Advanced Sustainable Urban Stormwater Infrastructure

Mark Joersz
Engineered Products Mgr
mark.joersz@ads-pipe.com
636-346-6139
Our Climate Is Changing...

Sporadic frequency of storm events

Increased intensity

Higher peak flows

Much higher runoff
MAX Daily Rainfall
June 2015
St. Louis MO

19 rain days

June total: 28.74”
MAX Daily Rainfall
June, September 2015
St. Louis MO

8 rain days

June total: 28.74”
Sept. total: 5.64”
MAX Daily Rainfall
June, September, late-December 2015
St. Louis MO

11.58”
MAX Daily Rainfall
June 2015 vs. June 2016
St. Louis MO
Overview

Subsurface Stormwater Management

- Present
- Future
Green infrastructure is practices or facilities that reduce the volume, rate or pollutant load of stormwater runoff before it goes into the sewer system and creeks. They do this by capturing stormwater and diverting it to where it can be detained, infiltrated into the ground, evaporated, taken up by plants, or reused.
Green and gray can co-exist

"A common misconception is that folks think green infrastructure and gray infrastructure are an either/or proposition. This is not true," Dreyfuss-Wells explained.

"Green infrastructure, or on-site stormwater management, is a tool in the smart stormwater-management tool box, as is gray—or traditional—infrastructure. The best solutions come when people from a range of backgrounds and interests work together to solve stormwater problems and prevent new issues. That is what we are doing at the Sewer District and how we are advancing green infrastructure in our communities."
USEPA Volume Reduction

REDUCE RUNOFF

Slow It Down
Spread It Out
Soak It In

https://www.youtube.com/watch?v=huO_NRn34GI
Green Infrastructure

Bioretention

Pervious Pavement
Green Infrastructure Volume Reduction
Maintenance Challenges
Maintenance

March 27, 2015
48 hours after end of rain

Installed - 2012

April 1, 2015
No rain since March 25
Urban Design Considerations

- Land Use
- Value of Land
- Linear Constraints
- Safety Concerns
- Construction Timing
- Maintenance
- Aesthetics
UNDERGROUND OPTIONS

Pervious Pavement
UNDERGROUND OPTIONS

Rain Gardens/Bioretention

Information from Selection of Stormwater Best Management Practices (BMPs) for the Removal of Specific Non-Point Source Pollutants - Herr
UNDERGROUND OPTIONS
UNDERGROUND OPTIONS
Infiltration Chambers – Long History
Infiltration Chambers

- Septic tank
- Interlocking Infiltrator chambers
- Native soil
Detention

Local Regulations

• Critical Storm
• Flood Protection

![Typical Storage Hydrograph](image)
Volumetric Reduction

100% Infiltration
Volumetric Reduction

Water Quality Volume (WQv)
Rainfall Data

<table>
<thead>
<tr>
<th>Precipitation Depth (mm)</th>
<th>Number of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June to Dec. 2008</td>
</tr>
<tr>
<td>2.4 – 5</td>
<td>5</td>
</tr>
<tr>
<td>6 – 15</td>
<td>19</td>
</tr>
<tr>
<td>16 – 25</td>
<td>5</td>
</tr>
<tr>
<td>26 – 35</td>
<td>2</td>
</tr>
<tr>
<td>36 – 45</td>
<td>1</td>
</tr>
<tr>
<td>&gt;45</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>
Inflow, overflow and infiltration summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Monitoring Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Precipitation (mm)</td>
<td>333</td>
</tr>
<tr>
<td>Total Inflow Volume (m$^3$)</td>
<td>8,137.099</td>
</tr>
<tr>
<td>Total Overflow Volume (m$^3$)</td>
<td>963.540</td>
</tr>
<tr>
<td>Total Infiltrated Volume (m$^3$)</td>
<td>7,173.559</td>
</tr>
<tr>
<td>Runoff Reduction Ratio</td>
<td>0.88</td>
</tr>
</tbody>
</table>
September 20, 2016

