Infiltration Trench

Stormwater BMP Type

Pretreatment BMP	□
Infiltration BMP	■
Filtering BMP	□
Stormwater Pond BMP	□
Stormwater Wetland BMP	□
Water Quality Conveyance BMP	□
Stormwater Reuse BMP	□
Proprietary BMP	□
Other BMPs and Accessories	□

Stormwater Management Suitability

Retention	■
Treatment	■
Pretreatment	□
Peak Runoff Attenuation*	■

*On-line systems only

Pollutant Removal

Sediment*	**High**
Phosphorus	**High**
Nitrogen	**Low**
Bacteria	**High**

*Includes sediment-bound pollutants and floatables (with pretreatment)

Implementation

Capital Cost	**Low**
Maintenance Burden	**Low**
Land Requirement	**Medium**

Description

Infiltration trenches are shallow, excavated, stone-filled trenches in which stormwater is collected and infiltrated into the ground. Infiltration trenches can be constructed at a ground surface depression to intercept overland flow. This BMP can also receive piped runoff discharged directly into the trench such that the trench is designed to distribute the flow from a point discharge in a manner that does not result in erosion. Runoff gradually percolates through the bottom and sides of the trench, removing pollutants through sorption, trapping, straining, and bacterial degradation, or transformation. Infiltration trenches may also be used to provide stormwater quantity control when designed as on-line facilities.

Infiltration trenches are a cost-effective approach to managing stormwater where there is adequate space for a narrow stormwater feature and where plantings are not needed, and the surface of the trench can be left open. They require less space than infiltration basins as they utilize the void spaces of the stone in the trench to temporarily store water.

Advantages

- Cost-effective approach to recharge stormwater.
- Requires less surface area than infiltration basins.
- Ideal for linear applications such as along sidewalks, medians, roadways, and bicycle paths.

- High solids, phosphorus, and bacteria removal efficiency. While not high removal efficiency Nitrogen reduction can be enhanced with careful design, typical removal efficiencies range between 10-55%.[79]
- Can provide stormwater retention, runoff volume reduction, groundwater recharge, and some peak runoff attenuation when designed as an on-line system.
- Surface of trench can be vegetated (with grass or plants) to provide landscaped features.

Limitations

- Pretreatment options are limited and should not be used in locations with the potential for high sediment loads.
- System clogging would require replacement of the trench.
- Low removal of dissolved pollutants especially in coarse soils.
- Should not be used with underdrain systems.

Siting Considerations

- **Potential Locations:** Best located parallel to linear features such as roads, sidewalks, and bicycle paths where runoff from a limited impervious surface can sheet flow onto the surface of the trench after being pretreated by a vegetative filter strip between the trench and impervious surface. Can be designed to receive point-source discharges to prevent erosion in the trench and distribute stormwater across the trench.

- **Drainage Area:** The maximum contributing drainage area for infiltration trenches is 5 acres.

- **General:** Meet the soils, water table, bedrock, and horizontal setback requirements specified in Chapter 10 - General Design Guidance for Stormwater Infiltration Systems(General Design Guidance for Stormwater Infiltration Systems). Infiltration trenches can be designed as on-line or off-line practices.

Soil Evaluation

- Conduct an evaluation of the soil characteristics and subsurface conditions at the location of the proposed system including soil type, depth to the seasonal high groundwater table, depth to bedrock, and soil infiltration rate. Refer to Chapter 10 - General Design Guidance for Stormwater Infiltration Systems for soil evaluation guidance.

[79] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/vol2-appB.pdf

Design Recommendations

Pretreatment

- Incorporate pretreatment measures at locations where runoff enters the infiltration trench in accordance with the Pretreatment BMPs section of this Manual.
- Acceptable pretreatment measures include vegetative filter strips, sediment forebays, pretreatment swales, deep sump hooded catch basins,[80] oil grit separators, and proprietary pretreatment devices.
- Sediment forebays should have a minimum storage volume of 25% of the Water Quality Volume (WQV), while flow-through Pretreatment BMPs should treat at least the equivalent Water Quality Flow (WQF). A minimum sediment forebay storage volume of 10% of the WQV may be used in urban settings, space constrained sites, and as retrofits, with the approval of the review authority.

