Inspection of Stormwater Treatment Measures During and After Construction

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Overview

- Pictures of Landscape-Based Stormwater Treatment Controls
- Checklists
- Design & Installation
- Operation and Maintenance
- Q&A - Discussion

Bioretention

Bioretention

Bioretention

Vegetated Swale

Thick Low-Growing Vegetation

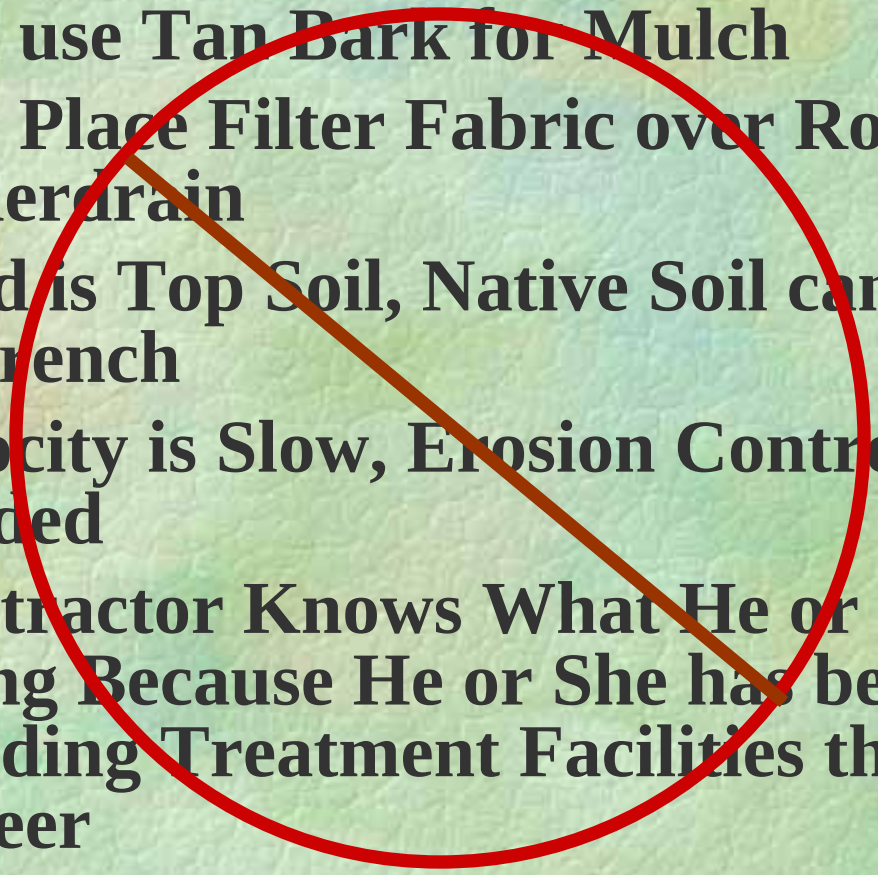
- **Heavy Vegetation**
- **Use a Sandy Loam Base, Not Native Clay Soils.**

Treatment is a New Concept Avoid Misunderstandings

- Engineers are Generating New Details
- These Details are Often Taken from Previous Job
- Reviewers have no Standard to Use for Review
- Inspectors do not Have Reference Point
- Contractors do Whatever is Least Expensive

Typical Misunderstandings

- Want non-vegetated flow path
- Can use Tan Bark for Mulch
- Can Place Filter Fabric over Rock Underdrain
- Sand is Top Soil, Native Soil can be Placed in Trench
- Velocity is Slow, Erosion Control is Not Needed
- Contractor Knows What He or She is Doing Because He or She has been Building Treatment Facilities their Whole Career



Big Picture
Treatment Control Measures

- **Treat Pollutants through:**
  - **Settling**
  - **Filtration**
  - **Biological Uptake, and**
  - **Adsorption.**

Landscape-Based Treatment Measures

- **Self-Treating Landscape**
  - **No Impervious Surface, No additional Treatment Measures are Necessary**
- **Treatment Measure**
  - **Impervious Surfaces are Conveyed to the Treatment Facility where the Flows are Treated**

