Volume/Peak Rate Reduction by Infiltration BMPs

BMP 6.4: Infiltration Trench

An Infiltration Trench is a "leaky" pipe in a stone-filled trench with a level bottom. An Infiltration Trench may be used as part of a larger storm sewer system, such as a relatively flat section of storm sewer. Or it may serve as a stormwater system for a small area, such as a portion of a roof or a single catch basin. In all cases, an Infiltration Trench must be designed with a positive overflow.

Key Design Elements

- Continuously perforated pipe set at a minimum slope in a stone filled, level-bottomed trench
- Limited in width (3 to 8 feet) and depth of stone (6 feet max. recommended)
- Trench is wrapped in nonwoven geotextile (top, sides, and bottom)
- Placed on uncompacted soils
- Minimum cover over pipe is 12-inches
- A minimum of 6" of topsoil is placed over trench and vegetated
- Positive Overflow always provided

Potential Applications

Residential: YES
Commercial: YES*
Ultra Urban: YES*
Industrial: YES*
Retrofit: YES
Highway/Road: YES*

** With consideration of hotspots*

Stormwater Functions

Volume Reduction: Medium
Recharge: High
Peak Rate Control: Medium
Water Quality: High

Pollutant Removal

TSS: 85%
TP: 85%
NO_3: 30%

Other Considerations

- **Infiltration Systems Guidelines** and **Soil Investigation Guidelines** should be followed, see Section 6.8.

Description

An Infiltration Trench is a linear stormwater BMP consisting of a continuously perforated pipe at a minimum slope in a stone-filled trench (Figure 1). Usually an Infiltration Trench is part of a **conveyance system** and is designed so that large storm events are conveyed through the pipe with some runoff volume reduction. During small storm events, volume reduction may be significant and there may be little discharge. All Infiltration Trenches are designed with a **positive overflow** (Figure 2).

An Infiltration Trench differs from an Infiltration Bed in that it may be constructed without heavy equipment entering the trench. It is also intended to convey some portion of runoff in many storm events.