Sizing and Dimensions

- Trench should be designed by either the Static or Dynamic Methods as described in Chapter 10 - General Design Guidance for Stormwater Infiltration Systems.
- Trench should completely drain in 48 hours or less after the end of the design storm as described in Chapter 10 - General Design Guidance for Stormwater Infiltration Systems.
- Trench depth may be limited by the requirement to maintain adequate separation to groundwater and bedrock as specified in Chapter 10 - General Design Guidance for Stormwater Infiltration Systems.
- Ponding Depth
    - Maximum for required water quality storm: 12 inches
    - Maximum for overflow events: 36 inches
- Bottom and Top Slope
    - Slope of the bottom of the trench should be level. Slope of the top of the trench should not exceed 0.5%.
- Side Slopes
    - Side slopes above the trench should be 3(H):1(V) or flatter especially on grassed slopes where mowing is required.
    - In ultra-urban locations or space constrained areas; side slopes of 2(H):1(V) may be utilized if properly designed to account for erosion and slope stability.

[80] Only recommended for space constrained sites where no other Pretreatment BMPs are feasible.

Stabilize the slope with turf reinforcement matting or equivalent if the slope could potentially erode.
    - If site topography does not allow for 3(H):1(V) slopes or adequately stabilized 2(H):1(V) slopes, vertical concrete walls with a maximum height of 30 inches can be used. Drop curbs or similar precast structures can also be used to create stable, vertical side walls.
    - The excavated side walls of the trench ideally should be vertical to maximize storage and infiltration capacity.

- Ensure adequate vehicle access to the entire length of the trench and pretreatment practices in order to allow trench media to be replaced if needed.

Inlet

- Design the inlet in accordance with the Inlet and Outlet Controls section of this Manual.
- Runoff can be introduced through overland flow, curb cuts, inlet structures, swales/channels, and/or pipes.
- Design in an off-line configuration to the extent feasible if runoff is delivered by a storm drainpipe or is along the main storm conveyance system.

Outlet & Overflow

- Design the outlet in accordance with the Inlet and Outlet Controls section of this Manual.
- Outlets are typically a stabilized spillway, gabion berm, concrete weir, curb cut opening, precast concrete structure, or polyethylene/polyvinyl chloride riser structure.
- On-line systems should have a primary outlet sized to convey the 10-year, 24-hour storm event, at a minimum, to the storm drainage system or stabilized channel. An emergency spillway is required to convey the 100-year storm event (assuming the primary outlet is not designed to pass the 100-year storm event).
- Off-line systems should be designed with a bypass or overflow for flows in excess of the water quality storm.

Materials

- Crushed Stone Storage Media
    - The trench should be filled with clean (washed and free from dirt and debris), crushed, angular aggregate with a diameter of 1.5" to 3" (porosity of 40 percent).
    - The sides and top of the trench should be lined with a non-woven geotextile (filter fabric).

- Observation Well
  - An observation well should be installed along the trench centerline to monitor the water drainage in the system. The well should consist of a well-anchored, vertical perforated 4- to 6-inch diameter PVC pipe with a lockable aboveground cap. Install one observation well per 50 feet of length.

- Surface Cover
  - Should consist of a minimum 3-inch-thick layer of pea gravel to suppress weed growth and improve sediment filtering in the top of the trench.
  - Pea gravel should consist of 3/8" AASHTO No. 8 stone. Pea gravel should be clean (washed and free from dirt and debris) and rounded in shape.
  - 4 to 6 inches of loam/topsoil and grass can also be used as an alternative surface cover for the surface of the trench. Select vegetation in accordance with Appendix F of this Manual.

- Filter Fabric
  - Use non-woven filter fabric that complies with State of Connecticut Department of Transportation Standard Specifications, Section M.08.01.19 (Drainage – Geotextiles).

Winter Operations

- Infiltration trenches should not be used as dedicated snow storage areas. To the extent feasible, locate and design the system to avoid snow storage areas and potential damage from snow plowing activities. Refer to Chapter 7 - Overview of Structural Stormwater Best Management Practices for general design considerations related to winter operations.

Construction Recommendations

- The designing qualified professional should develop a detailed, site-specific construction sequence.