Landscape-Based Treatment Measures

- Bioretention
- Flow Through Planter
- Tree Well
- Vegetated Swale
- Buffer Strip
- Extended Detention Basin
- Infiltration Trench
- Media Filter

Landscape-Based Treatment Measures

Vocabulary

- Curb Opening
- Pop-up Emitter
- Beehive Inlet
- Subdrain

Inspection Items
1. Curb Opening

- Note that Grass Partially Blocks Opening
- Rock Should be Used to Keep Opening Clear.
- Keep Vegetation Away from Inlet Location

Inspection Items
2. Subdrain

- If Concrete Bottom, Slope Point to a Collection Point.
- Collect Runoff at Lowest Point
- Perforated Holes Pointed Downward

Photo by Peter Schultze-Allen

Inspection Item
3. Outlet Works

Bee Hive Opening

- **Interior Orifice Used to Detain Flow at this Location**
- **Not Needed for Treatment Purposes**

Inspection Item
4. Basin Inlet

Pop-Up Emitter
From NDS PRO Website

Erosion Protection Around Discharge Point

Phases of Construction

- **Prior to Construction of Treatment Measure (Pre-Construction)**
  - **No Grading of the Treatment Measure has Occurred**
- **Rough Grading of Treatment Area**
  - **Initial Grading has Occurred, Facilities are poorly Defined**
- **Structures**
  - **Facilities are Defined**
- **Landscaping**
  - **Planting is Complete**
- **Final Inspection**
  - **The System in Functional**

Inspection 1
Prior to Start of Construction of Treatment Measure

- **Initial Inspection of Treatment Measure Site**
  - **Layout Area – Does it Work in 3-D**
  - **Is the Outfall Pipe Deep Enough to Support an Underdrain**
  - **Will there be Utility Conflicts?**
- **Potential Problems**
  - **Tree not Shown on Survey in Treatment Area**
  - **Utility Pole Guy Wires in Middle of Treatment Area**

Inspection 1
Prior to Construction of Treatment Measure

- **Actions**
  - **View Staked Layout of Treatment Facility**
  - **View Storm Drain Connection Point**
  - **Field Measure to Check Reasonableness of Gravity Outflow**

Inspection 2
Rough Grading of Treatment Area

- **Make Contractor Follow SWPPP – Even in Treatment Areas**
- **Typically Two Contractors Involved, First Does Rough Grade, Second does Planting and Final Grading**
  - **Check that Rough Grades are with Specified Materials**

Rough Grade

Inspection 2
Rough Grading of Treatment Area

- Contractor Coordination
- Define Finished Grade by Phase
- If Sod Used, Does Rough Grade Allow for Placement of Sod Layer

Inspection 3
Structural

- Inlet with Erosion Protection
- Outlet with Erosion Protection
- Trash Grate
- Access Path for Maintenance
- Cleanouts Accessible

Inspection 4
Vegetation

- **Important – Covered by Others**

Inspection 5
Final Inspection

- **Check Maintenance Form from Stormwater Management Plan**
- **Positive Drainage to Maintenance Facility**
- **Curb Openings have Adequate Fall into Treatment – Will Vegetation Act as Dam to Inflow**

Inspection 5
Final Inspection

- **Check that the Treatment Facility has Survived the Construction Period**
- **Has Sediment Plugged the Sand Soil Material**
- **Have Inlet or Outlet Structures been Damaged**

Bioretention & Flow Through Planter

- **Vegetated Area is the Desired Project**
- **Planter Area undulates with the bottom varying by about 4 inches Vertical from the low point to the high point.**
- **Breaks in Bioretention are Allowed. Bridges, Curb Drains, Paving Stones, etc.**
- **Under Drain – Perforations Point Downwards**
- **No Filter Fabric between Sand and Drain Rock**