ADS
Attn: Mr. Mark Joersz
605 Dartmouth Crest Dr.
St. Louis, MO 63011

RE: Stormtech and Isolator Row

Dear Mr. Joersz,

The Metropolitan St. Louis Sewer District (MSD) has reviewed your July 5, 2016 analysis of the ADS Stormtech/Isolator Row system as a standalone post-construction stormwater Best Management Practice. MSD hereby grants approval of the Stormtech/Isolator Row system for use on new development, redevelopment and highway/roadway improvement projects of any size under the following conditions:

The Stormtech outlet shall be perched a minimum 6” and the infiltration bed area sized in accordance with the attached Figure 1. With a perched outlet, and when sized in accordance with Table 1 and Figure 1, the Isolator Row and Stormtech Chambers provide sufficient water quality treatment for its tributary area. A runoff volume reduction credit of 0.45 may be entered into “Item 11, Site Specific BMP” in the MSD MEP spreadsheets.

Metropolitan St. Louis Sewer District
2350 Market Street
St. Louis, MO 63103-2555
(314) 768-6200
# Table 4.4

**Best Management Practice Value Ratings**

<table>
<thead>
<tr>
<th>Cover Type or BMP</th>
<th>Median Expected Effluent EMC TSS (mg/L)³</th>
<th>Water Quality Value</th>
<th>Volume Reduction</th>
<th>Temperature Reduction</th>
<th>Oils/Floatables Reduction</th>
<th>Overall Value Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation</td>
<td>N/A</td>
<td>5.25</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>9.25</td>
</tr>
<tr>
<td>Native Vegetation preserved or established</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rain Garden</td>
<td>&lt; 10</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>9.0</td>
</tr>
<tr>
<td>A small residential depression planted with native vegetation designed to capture and infiltrate runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infiltration Practices</td>
<td>&lt; 10</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>9.0</td>
</tr>
<tr>
<td>Infiltration Basin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infiltration Trenches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioretention</td>
<td>&lt; 10</td>
<td>4</td>
<td>1.5</td>
<td>1</td>
<td>2</td>
<td>8.5</td>
</tr>
<tr>
<td>Small engineered and landscaped basins designed to filter runoff before release</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pervious or Porous Pavement</td>
<td>10-20</td>
<td>3</td>
<td>1.5</td>
<td>1</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>Pervious Concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porous Asphalt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modular Concrete Block</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Detention Wetland</td>
<td>&lt; 10</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>7.0</td>
</tr>
<tr>
<td>A land area that is permanently wet with hydric soils sized to detain the WOv for a minimum of 40 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MARC Infiltration Practices - Chambers

Infiltration Trench
The proposed infiltration trench will treat 1.20 acres of runoff from the proposed development. The infiltration trench has a value rating of 9.00 and a total value rating of 10.80 based on the 1.20 acres of treatment.

Total Value Rating = 1.20 acres * (VR=9.00) = 10.80

The infiltration trench was sized to infiltrate the water quality event which was determined to be 4,282 cubic feet of required storage. The infiltration trench consists of 2 rows StormTech MC-3500 Chambers (15 chambers per row). The bottom elevation of the MC-3500 Chambers is 1025.70 and the top elevation of the MC-3500 chambers is 1029.45.

A junction box, located directly upstream of the infiltration trench, will act as both the inflow structure and the overflow. The junction box consists of a 15” pipe connecting to the infiltration trench and an 18” outflow pipe connecting to the existing enclosed storm sewer system. The 15” pipe has will convey water to the infiltration trench and is set at a $F_{out}=1028.95$. The second 18” outflow pipe will act as the overflow and is set at a $F_{out}=1029.45$. If the hydraulic grade line increases above 1029.45, overflow will be conveyed through the outflow pipe.

The total available storage in the infiltration trench was determined to be 4,305 cubic feet. The infiltration trench design calculations and details can be found in Exhibit B of this report.
Chapter 5

Stormwater Best Management Practices

IN.04 – Infiltration Vault

Description: Bottomless underground structures used for temporary storage and infiltration of stormwater runoff to groundwater. May be modified for runoff treatment.

