# Infiltration Trenches

**Description:** Excavated trench filled with stone aggregate used to capture and allow infiltration of stormwater runoff into the surrounding soils from the bottom and sides of the trench. Runoff from each rain event is captured and treated primarily through settling and filtration.

**Components:**
- Soil infiltration rate of greater than 0.5 in/hr required
- Excavated trench (3 to 8 foot depth) filled with stone media (1.5- to 2.5-inch diameter); pea gravel and sand filter layers
- A sediment forebay and grass channel, or equivalent upstream pretreatment, must be provided
- Observation well to monitor percolation

**Advantages/Benefits:**
- Provides for groundwater recharge
- Good for small sites with porous soils
- Cost effective
- High community acceptance when integrated into a development

**Disadvantages/Limitations:**
- Potential for groundwater contamination
- High clogging potential; should not be used on sites with fine-particle soils (clays or silts) in drainage area
- Cannot be used in karst soils
- Geotechnical testing required
- Community perceived concerns with mosquitoes and safety

**Design considerations:**
- 5 acres maximum drainage area
- Space Required – Varies depending on the depth of the facility
- Minimum Depth to Water Table – 2 feet between the bottom of the infiltration trench and the elevation of the seasonally high water table

**Selection Criteria:**

**Level 1 – 50%**

**Level 2 – 90%**

**Land Use Considerations:**

- [X] **Residential**
- [X] **Commercial**
- [X] **Industrial (with City approval)**

**Maintenance:**
- Inspect for clogging
- Remove sediment from forebay
- Replace pea gravel layer as needed
- Maintain side slopes/remove invasive vegetation

[H] **Maintenance Burden**
L = Low M = Moderate H = High

## SECTION 1: DESCRIPTION

Infiltration trenches are excavations typically filled with stone to create an underground reservoir for stormwater runoff (see **Figure 4.1**). The runoff volume gradually exfiltrates through the bottom and sides of the trench into the subsoil over a 2-day period and eventually reaches the water table. By diverting runoff into the soil, an infiltration trench not only treats the water quality volume, but also helps to preserve the natural water balance on a site and can recharge groundwater and preserve base flow. Due to this fact, infiltration systems are limited to areas with highly porous soils where the water table and/or bedrock are located well below the bottom of the trench.

In addition, infiltration trenches must be carefully sited to avoid the potential of groundwater contamination. Infiltration trenches are not intended to trap sediment and must always be designed with a sediment forebay and grass channel, filter strip or other appropriate pretreatment measures to prevent clogging and failure. Due to their high potential for failure, these facilities must only be considered for sites where upstream sediment control can be ensured.

Using the natural filtering properties of soil, infiltration trenches can remove a wide variety of pollutants from stormwater through sorption, precipitation, filtering, and bacterial and chemical degradation. Sediment load and other suspended solids should be removed from runoff by pretreatment measures on-site before they reach the trench surface.

## SECTION 2: PERFORMANCE

When used appropriately, infiltration has a very high runoff volume reduction capability, as shown in **Table 4.1.**

**Table 4.1. Summary of Runoff Reduction Provided by Infiltration[1]**

| Stormwater Function | Level 1 Design | Level 2 Design |
|---|---|---|
| Runoff Volume Reduction (RR) | 50% | 90% |

## SECTION 3: DESIGN TABLE

The major design goal for infiltration is to maximize runoff volume reduction. To this end, designers may choose to go with the baseline design (Level 1) or choose an enhanced design (Level 2) that maximizes runoff reduction. To qualify for Level 2, the infiltration practice must meet all the design criteria shown in the right hand column of **Table 4.2**.

| Table 4.2. Level 1 and Level 2 Infiltration Design Guidelines | |
|---|---|
| **Level 1 Design (RR:50)** | **Level 2 Design (RR:90)** |
| Sizing: Tv = (1*Rv*A)/12 | Sizing: Tv = (1.1*Rv*A)/12 |
| At least two forms of pre-treatment (see **Table 4.4**) | At least three forms of pre-treatment (see **Table 4.4**) |
| Soil infiltration rate > 0.5 in/hr & <1 in/hr<br>1 test hole/50 linear ft, minimum of 2 (see Appendix **B**) | Soil infiltration rates of 1.0 to 4.0 in/hr<br>1 test hole/50 linear ft, minimum of 2 (see Appendix **B**) |
| Minimum of 2 feet between the bottom of the infiltration practice and the seasonal high water table or bedrock (**Section 4.1**) | |
| $T_v$ infiltrates within 48 hours (**Section 4.3**) | |
| Setbacks – see suggested minimum setbacks **(Section 4.1)** | |
| All Designs are subject to hotspot runoff restrictions/prohibitions | |