Bioretention & Flow Through Planter

- **Waterproofing is Critical if Near a Building – Inspect to Ensure Waterproofing is Properly Applied**
- **Rough Grades needed to Allow for Planting**
- **Bottom of Bioretention Area Must be Able to Drain. Outlet Pipe should be at Bottom. If at Side, Is there a Way to Get Bottom to Drain? Avoid Mold Problems Associated with Moist Environment**
- **If Concrete or Other Impervious Bottom Is Used, Drain Bottom to Outlet Pipe.**

Tree Wells

- **Waterproofing is Critical to Below Grade of Sub-base of Roadway**
- **Bottom of Tree Well Must be Able to Drain. Avoid Mold Problems Associated with Moist Environment.**
- **If Bottom of Well is in Ground, No Additional Measures are Required. If Concrete Bottom, an Outlet is Needed at the Low Point.**

Testing

- **Contractor shall demonstrate the in-situ percolation of each treatment facility for design storm flows through the installed soil to the satisfaction of the Authority Having Jurisdiction.**

- **Wet Soil Prior to Testing. Upper 4 inches should be Wetted Prior to Testing**

Testing

- **For Bioretention, Tree-Filter and Flow-through Planter:**
  - **The material shall have an onsite tested percolation rate of 5 to 10 inches per hour.**
  - **In-field percolation test shall consist of a 1-foot diameter pipe, 2.5 feet long pipe, driven 1.5 feet deep into dewatering soils. Pipe shall be filled with 1 foot of water after facility has been wetted.**
  - **The pipe should empty 1 foot of water above the wetted soil layer in less than 2 hours, 24 Minutes. Contractor shall provide records of percolation tests to city inspector.**

Testing

- **For Vegetated Swale:**
  - **The material shall have an onsite tested percolation rate of 2 to 10 inches per hour.**
  - **In-field percolation test shall consist of a 1-foot diameter pipe, 2.5 feet long pipe, driven 1.5 feet deep into dewatering soils. Pipe shall be filled with 1 foot of water after facility has been wetted.**
  - **The pipe should empty 1 foot of water above the wetted soil layer in less than 6 hours. Contractor shall provide records of percolation tests to city inspector.**

