Drainage Program Guide

Green Stormwater Infrastructure (GSI)

Best Management Practice: Subsurface Storage

Subsurface storage systems generally consist of a pretreament process at the entry point and an aggregate storage bed below surfaces such as parking areas, lawns, and playfields. Examples of these underground facilities include arch storage, concrete vault storage, cube storage, stackable columns, or an aggregate storage bed. Stormwater runoff is stored and slowly released over a defined period of time. These GSI practices are most useful for developments where land availability and land acquisition costs limit the use of surface detention practices and when site improvements are already planned.

How can I use subsurface storage to reduce my drainage charge?

A subsurface storage system that manages stormwater runoff from a parking area or rooftop can achieve up to an 80 percent drainage charge credit, depending on the available storage and site conditions. Of the maximum 80 percent credit available, up to 40 percent peak flow credit can be attained for controlling how fast water is leaving the property (evaluated on a case-by-case basis) and up to 40 percent volume credit can be attained based on how much water can be permanently removed from the sewer system (through infiltration). See A Guide to Credits for Commonly Used Stormwater Management Practice on DWSD's drainage website (www.detroitmi.gov/drainage) for further explanation.

NOTE: Residential customers receive an automatic 25 percent credit. If practice does not exceed the 25 percent automatic credit, no additional credit will be applied.

Installation of an underground plastic grid storage system

What is the typical cost of a subsurface storage system?

The cost of a subsurface storage system is dependent on the size and type of system used. Planning level capital costs can range from $10 to $20 per cubic foot of storage, not including construction cost, mobilization, engineering, and contingency.

What are the different types of subsurface storage systems?

Subsurface storage systems come in a variety of types, but generally fall within the following three categories:

1. **Underground stone storage** consists of buried stone beds wrapped in permeable geotextile that promote infiltration into the native soils. Stone storage beds provide the least amount of storage volume per unit area among the subsurface infiltration types. Removing sediment from underground stone storage is difficult, which necessitates effective pretreatment.

What is Pretreatment?

To prevent clogging of the subsurface storage system, sediment must be prevented from entering the system and pretreatment measures such as catch basins with sumps should be included in the system design.