## SECTION 4: TYPICAL DETAILS

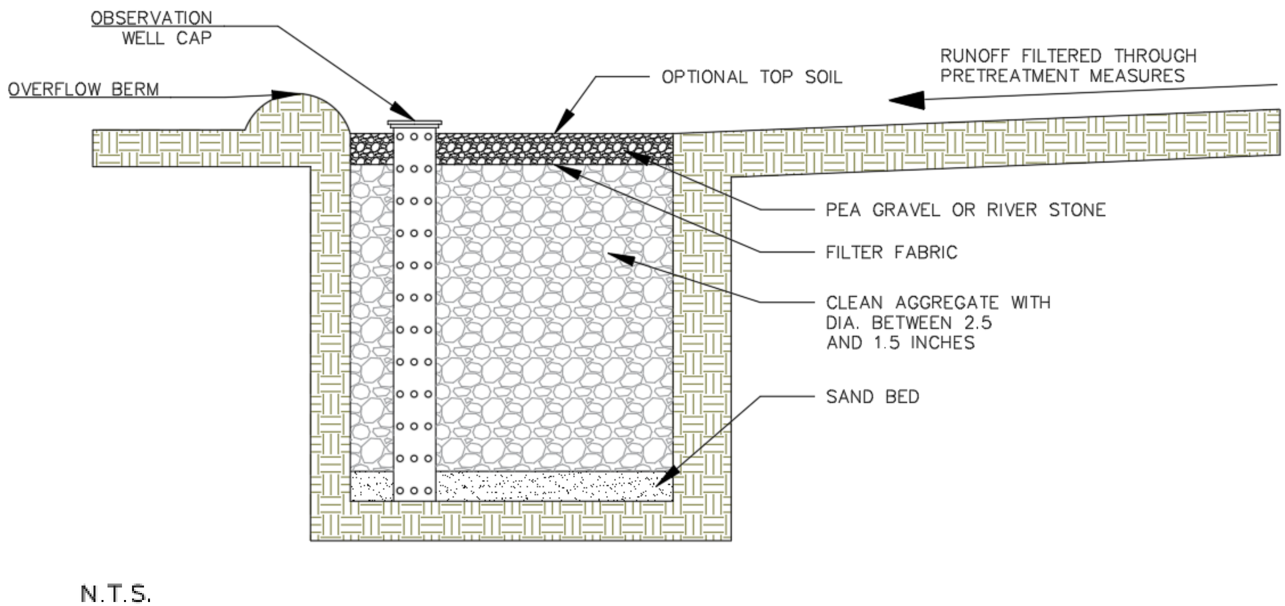