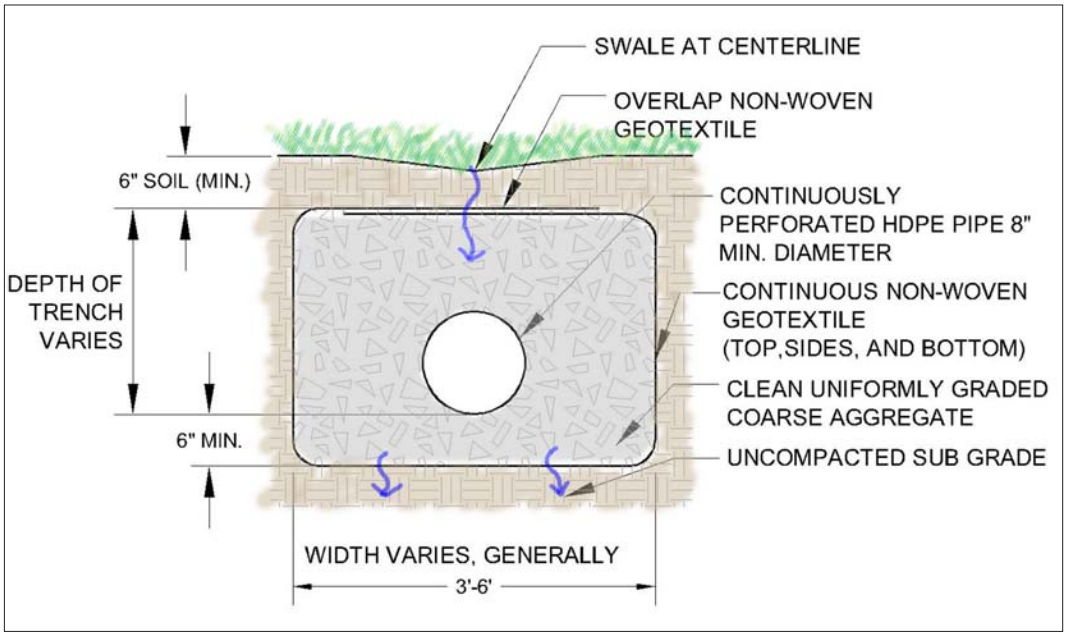

Figure 6.4-1. Cross section of an Infiltration Trench

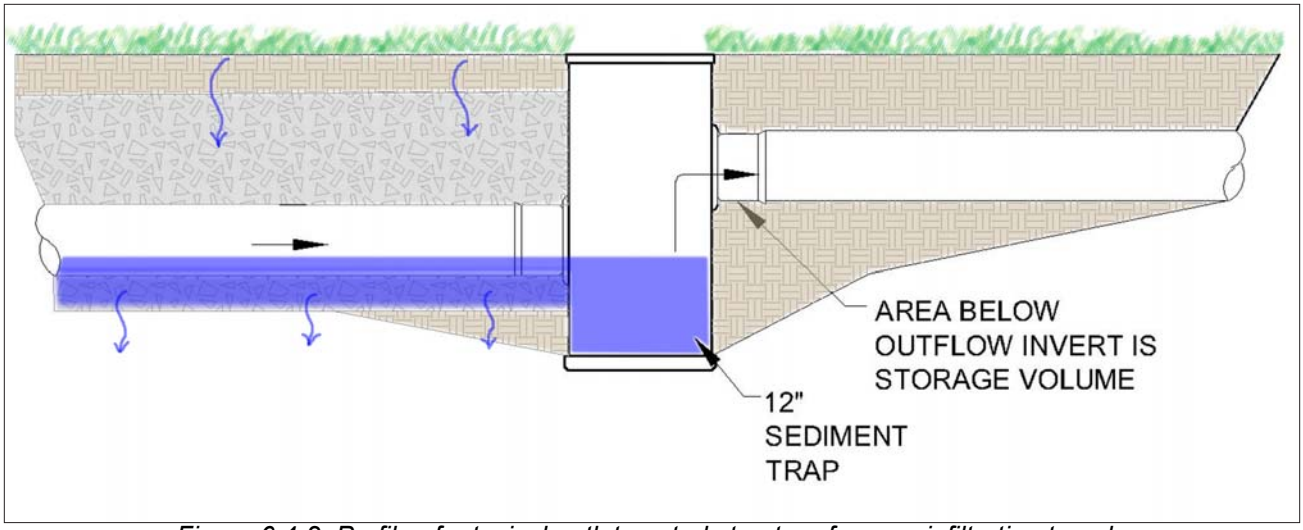

Figure 6.4-2. Profile of a typical outlet control structure from an infiltration trench.

All Infiltration Trenches must be designed in accordance with the Guidelines for Infiltration Systems. Although the width and depth can vary, it is recommended that Infiltration Trenches be limited in depth to not more than six (6) feet of stone. This is due to both construction issues and Loading Rate issues (as described in the Guidelines for Infiltration Systems). Appropriate depth should be considered by the designer.

Variations

Infiltration Trenches generally have a vegetated (grassed) or gravel surface. Infiltration Trenches also may be located beneath or within roadways or impervious paved areas with proper design. The subsurface drainage direction should be to the downhill side (away from subbase of pavement), or located lower than the impervious subbase layer. Proper measures must be taken to prevent water infiltrating into the subbase of impervious pavement.

Infiltration Trenches may also be located down a mild slope by "stepping" the sections between control structures as shown in Figure 3. A level or nearly level bottom is recommended for even distribution.