Geometry Limitations
Limit to sites where infiltration ponds cannot be located due to site constraints.

BMP Function
- LID
- Flow Control
- Runoff Treatment*
  - Oil Control
  - Phosphorus
  - TSS - Basic
  - Dissolved Metals - Enhanced

NOTES:
1. CHAMBER DESIGN SHALL BE IN ACCORDANCE WITH ASTM F2767.
2. CHAMBER FOOT MUST BE DESIGNED TO DEVELOP A STRUCTURAL STONE COLLUMN BETWEEN ROWS.
3. THE CHAMBER MANUFACTURES CUMULATIVE STORAGE SHALL BE USED AND INCLUDED IN THE DESIGN DOCUMENTATION.
4. THE CHAMBER ROW SPACING, BASE STONE, COVER STONE, MINIMUM COVER, AND MAXIMUM COVER SHALL BE PER THE CHAMBER MANUFACTURES SPECIFICATIONS.

CITY OF GIG HARBOR
ENGINEERING DIVISION

STORMWATER CHAMBER DETAIL
DETAIL NO. 3-06

APPROVED FOR PUBLICATION
DATE: MAY 18, 2015
Rainwater Harvesting

- Option when no infiltration
- Irrigation, Graywater, Fire Suppression
- Treatment of Water
- Roof vs Parking Lot
- Water and Electricity Savings
- Return on Investment
Pretreatment

- Typically Located Upstream
- Manufactured or Green Infrastructure
- Design Pretreatment for WQf (Water Quality Flowrate)
Thermal

- Lag Time
- Heat Sink

(USF) VERY RESISTANT TO SEASONAL TEMP

Examination of Thermal Impacts From Stormwater Best Management Practices

Prepared by
The University of New Hampshire Stormwater Center

Prepared with Support from U.S. Environmental Protection Agency Region 1 TMDL Program
January 2011
USF w/Rain Gardens or Pervious Pvmt

NO DEEP ROOTING TREES OR PLANTS
Shallow rooting grasses, plants and bushes by Landscape Architect

Engineered Soil Mix
by Landscape Architect

30 cm, 12 inches
40 cm, 15.75 inches
4 units Maximum

Geogrid (below fabric)
Geogrid (inside fabric, Above Rainstone3)
Rainstone3 Units

Geogrid (above fabric)
8 oz/yd Geotextile Fabric
Sand

8 oz/yd Geotextile Fabric (Encases Rainstone3)

Non-sewered hose clamp used to fasten liner to pvc to prevent backfill from entering structure.

Detention outflow pipe if necessary. Sized for desired flow rate. Location near inflow allows suspended solids to exit before settling.

Geogrid (Tensar TrX 100 or equiv.)

Geogrid (Tensar TrX 100 or equiv.)
overlapped

Excavation line

Geogrid (Tensar TrX 100 or equiv.)
interior of fabric.

Rainstone3 structure
Reinforced concrete structure.

20" (5.0 m) minimum to allow space for proper compaction.

Backfill compacted to 95% modified proctor density.
12" (0.3 m) minimum.
30" (0.9 m) maximum depth.

49" (1.2 m) geogrid overlap.

Detention outflow pipe if necessary. Sized for desired flow rate. Location near inflow allows suspended solids to exit before settling.

Geogrid (Tensar TrX 100 or equiv.)
interior of fabric.

Rainstone3 structure
Reinforced concrete structure.

20" (5.0 m) minimum to allow space for proper compaction.
Johnston IA Roadway Reconstruction

Bioswale with 100% infiltration.
No outlet
14 systems installed
   4 chambers per cell
Underground Stormwater Facilities

- Sustainable long-term
- Volume reduction
- Peak flow attenuation
- Dual use of urban environments
QUESTIONS?

Mark Joersz  
Engineered Products Manager  
mark.joersz@ads-pipe.com  
636-346-6139