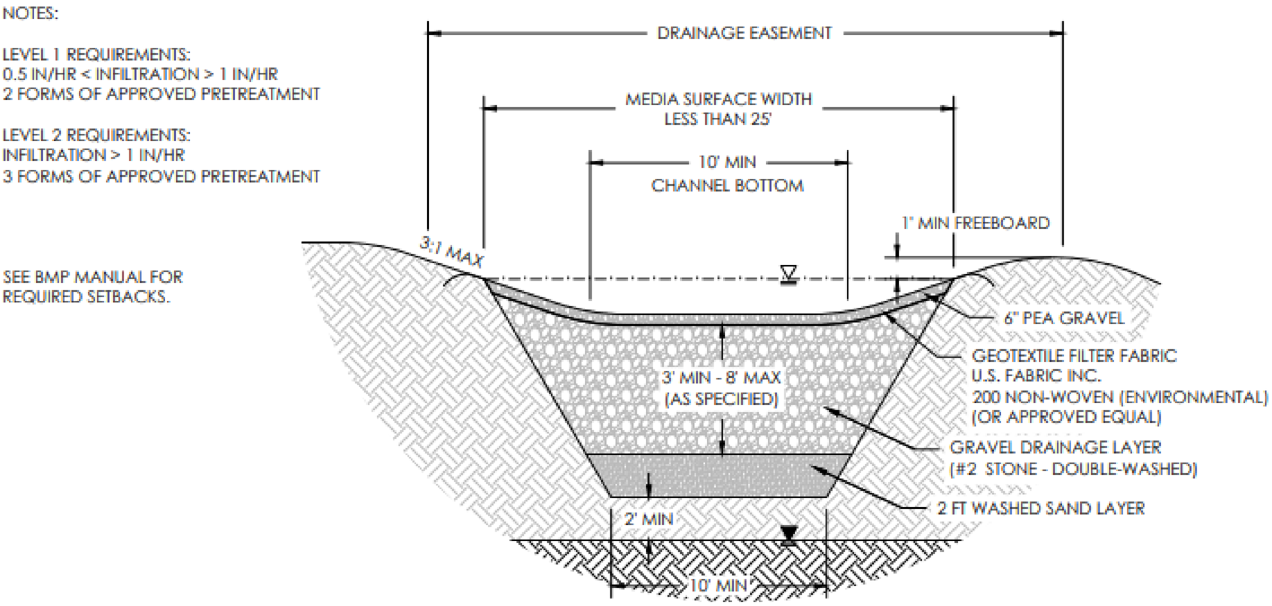
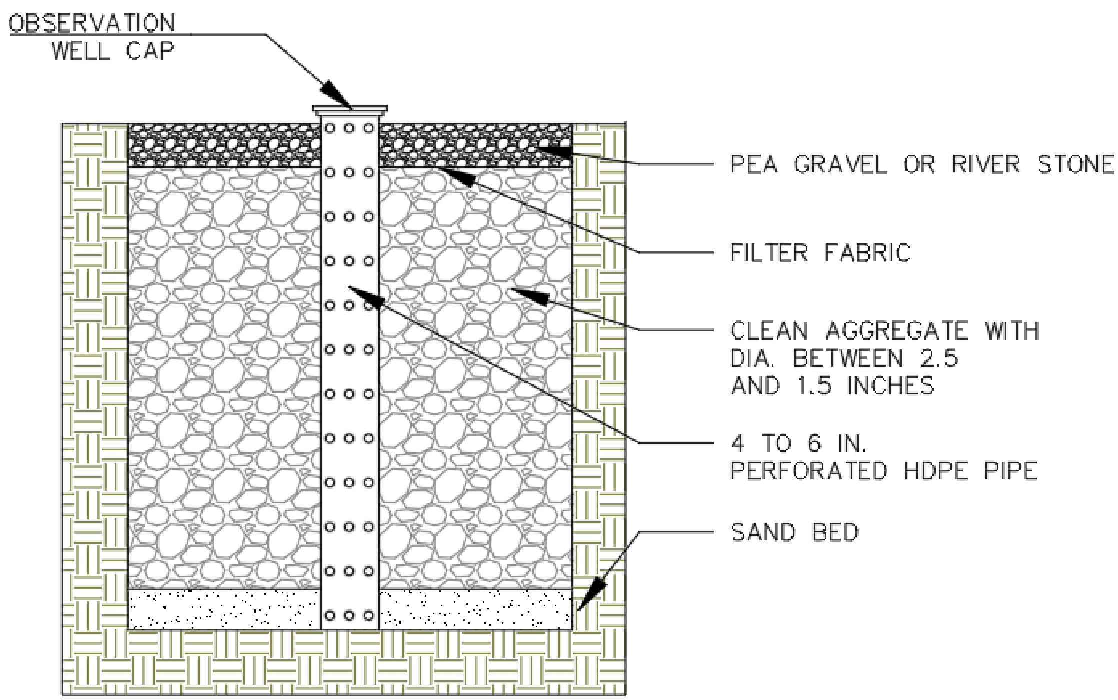