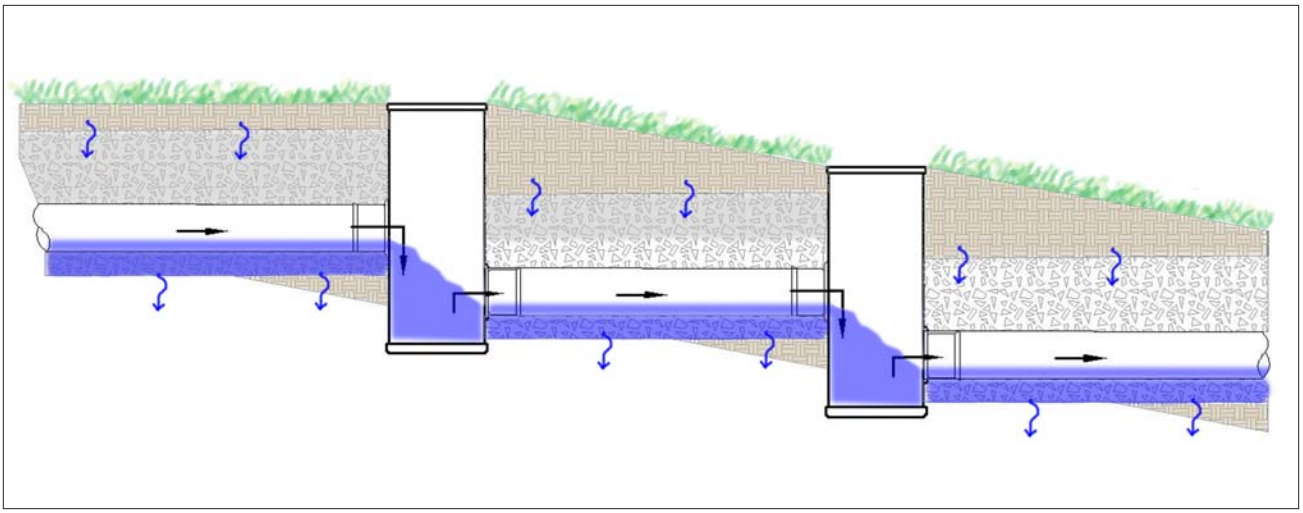

Figure 6.4-3. Profile of "stepping" down an infiltration trench.

Figure 6.4-6. (From left to right) Installation of Inlets and Control Sturcture; Non-woven Geotextile is folded over Infiltration Trench; Stabilized Site

Figure 6.4-7. (Clockwise from top left) Infiltration Trench is on downhill side of roadway; Infiltration Trench is Installed; Infiltration Trench is paved with standard pavement material

Maintenance and Inspection Issues

- Catch Basins and Inlets should be inspected and cleaned on an annual basis.
- The vegetation along the surface of the Infiltration Trench should be maintained in good condition, and any bare spots immediately revegetated.
- Vehicles should not be parked or driven on a vegetated Infiltration Trench, and care should be taken to avoid excessive compaction by mowers.

Cost Issues

The construction cost of infiltration trenches can vary greatly depending on the configuration, location, site-specific conditions, etc. Typical construction costs in 2003 dollars range from $4 - $9 per cubic foot of storage provided (SWRPC, 1991; Brown and Schueler, 1997). Annual maintenance costs have been reported to be approximately 5 to 10 percent of the capital costs (Schueler, 1987).

Specifications

The following specifications are provided for information purposes only. These specifications include information on acceptable materials for typical applications, but are by no means exclusive or limiting. The designer is responsible for developing detailed specifications for individual design projects in accordance with the project conditions.

1. Stone for infiltration trenches shall be 2-inch to 1-inch uniformly graded coarse aggregate, with a wash loss of no more than 0.5%, AASHTO size number 3 per AASHTO Specifications, Part I, 19th Ed., 1998, or later and shall have voids 40% as measured by ASTM-C29.

2. Non-Woven Geotextile shall consist of needled nonwoven polypropylene fibers and meet the following properties:

a. Grab Tensile Strength (ASTM-D4632)	³ 70%
b. Mullen Burst Strength (ASTM-D3786)	³ 120 lbs
c. Flow Rate (ASTM-D4491)	³ 225 psi
d. UV Resistance after 500 hrs (ASTM-D4355)	³ 95 gal/min/ft^2
e. Heat-set or heat-calendared fabrics are not permitted	

Acceptable types include Mirafi 140N, Amoco 4547, and Geotex 451.

3. Topsoil See Appendix C.

4. Pipe shall be continuously perforated, smooth interior, with a minimum inside diameter of 8-inches. High-density polyethylene (HDPE) pipe shall meet AASHTO M252, Type S or AASHTO M294, Type S.