- The designing qualified professional should inspect the installation during the following stages of construction, at a minimum:
  - After excavation of the infiltration trench and scarification of bottom and sidewalls of excavation
  - After installation of observation well
  - After placement and leveling of stone storage media
  - After installation of bypass, outlet/overflow, and inlet controls
  - After pea gravel or loam/topsoil and grass surface cover have been installed

- The designing qualified professional should provide an as-built plan of the completed infiltration trench along with a certification that the system was designed in accordance with the guidance contained in this Manual and other local or state requirements and that the system was installed in accordance with the approved plans.

- The entire contributing drainage area should be completely stabilized prior to directing any flow to the system. Adequate vegetative cover must be established over any pervious area adjacent or contributing to the system before runoff can be accepted.
- Erosion and sediment controls should be in place during construction in accordance with the Connecticut Guidelines for Soil Erosion and Sediment Control and the Soil Erosion and Sediment Control (SESC) Plan developed for the project.
- Infiltration trenches should not be used as temporary sediment traps for construction erosion and sediment control.
- During clearing and grading of the site, measures should be taken to avoid soil compaction at the location of the proposed system.
- The system should be fenced off during the construction period to prevent disturbance of the soils.
- The infiltration trench should be excavated to the dimensions, side slopes, and elevations shown on the plans. The method of excavation should avoid compaction of the bottom of the system. A hydraulic excavator or backhoe loader, operating outside the limits of the infiltration trench, should be used to excavate the system. Excavation equipment should not be allowed within the limits of the system.
- The stone storage media and pea gravel layer should be placed in the excavation by a hydraulic excavator or backhoe loader located outside the limits of the infiltration trench and then hand-raked to the desired elevation.
- Install vegetation (e.g., drought tolerant grass) on the side slopes and surface of the infiltration trench (if grass is used instead of pea gravel) in accordance with the planting plan and plant schedule on the plans. Water vegetation thoroughly immediately after planting and as necessary until fully established.

Maintenance Needs

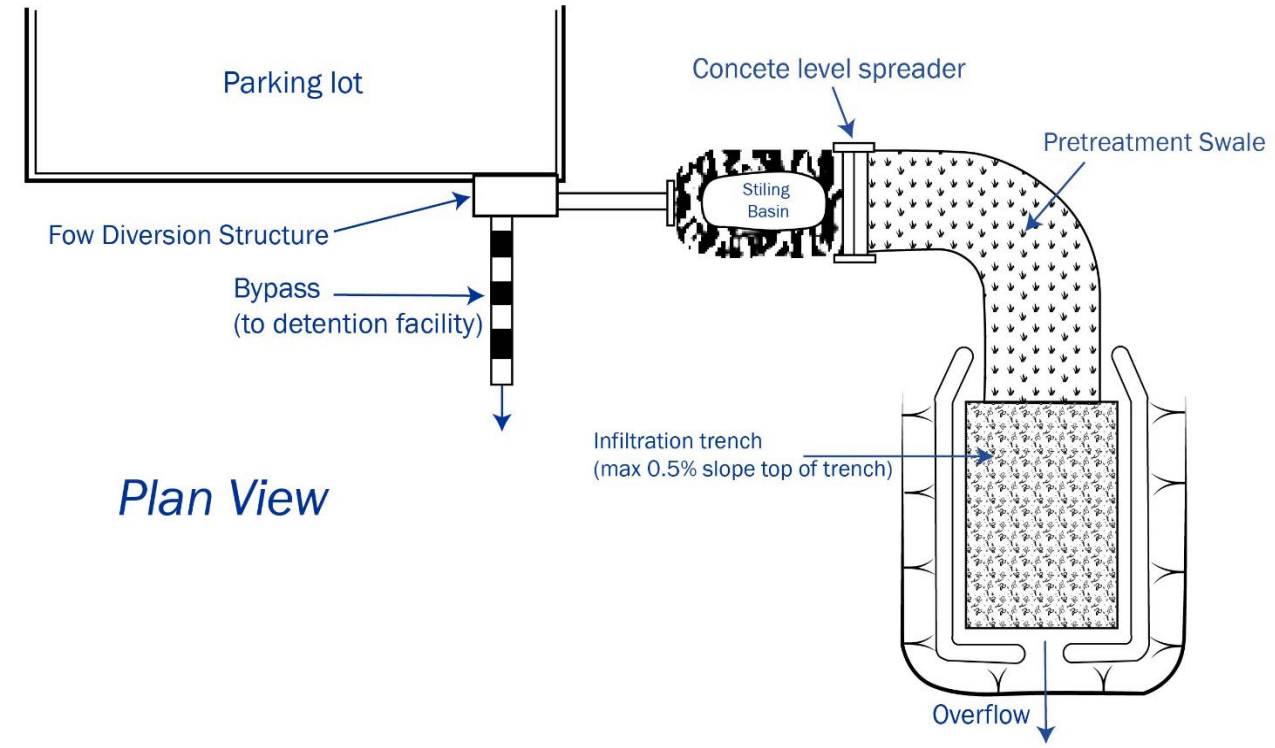
- Infiltration trenches should be designed with easy access to all components of the system for maintenance purposes. Refer to Chapter 7 - Overview of Structural Stormwater Best Management Practices for general design considerations to reduce and facilitate system maintenance.
- Detailed inspection and maintenance requirements, inspection and maintenance schedules, and those parties responsible for maintenance should be identified on the plans and in the Stormwater Management Plan.
- Maintenance should be detailed in a legally binding maintenance agreement.