***Figure 4.1. Typical Infiltration Trench Section***




N.T.S.

***Figure 4.2. Typical Infiltration Trench Detail***




N.T.S.

***Figure 4.3. Observation Well Typical Section***

## SECTION 5: PHYSICAL FEASIBILITY & DESIGN APPLICATION

Infiltration trenches are generally suited for medium-to-high density residential, commercial and institutional developments where the subsoil is sufficiently permeable to provide a reasonable infiltration rate and the water table is low enough to prevent groundwater contamination. They are applicable primarily for impervious areas where there are not high levels of fine particulates (clay/silt soils) in the runoff and should only be considered for sites where the sediment load is relatively low

***Accessibility.*** Infiltration trenches require periodic maintenance and shall be accessible to various types of equipment. A path of travel for equipment no less than 12 feet in width shall be provided for the infiltration trench. Each infiltration trench shall have one point of vehicle access.

***Applications.*** Infiltration trenches can either be used to capture sheet flow from a drainage area or function as an off-line device. Due to the relatively narrow shape, infiltration trenches can be adapted to many different types of sites and can be utilized in retrofit situations. Unlike some other structural stormwater controls, they can easily fit into the margin, perimeter, or other unused areas of developed sites. To reduce the potential for costly maintenance and/or system reconstruction, it is strongly recommended that the trench be located in an open or lawn area, with the top of the structure as close to the ground surface as possible. Infiltration trenches shall not be located beneath paved surfaces, such as parking lots

***Contributing Drainage Area (CDA).*** Infiltration trenches work best with smaller contributing drainage areas, where it is easier to achieve flow distribution over the filter bed without experiencing erosive velocities and excessive ponding times. Infiltration trenches shall have a total contributing drainage area of 5 acres or less.

***Curb Cuts.*** If curb cuts are to be used in the design of the infiltration trench, the designer shall provide calculation showing the curb cut can safely pass the 10 year storm event.

***Floodplains.*** Infiltration trench should be constructed outside the limits of the 100-year floodplain. While not prohibited from use in floodplain areas, designers should be aware of the resulting increased maintenance burden for the property owner.

***Irrigation.*** The planned infiltration trench should not receive baseflow, irrigation water, chlorinated wash-water or other such flows that are not stormwater runoff, except for irrigation as necessary for the survival of plantings within the infiltration trench. If irrigation is to be placed within the infiltration trench footprint, an irrigation plan shall be submitted to the City for review and approval. A soil moisture sensor shall be included in all irrigation plans submitted.

***Setbacks.*** Suggested minimum setback requirements for infiltration trench facilities:

- From a property line – 10 feet
- From a building foundation – 25 feet
- From a private well – 100 feet
- From a public water supply well – 1,200 feet
- From a septic system tank/leach field – 100 feet
- From surface waters – 100 feet
- From surface drinking water sources – 400 feet (100 feet for a tributary)
- From adjacent hardscapes – 5 feet (minimum) or the depth of the infiltration trench

***Subsurface Constraints.*** There shall be at least 2 feet between the bottom of the infiltration trench and the elevation of the seasonally high water table.

***Utilities.*** Designers should ensure that future tree canopy growth in the infiltration trench will not interfere with existing overhead utility lines. Interference with underground utilities and any associated utility easements shall also be avoided, particularly water and sewer lines. No below-grade utilities are allowed within the footprint of infiltration trench, including pretreatment. No overhead utilities are allowed over the infiltration trenches incorporating tree plantings.

# SECTION 6: DESIGN CRITERIA

## 6.1 SIZING OF INFILTRATION TRENCHES

The major design goal for infiltration is to maximize runoff volume reduction. To this end, designers may choose to go with the baseline design (Level 1) or choose an enhanced design (Level 2) that maximizes runoff reduction. To qualify for Level 2, the infiltration practice must meet all the design criteria shown in the right hand column of **Table 4.2**.

### 6.1.1 Stormwater Quality

Sizing of the surface area (SA) for the infiltration trench id based on the computed treatment volume (Tv) for the contributing drainage area and the storage provided in the facility. The required surface area (in square feet) is computed as the Treatment Volume (in cubic feet) divided by the equivalent storage depth (in feet). The equivalent storage depth is computed as the depth of gravel, media, and surface ponding (in feet) multiplied by the accepted porosity. See **Table 4.3** below for accepted porosities.

| Table 4.3. Infiltration Trench Accepted Porosities | | |
|---|---|---|
| | **Minimum Depth Required (inches)** | **Porosity Value (n)** |
| Reservoir | 36-96 inches | 0.40 |

Use the following equation to calculate the required reservoir depth:

*Equation 5.1. Required Depth of Reservoir Layer*

$$\mathrm{D_{r-req}} = \frac{\mathrm{T_{v-req}}}{\mathrm{SA} * \mathrm{n}}$$

Where:

$\mathrm{D_{r-req}}$ = The required depth of the reservoir layer (ft); 36 inch minimum
$\mathrm{T_{v-req}}$ = The required treatment volume (cu. Ft.)
SA = The surface area of the infiltration trench (sq. ft.); 25- foot maximum width
n = The porosity of the reservoir layer

The maximum allowable depth of the reservoir layer is constrained by the allowable drain time, which is calculate using **Equation 4.2.**

*Equation 4.2. Maximum Depth of Reservoir Layer*

$$D_{r-max} = \frac{(\frac{i}{2} * t_d)}{n}$$

Where:
$D_{r-max}$ = The maximum depth of the reservoir layer (ft.)
$i$ = The field-verified infiltration rate for native soils (ft./day); slowest infiltration rate shall be used
$t_d$ = The maximum allowable time to drain the reservoir layer; typically, 24 to 48 hours
n = The porosity of the reservoir layer

The required depth of the reservoir layer ($\mathrm{D_{r-req}}$) must not exceed the maximum depth of the reservoir layer ($D_{r-max}$).

