed by contractor
- Bed scouring
- Litter
- Space limitations
- Neighborhood acceptance



Lessons Learned – Design Improvements

- **Gravel layer as a separation medium** (beneath engineered soil) vs. filter fabric
 - root growth is inhibited with fabric
- **Underdrain system**
 - elevate system to allow for some natural infiltration
 - connect to catch basins to facilitate drainage
- **Use large cobbles at inlets**
 - diffuses stormwater inflow, prevents scouring & mulch clogging



Lessons Learned - Design Improvements

- **Better selection of vegetation**
 - aesthetics and proper plant establishment
- **Buffer Zone**
 - if located at terrace areas, add two foot minimum buffer for unloading and safety
- **Concrete Boxes**
 - not necessary: safety reasons
- **Liners**
 - necessary for contaminated soil
- **Citizen Education**
 - Install informational signs



INFORMATIONAL SIGN



EACH PLANTER BED DISPLAYS THEIR OWN INFORMATIONAL SIGN. THE SIGN HELPS THE PUBLIC UNDERSTAND THE MUNICIPALITY'S EFFORTS TO IMPROVE STORM WATER RUNOFF.

Successful Solutions

- Partner with City's Forestry department
- Maintenance by local community groups
 - ▣ Milwaukee's Green Corridor



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