- Maintenance activities such as sediment removal, mowing, and repairs should be performed with rakes and light-weight equipment rather than heavy construction equipment to avoid compaction of the filter media and underlying soils. Heavy equipment may be used for sediment removal and other maintenance activities if the equipment is positioned outside the limits of the system. Heavy construction equipment should not be allowed within the limits of the system for maintenance purposes.

Recommended Maintenance Activities

- Inspect after major storms (1 inch or more of precipitation) in the first few months following construction.
- Inspect the sediment forebay or other pretreatment area twice a year.
- Inspect the remainder of the infiltration trench annually.
- Refer to Appendix B for maintenance inspection checklists, including items to focus on during inspections.
- Remove trash and organic debris (leaves) in the Spring and Fall.
- Remove sediment from the sediment forebay or other pretreatment area when it accumulates to a depth of more than 12 inches or 50% of the design depth. Clean outlet of sediment forebay or other pretreatment measures when drawdown time exceeds 36 hours after the end of a storm event.
- Remove sediment from the infiltration trench surface when the sediment accumulation exceeds 2 inches or when drawdown time exceeds 48 hours after the end of a storm event, indicating that the system is clogged.
- Weed as necessary. Mow grass within infiltration trench to a height of 4 to 6 inches. Maintain a healthy, vigorous stand of grass cover; re-seed as necessary.
- Maintain vegetated filter strips or grassed side slopes of infiltration trench in accordance with maintenance recommendations in the Pretreatment BMPs section of this Manual.
- Periodically remove grass clippings to prevent clogging of the surface of the infiltration trench.
- Mowing should not be performed when the ground is soft to avoid the creation of ruts and compaction, which can reduce infiltration.