### 6.1.2 Stormwater Quantity

It is recommended that rain events larger than the 1 inch storm bypass infiltration trench to prevent additional maintenance burden. If designed with sufficient volume and appropriate outlet structures, designers can utilize the infiltration trench as both water quality and peak flow attenuation.

***Surface Storage.*** The ponding depth for any infiltration trench within the any storm event shall be a maximum of 12 inches.

***Subsurface Storage.*** Additional volume can be provided for peak flow attenuation by increasing the depth of the media or stone. Additional subsurface storage will not be allowed without sufficient infiltration rates. The maximum excavation depth is 10 feet.

***Adjusted CN.*** The removal of volume by infiltration trench changes the runoff depth entering downstream flood control facilities. An approximate approach to accounting for this in reducing the size of peak flow detention facilities is to calculate an "effective SCS curve number" ($CN_{adj}$), which is less than the actual curve number (CN). $CN_{adj}$ can then be used in hydrologic calculations and in routing. The method can also be used for other hydrologic methods in which a reduction in runoff volume is possible.

***Hydraulic Modeling Requirements.*** Due to the variability of infiltration rates over time, specific rates of infiltration shall not to be utilized in hydraulic modeling for detention facilities. Where underdrains are utilized, they shall be included in hydraulic modeling, with only the "sump" portion below the underdrain being completely removed from the downstream runoff volume. Note that for design calculations and sizing of detention facilities to be accurate, infiltration must be confirmed by on-site infiltration testing. The infiltration trench shall be modeled using an equivalent volume based on the equivalent depth calculation. The underdrain shall be modeled as an equivalent orifice.

## 6.2 SOIL INFILTRATION RATE TESTING

To be suitable for infiltration, underlying soils shall have an infiltration rate of greater than 0.5 inches per hour, as initially determined from NRCS soil textural classification and subsequently confirmed by field geotechnical tests. The minimum geotechnical testing is one test hole per 50 linear feet, with a minimum of two borings per facility (taken within the proposed limits of the facility). Infiltration trenches cannot be used in fill soils. Clay lenses, bedrock or other restrictive layers below the bottom of the trench will reduce infiltration rates unless excavated.

On-site soil infiltration rate testing procedures are outlined in **Appendix B**. The number of soil tests varies base on the size of the infiltration trench:

- $< 1{,}000$ ft$^2$ = 2 tests
- 1,000 – 10,000 ft$^2$ = 4 tests
- $>10{,}000$ ft$^2$ = 4 tests + 1 test for every additional 5,000 ft$^2$

The bottom sump elevation of the infiltration trench must be at least two feet above bedrock and the seasonally high groundwater table. If, during construction, infiltration rates are suspected to have decreased due to machinery, material storage, or other causes of compaction of the underlying soils, additional infiltration testing may be required to verify pre-construction infiltration rates have not been reduced.

### 6.3 BMP GEOMETRY

Infiltration trenches are designed for intermittent flow and must be allowed to drain and allow aeration of the surrounding soil between rainfall events. They must not be used on sites with a continuous flow from groundwater, sump pumps, or other sources. Infiltration trenches shall fully dewater within 48 hours of the preceding rain event. The infiltration trench shall be designed to fully dewater the entire Tv within 24 to 48 hours after a rainfall event. The slowest infiltration rate obtained from tests performed at the site shall be used in the design calculations. Trench depths should be between 3 and 8 feet, to provide for easier maintenance. The width of a trench shall be less than 25 feet. The bottom slope of a trench shall be flat across its length and width to evenly distribute flows, encourage uniform infiltration through the bottom, and reduce the risk of clogging.

Broader, shallow trenches reduce the risk of clogging by spreading the flow over a larger area for infiltration. The surface area required is calculated based on the trench depth, soil infiltration rate, aggregate void space, and fill time (assume a fill time of 2 hours for most designs).

### 6.4 PRETREATMENT

Pretreatment facilities shall always be used in conjunction with an infiltration trench to prevent clogging and failure. Details and design criteria for pretreatment measures for infiltration trenches can be found in **Appendix A**.