Testing

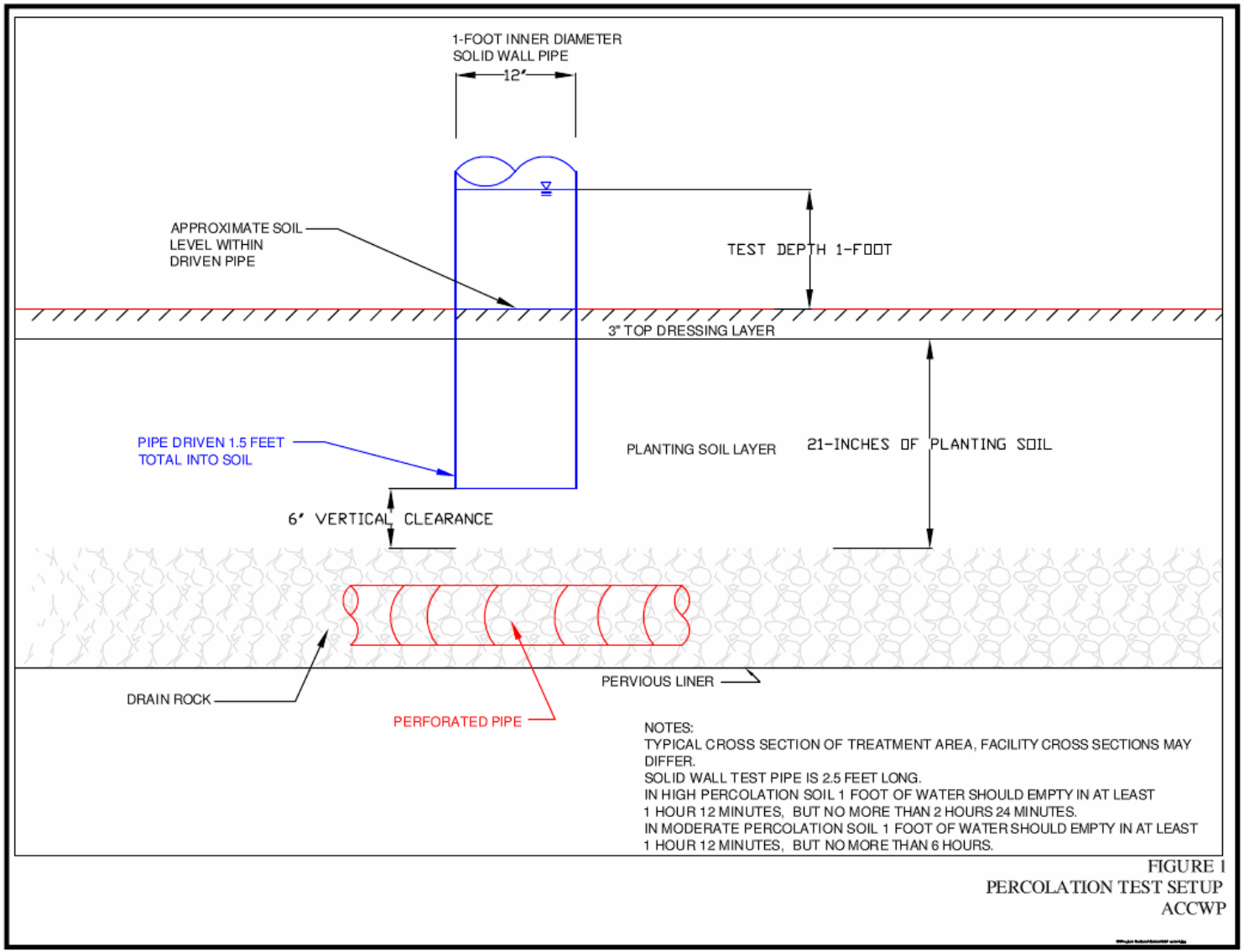


FIGURE 1
PERCOLATION TEST SETUP
ACCWP

Vegetated Swale

- **Thick Vegetation is the Desired Project**
- **Breaks in the Swale are Allowed. Bridges, Curb Drains, Paving Stones, etc.**
- **Under Drain – Perforations Point Downwards**
- **Check Dams – Spill Point is Protected. Runoff will not Run Around Check Dam**

Vegetated Swale

- **Fill Swale with Water – Place Hose Outside of Swale**
- **Requirements:**
  - **Mulch Must Be Stable – No Good if it Floats or is Conveyed Downstream**
  - **Water Must Percolate – No Good if Ponding Observed 30 Minutes After Water is Shut Off**
  - **Water Must be Able to Get Into Swale – No Good If Water Ponds on Pavement, Vegetation Acts as Dam, Water Bypasses Facility**

Infiltration Basin

- **Runoff Must be able to Flow Freely into Infiltration Basin**
- **Drainage area to the Infiltration Basin Must be Stabilized to Prevent Erosion**
- **During Construction, Keep Sediment Out of Basin.**
- **Following Construction, Remove Sediment from Basin.**
- **If Pre-Treatment Used, Check that Pre-Treatment Measure is Functioning.**

Media Filter

- Manufacturer Certification must be Provided.
- High Flow Bypass is Connected and Functional.
- Access must be Sufficient for Maintenance.
- Check Manufacturer’s Installation Guidelines.

Buffer Strips

- **Vegetated Area Adjacent to Impervious Area is Desired Product**
- **Planting Area should Match Compaction of Native Soils**
- **Distribute Flow Evenly to Treatment Area**

Extended Detention Basin

- **Key Items**
  - **Groundwater Levels**
  - **Side Slopes**
  - **Safety Bench**
  - **Pre-Treatment**
  - **Maintenance Ramp**
  - **Forebay**
  - **Liner**

Inspection

- **Follow Construction Checklist**
- **Inspect at Various Project Phases**
- **Checklist is Available at:**

http://cleanwaterprogram.org/businesses_developers.htm

QUESTIONS?