Figure 13-7. Infiltration Trench Schematic 1



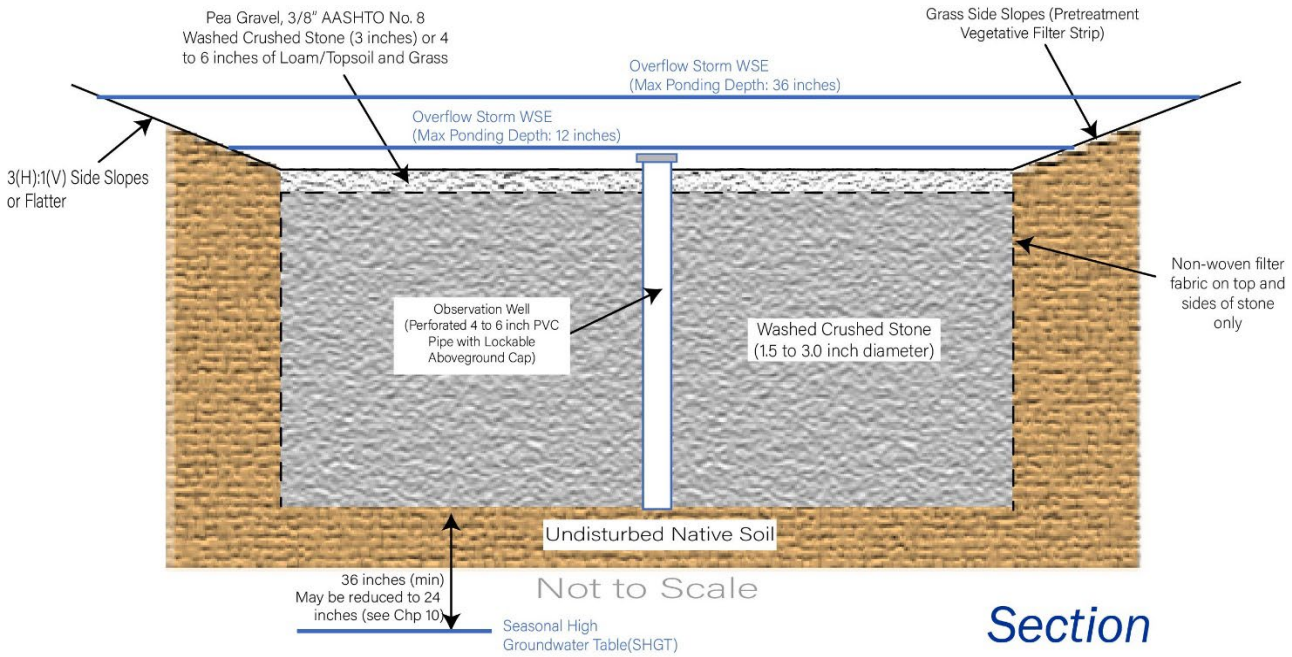


Figure 13-8. Infiltration Trench Schematic 2

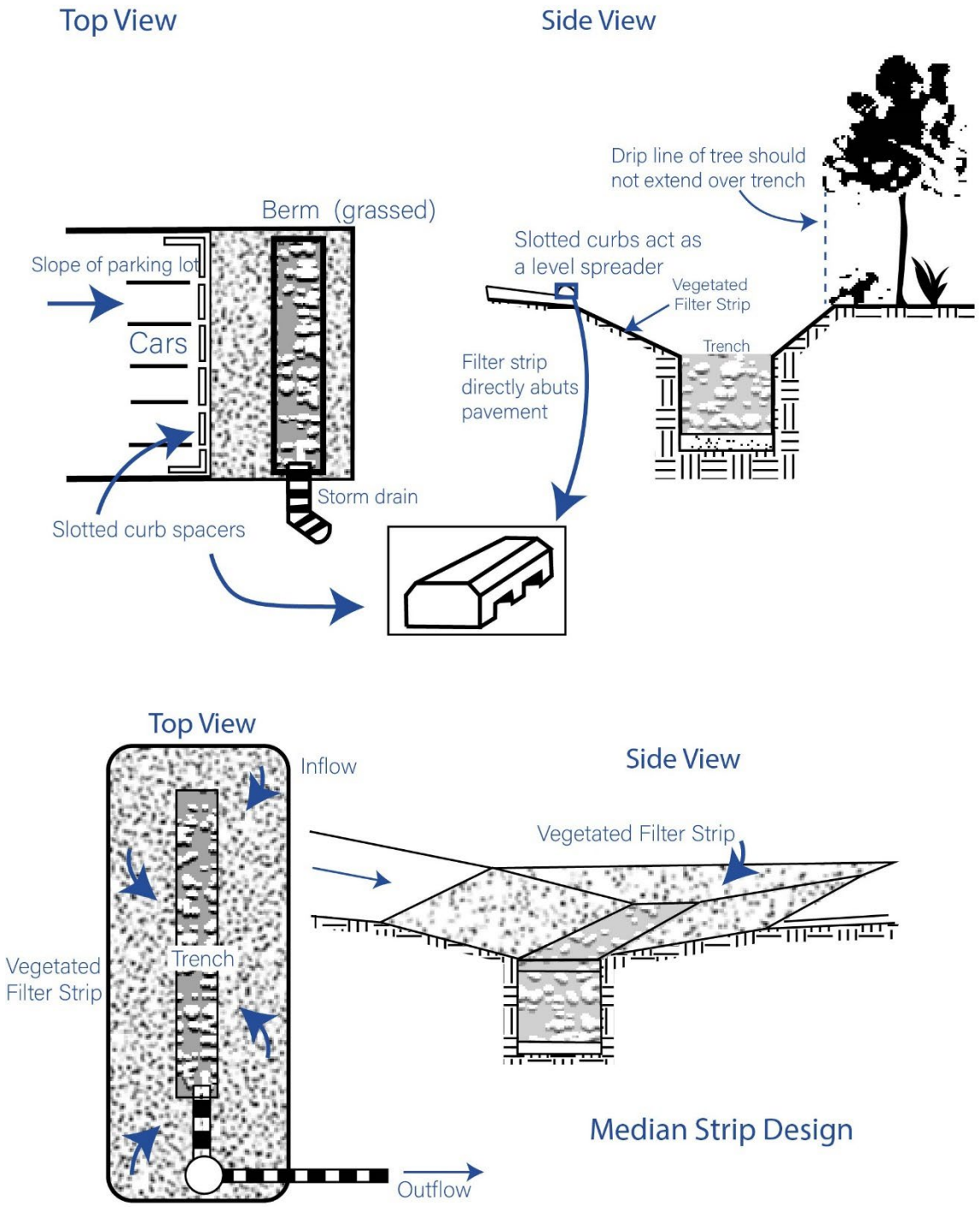