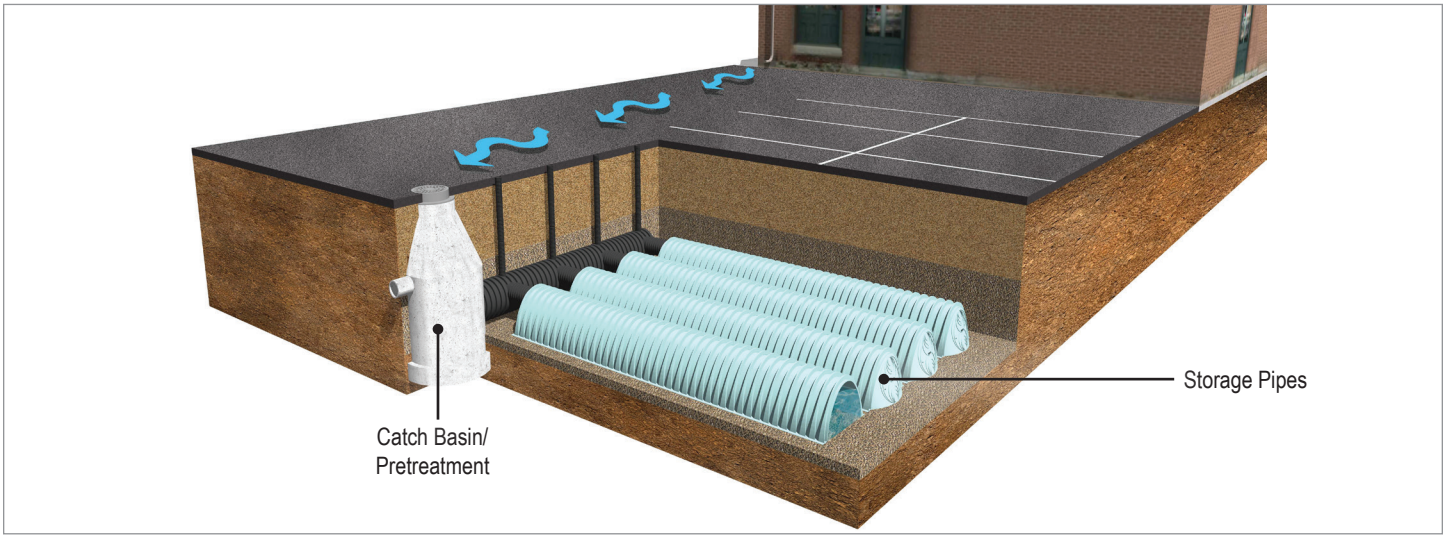

Illustration of an underground pipe and chamber storage system under a parking lot

2. **Underground pipe and chamber storage** comprises perforated plastic or metal pipes, or pipe-like linear chambers, that are placed in a stone bed to provide more storage per unit volume and promote infiltration into the native soils. Various pipe dimensions and shapes can be used to optimize the storage volume to meet the specific site requirements.

3. **Underground plastic grid storage (cube storage)** consists of buried plastic structures that can be stacked and interconnected to form various shapes and sizes. Grid systems can provide as much as 95 percent void space for storage of stormwater. Stormwater can enter the system through a traditional stormwater inlet and pipe conveyance.

The underground pipe/chamber storage and underground plastic grid storage systems are often sold by commercial vendors. Some examples of these commercial proprietary systems include Contech Systems, StormTrap, and Invisible Structures.

Credit Related Design Guidelines

- The maximum peak flow credit is provided for detention practices that can store the 100-year, 24-hour storm event.
- Detention practices need planned locations to manage sediment so that they do not reduce the performance of the detention area. A sediment trap upstream of the practice can assist in this objective.
- The outlet must be controlled to reduce discharge rates to the sewer system during storm events. The outlet must have a release rate of: 0.15 cfs per acre (or less) and be dewatered in 24 to 72 hours.
- A planned emergency overflow or detention bypass must be provided in the event the system is full.
- Practice can be designed to earn both a volume and peak flow credit.

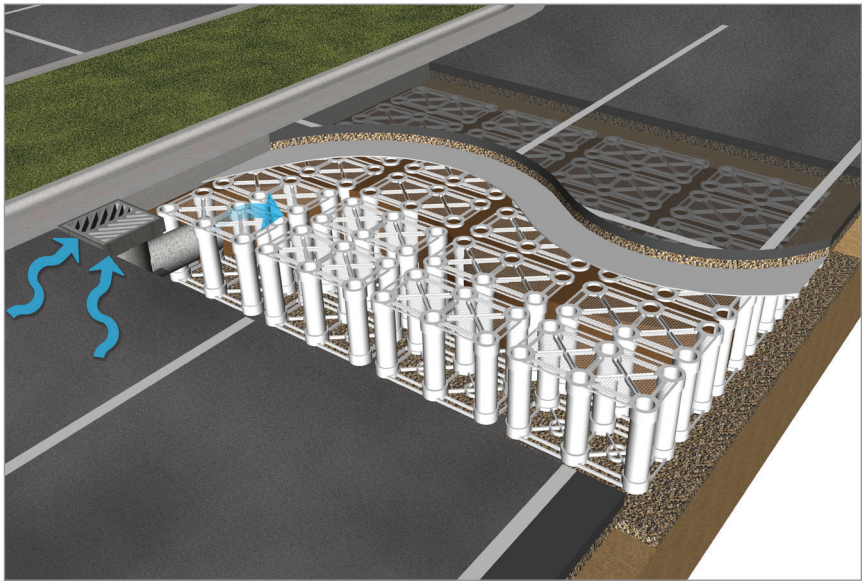

Illustration of an underground plastic grid storage system under a parking lot

Maintenance

Maintenance of any GSI practice is critical to the long-term performance of the system.