Every infiltration practice must include multiple pretreatment techniques, although the nature of pretreatment practices depends on the scale at which infiltration is applied. The number, volume and type of acceptable pretreatment techniques needed for the two scales of infiltration are provided in **Table 4.4**.

**Table 4.4. Required Pretreatment Elements for Infiltration Practices**

| Pretreatment[1] | Level of Infiltration Trench | |
|---|---|---|
| | **Level 1 Infiltration** | **Level 2 Infiltration** |
| **Number and Volume of Pretreatment Techniques Employed** | **2** techniques; **15%** minimum pretreatment volume required (exclusive). | **3** techniques; **25%** minimum pretreatment volume required (exclusive); at least **one** separate pre-treatment cell. |
| **Acceptable Pretreatment Techniques** | Grass filter strip<br>Grass channel<br>Gravel diaphragm | Sediment trap cell<br>Sand filter cell<br>Grass filter strip<br>Gravel diaphragm |

[1] A minimum of 50% of the runoff reduction volume must be pre-treated by a filtering or bioretention practice *prior* to infiltration *if* the site is a restricted stormwater hotspot

For a trench receiving sheet flow from an adjacent drainage area, the pretreatment system shall consist of a vegetated filter strip with a minimum 25-foot length. A vegetated buffer strip around the entire trench is required if the facility is receiving runoff from both directions. If the infiltration rate for the underlying soils is greater than 2 inches per hour, 50% of the Tv should be pretreated by another method prior to reaching the infiltration trench.

For an off-line configuration, or concentrated flow, pretreatment shall consist of a sediment forebay, vault, plunge pool, or similar sedimentation chamber (with energy dissipaters) sized to 25% of the storage volume (Tv). Exit velocities from the pretreatment chamber shall be nonerosive for the 2-year design storm.

### 6.5 CONVEYANCE AND OVERFLOW

Outlet structures are not required for infiltration trenches. If an outlet structure is utilized, the structure shall be placed outside the footprint of the infiltration trench. Typically for off-line designs, there is no need for an emergency spillway. However, a nonerosive overflow channel shall be provided to safely pass flows that exceed the storage capacity of the trench to a stabilized downstream area or watercourse.

***On-line Infiltration Trench.*** An overflow structure shall always be incorporated into on-line designs to safely convey larger storms through the infiltration trench. The following criteria apply to overflow structures:

- The overflow associated with the 100-year design storms should be controlled so that velocities are non-erosive at the outlet point (i.e., to prevent downstream erosion).
- A common overflow system within infiltration practices consists of an outlet structure, which is scaled for the application, where the top of the structure is placed at the maximum water surface elevation of the infiltration trench (typically 6 inches above the surface of the filter bed).
- A trench shall be designed to fully dewater the entire Tv within 24 to 48 hours after a rainfall event. If used for both quality and quantity design, the infiltration trench shall fully dewater in 48 hours in the 100-year storm event. The slowest infiltration rate obtained from tests performed at the site should be used in the design calculations.

***Off-line Infiltration Trench.*** Off-line designs are preferred. One common approach is to create an alternate flow path at the inflow point into the structure such that when the maximum ponding depth is reached, the incoming flow is diverted past the facility. In this case, the higher flows do not pass over the filter bed and through the facility, and additional flow is able to enter as the ponding water filtrates through the soil media.

Another option is to utilize a low-flow diversion or flow splitter at the inlet to allow only the Treatment Volume to enter the facility. This may be achieved with a weir or curb opening sized for the target flow, in combination with a bypass channel. Using a weir or curb opening helps minimize clogging and reduces the frequency of required maintenance. Using differing pipe elevations is not an approved method to achieve flow splitting.

### 6.6 OBSERVATION WELL

An observation well must be installed in every infiltration trench and should consist of a perforated PVC or HDPE pipe, 4 to 6 inches in diameter, extending to the bottom of the trench (see **Figure 4.2** for a schematic of an observation well). The observation well will show the rate of dewatering after a storm, as well as provide a means of determining sediment levels at the bottom and when the filter fabric at the top is clogged and maintenance is needed. It should be installed along the centerline of the structure, flush with the ground elevation of the trench. A visible floating marker should be provided to indicate the water level. The top of the well should be capped and locked to discourage vandalism and tampering.

### 6.7 MATERIAL SPECIFICATION

The stone aggregate used in the trench should be washed, bank-run gravel, 1.5 to 2.5 inches in diameter with a porosity of about 40%. Aggregate contaminated with soil shall not be used. A 6-inch layer of clean, washed sand is placed on the bottom of the trench to encourage drainage and prevent compaction of the native soil while the stone aggregate is added.