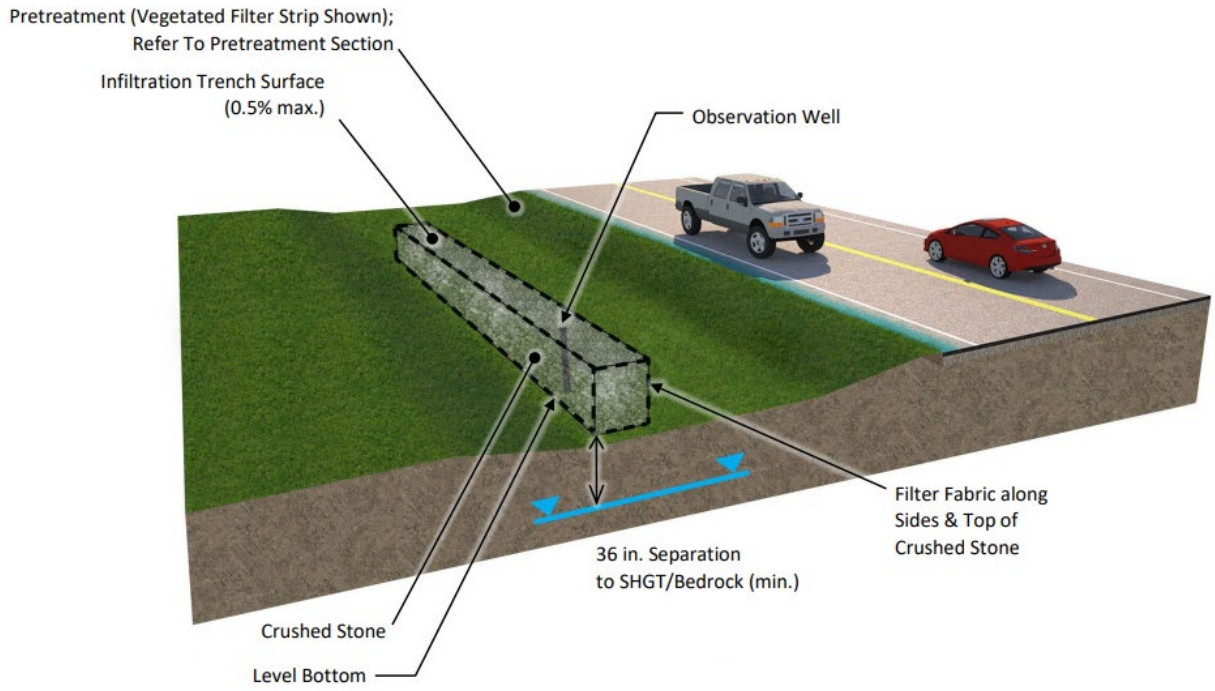


Figure 13-9. Infiltration Trench Schematic - Near Road



Source: Rhode Island Department of Transportation Linear Stormwater Manual, RIDOT (2019)