Subsurface storage systems require regular maintenance to ensure long-term functionality. Annual maintenance costs typically range between 3 to 8 percent of the capital project cost. This includes:

- Regular inspections of the catch basins, inlets, and pretreatment devices to remove sediment and/or debris.
- Evaluating the drain-down time of the system to ensure the maximum time of 48 hours is not being exceeded.
- Sediment removal from vaults, chambers, and pipes may be required using a vacuum or flushing system (consult maintenance professional).

Installation of an underground pipe and chamber storage system

Setback Requirements

- From property line: 2-foot minimum
- From building foundation: 10-foot minimum
- From municipal sanitary or combined sewer: 10-foot minimum
- From public water supply well: 50-foot minimum

Permits and Forms

- Make sure to identify and avoid utilities by contacting MISS DIG at 811 or 1.800.482.7171 before starting the project.
- If the project will disturb 1 acre or more, or is within 500 feet of a water of the state, contact Wayne County Environmental Services for a Soil Erosion and Sedimentation Control (SESC) permit.
- Underdrain or sewer pipe connections to a public sewer will require a permit from both the Building, Safety, Environment and Engineering Department (BSEED) and DWSD (sewer tap permit).
  - Sewer Tap (DWSD): Contact DWSD at 313.964.9236
  - Plumbing Permit (BSEED): Any time project work on private property connects to City sewer, contact: BSEED's Plumbing Inspector at 313.224.3158
  - Construction and any other City, State, or Federal permit
- Complete engineered drawings stamped by a registered Professional Engineer or Landscape Architect must accompany the Drainage Charge Credit Application. Additional required documentation is found on the application and can be downloaded from www.detroitmi.gov/drainage.

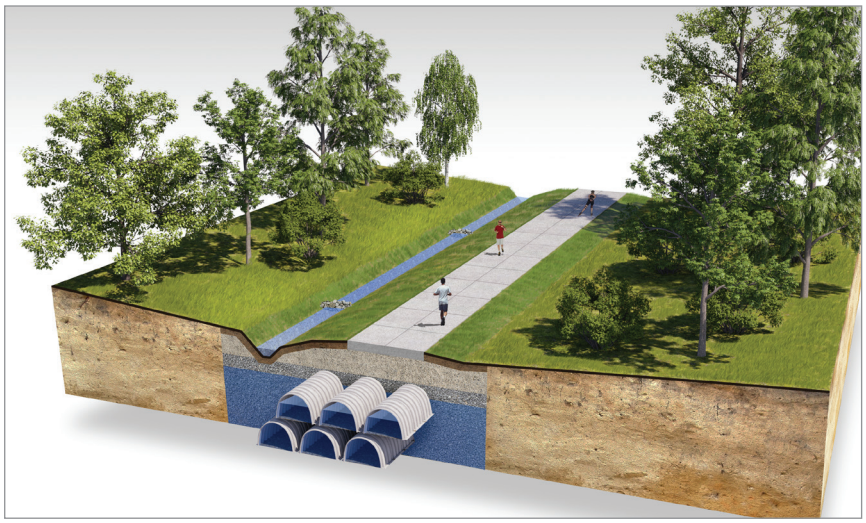

Illustration of an underground pipe and chamber storage system under a recreational trail

Additional Resources

For Drainage Charge Credit Information and other resources, visit the drainage webpage: www.detroitmi.gov/drainage

Specific documents to review:

- Guide to Drainage Credits
- Guide to Credits for Commonly Used Stormwater Management Practices
- Credit Calculator
- Credit Application

Washtenaw County Water Resources Commissioner. Revised 2016. Rules and Guidelines. *Procedures & Design Criteria For Stormwater Management Systems*. Part J – Design Requirements – Subsurface Infiltration Beds

NRCS Soil Survey website: https://websoilsurvey.arcs.usda.gov

Uncontrolled document when printed. Refer to website for most current version.