A top layer of filter fabric is located 2 to 6 inches from the top of the trench and serves to prevent sediment from passing into the stone aggregate. Since this top layer serves as a sediment barrier, it will need to be replaced more frequently and must be readily separated from the side sections. The top surface of the infiltration trench above the filter fabric is typically covered with pea gravel. The pea gravel layer improves sediment filtering and maximizes the pollutant removal in the top of the trench. In addition, it can easily be removed and replaced should the device begin to clog. Alternatively, the trench can be covered with permeable topsoil and seeded with grass in a landscaped area. Vegetated filter strips and buffers should fit into and blend with surrounding area. Native grasses are preferable, if compatible. The trench may be covered with permeable topsoil and planted with grass in a landscaped area. If sod is to be used it shall be a sand based or washed sod product.

**Table 4.5. Infiltration Trench Material Specifications**

| Material | Specification | Notes |
|---|---|---|
| **Surface Layer** | River Stone<br>Turf (Seeded not sodded) | Lay a 3 inch layer on the surface of the filter bed to suppress weeds and prevent erosion |
| **Filter Fabric** | Use a non-woven geotextile fabric with a flow rate of >110 gal./min./ft$^2$ | Apply to sides and below surface cover. Meet AASHTO M288-06, ASTM D4491 & D4751 standards |
| **Gravel Drainage Layer** | #57 or #2 clean washed stone | Meet TDOT Construction Specifications |
| **Choker Layer** | 6-inch layer of clean, washed sand or # 8 or # 89 stone | Meet TDOT Construction Specifications |
| **Observation Wells** | 6 inch PVC or HDPE pope with vented cap | Install one per 50 feet of length of the infiltration trench (minimum 1) |

## SECTION 7: SPECIAL CASE DESIGN APPLICATION

### 7.1 SHALLOW BEDROCK AND GROUNDWATER CONNECTIVITY

Many parts of Franklin have shallow bedrock and groundwater, which can constrain the application of deeper infiltration trenches (particularly Level 2 designs). If bedrock or groundwater is encountered during subsurface testing for the construction of the bioretention area, the bottom sump elevation of the infiltration trench design shall be above the lowest bedrock/refusal or groundwater elevation encountered in subsurface testing. Bedrock removal should be limited to unexpected outcroppings and rises not encountered in subsurface testing.

Note that planned removal of bedrock is not desirable and should be utilized only when all other design possibilities have been exhausted. Where a hardship can be show and all other possibilities have been exhausted, a stormwater variance for bedrock removal may be granted on a case-by-case basis.

In cases where the reduced curve number method is to be utilized in stormwater quantity calculations, the bottom sump elevation shall be a minimum of 2 feet above existing bedrock elevations.

### 7.2 KARST

Karst regions are found in much of Middle Tennessee. Infiltrative practices, such as infiltration trenches, shall not be used in any areas with high risk of sinkhole formations or in areas of know sinkholes.

### 7.3 SITE SPECIFIC LIMITATIONS

Some sites may have areas identified as site specific limitations to infiltration of stormwater runoff. Site specific limitations shall be determined by the City engineer and approved through the Stormwater variance process. Sites with brownfield permits are an example of site specific limitations. Site specific limitations cannot be self-imposed or be caused by requirements within the City Ordinance. It should be noted that the site specific limitation may only occupy a portion of the entire proposed use, and that some "clean" areas (such as rooftops) can be diverted away to another infiltration or runoff reduction practice. Development proposals should be carefully reviewed to determine if any future operation, on all or part of the site, will be designated as a potential site specific limitation. Based on this designation, infiltration may be restricted or prohibited.

## SECTION 8: CONSTRUCTION

The trench excavation should be limited to the width and depth specified in the design. Excavated material should be placed away from the open trench so as not to jeopardize the stability of the trench sidewalls. The bottom of the excavated trench shall not be loaded in a way that causes soil compaction and should be scarified prior to placement of sand. The sides of the trench shall be trimmed of all large roots. The sidewalls shall be uniform with no voids and scarified prior to backfilling. All infiltration trench facilities shall be protected during site construction and should be constructed after upstream areas have been stabilized.

Unless otherwise approved by the City of Franklin Engineering Department the following installation steps shall be required of the person(s) installing the water quality BMPs located on this site. Failure to adhere to the following procedures may require reinstallation, reconstruction, or replacement of part or whole sections of the water quality BMP as well as denial of bond reductions and/or releases. Please contact the City's Engineering Department or your EPSC inspector for guidance if parts of this procedure are not applicable to a BMP that you are installing.

*Step 1.* Construction of the trench area may only begin after the entire contributing drainage area has been stabilized with vegetation. It may be necessary to block certain curbs or other inlets while the area is being constructed. The proposed site should be checked for existing utilities prior to any excavation.

*Step 2*. Contractor is to provide method of diverting runoff flow around the construction of the infiltration trench area during periods of rainfall to ensure sediment does not enter aruea. EPSC measures may need to be utilized during the installation. Construction materials that are contaminated by sediments must be removed and replaced with clean materials.

*Step 3.* Excavate infiltration trench area. Excavators or backhoes should work from the sides to excavate the area to the design depth and dimensions. Excavating equipment should have scoops with adequate reach so they do not sit inside the footprint of the area. If heavy rainfall occurs while the trench is open the soil shall be scarified/raked to ensure the surrounding soils have not been smeared.

*Step 4.* Scarify subgrade by ripping the bottom soils to a depth of 12" prior to stone placement.

*Step 5.* CALL CITY OF FRANKLIN INSPECTOR FOR INSPECTION 615-791-3218.

*Step 6*. Install washed stone layer. Install underdrain pipes and connect to the outlet structure. Install additional stone on the underdrain pipes as per the infiltration trench section detail. Contractor to flag the underdrain locations (3' each side) as the additional sections are being installed. A small loader is to be used for placement of additional sections and is to avoid accessing the areas of the underdrain pipe installation to prevent damage to the perforated pipe.

*Step 7.* CALL CITY OF FRANKLIN INSPECTOR FOR INSPECTION 615-791-3218.

*Step 8.* Install permeable geotextile fabric.

*Step 9.* Backfill with media that is specified.

*Step 10*. Contractor to flag limits of BMP for survey to locate and show on AS-BUILT plans.

## SECTION 9: AS-BUILT REQUIREMENTS

As-built and certification requirements can be found in **Appendix D.** Please reference the appendix, as required components of the as-built differ from measure to measure.

## SECTION 10: OPERATION & MAINTENANCE

### 10.1 MAINTENANCE DOCUMENT

Each BMP must have a City of Franklin Long Term Maintenance Plan (LTMP) Agreement submitted for approval and maintained and updated by the BMP owner. The LTMP Agreement must be completed and submitted to the City with the grading permit application. The LTMP Agreement is for the use of the BMP owner in performing routine inspections. The developer/owner is responsible for the cost of maintenance and annual inspections. The BMP owner must maintain and update the BMP operations and maintenance plan.

### 10.2 MAINTENANCE INSPECTIONS

It is highly recommended that spring maintenance inspections and a cleanup is conducted at the infiltration trench yearly. The following is a list of some key maintenance items to look for:

- Check to see if 75% to 90% cover (stone or vegetative cover) has been achieved in the bed and measure the depth of the remaining stone. If the stone layer is less than 3 inches, additional stone is required.
- Check for sediment buildup at inflow points, curb cuts, gravel diaphragms or pavement edges that prevents flow from reaching the filter bed, and check for other signs of bypassing. Remove accumulated sediment.
- Check for any winter- or salt-killed vegetation and replace.
- Note presence of accumulated sand, sediment and trash in the pretreatment cell or filter beds and remove it.
- Inspect infiltration trench side slopes and grass filter strips for evidence of any rill or gully erosion, and repair and stabilize any erosion issues found.
- Check the infiltration trench for evidence of excessive ponding or concentrated flows and take appropriate remedial action.
- Look for any bare soil or sediment sources in the contributing drainage area and stabilize them immediately.
- Check observation wells following 3 days of dry weather. Failure to percolate within this time period indicates clogging.
- Remove trees and other unwanted vegetation that starts to grow in the vicinity of the trench.
- Excavate trench walls to expose clean soil.

### 10.3 ROUTINE AND NON-ROUTINE MAINTENANCE TASKS

The most common non-routine maintenance problem involves standing water for longer than 24-48 hours. If water remains on the surface for longer than 24 hours after a preceding rain event, the infiltration trench is no longer functioning as designed. The following are several methods to remediate the ponding water.

- Replace pea gravel/topsoil and top surface filter fabric when clogged.
- Perform total rehabilitation of the trench to maintain design storage capacity.