**Construction Inspection Checklist for Bioretention Cells**

# Introduction

Proper construction of permanent stormwater best management practices (BMPs) is essential to assure that BMPs achieve the objectives they are designed for; namely reducing the amount of stormwater runoff and pollution discharged to local lakes, rivers and streams.

This checklist of items for construction inspection is intended to reduce the number of construction errors that typically occur for **bioretention cells** (one type of BMP), which ultimately lead to inadequate BMP performance and/or expensive maintenance and rehabilitation costs to the BMP owner. The checklist that is included in this document should be filled out by an inspector, construction supervisor and/or design engineer throughout the duration of BMP construction to assure that the BMP is installed correctly.

In general, the items in this checklist assume that designs follow those recommended in Volume 3 of the Urban Drainage and Flood Control District Design Criteria Manual. In some locations design criteria may be different and certain items may not apply.

# Pre-Construction

## 1.1 - Pre-Construction Meeting

A pre-construction meeting should be held between design engineers, project managers, contractor foreman and other relevant personnel to discuss important aspects of BMP installation, including (but not limited to) verifying the items outlined in this document.

## 1.2 – Stake BMP Perimeter

Prior to excavation, stake the perimeter of excavation and verify the dimensions match the design drawings.

# Excavation

## 2.1 – Heavy Equipment

Proper excavation assures that the underlying soils are not compacted and that stormwater runoff will be evenly distributed throughout the storage layer to maximize storage capacity and infiltration. Excavation should be performed using equipment and methodologies to minimize compaction of the underlying soils. If possible, use a backhoe/excavator that avoids driving over the excavated area. Alternatively, use low ground pressure equipment is travel over the excavated area is necessary.

## 2.2 – Bottom “Ripping”

If equipment must travel over the excavated area, the bottom of the cell should be “ripped” to a depth 8-12 inches excavating to the appropriate depth. *If using an impermeable liner, these requirement can be ignored.*

## 2.3 – Bottom is Flat and Level

The bottom of the cell should be flat and level to allow for even distribution of water throughout the storage layer. If design calls for a sloped bottom to drain storage layer towards an underdrain, this requirement is not applicable.

## 2.4 – Protection After Excavation

Immediately after excavation is complete, place construction sediment control BMPs around the basin to prevent runoff from entering the cell. Sediment control BMPs should only be removed once the upstream catchment is stabilized.

## 2.5 – Infiltration Testing

If facility is “full-infiltration” design, verify that infiltration rates through bottom of the cell are greater than 0.5 inches/hour. Infiltration tests should be conducted using ASTM D3385 or other method approved by inspector/reviewer. If infiltration rates are less than 0.5 in/hr, notify the project engineer immediately for design review.

# Inlet

## 3.1 – Inlet Installation and Location

Verify that the inlet was installed and that runoff from upstream catchment drains to the inlet(s).

## 3.2 – Inlet Invert Elevation

Verify that the inlet invert elevation is at least 2 inches above the water quality capture volume (WQCV) elevation to allow runoff to enter the BMP unhindered by ponding. 2 inches of “freeboard” allows for some accumulation of trash/sediment and debris near the outlet without reducing inflow.

# Forebay/Energy Dissipation

## 4.1 – Forebay Overflow Elevation

Verify that forebay overflow elevation is at least 2 inches above the filter media elevation to assure that runoff that overflow into the BMP. If design does not specify a forebay, this item is not applicable.

## 4.2 – Forebay Bottom

Verify that the forebay has a concrete bottom to allow for easy maintenance. If design calls for forebay design without concrete bottom, contact the design engineer/reviewer to discuss alternatives. If design does not specify a forebay, this item is not applicable.

## 4.3 – Energy Dissipation

Verify that energy dissipation materials (rip-rap or other) meet design specifications and are installed according to design. If rip rap is placed directly on top of filter media, verify that erosion control matting has been placed between rip rap and filter media to reduce settling.

# Outlet Structure/Overflow

## 5.1 – Outlet Structure/Overflow Elevation

Verify that overflow elevation is according to design drawings and that the distance between the overflow invert and top of the filter media is equal to or greater than the WQCV depth.

# Impermeable Liner

The impermeable liner will prevent runoff from infiltrating into adjacent soils and potentially damaging nearby structures.

## 6.1 - Liner Material

Verify that liner material meets the design specifications and is at least 30 mil thick. Verify that liner has no tears prior to and after placement.

## 6.2 – Liner Attachment

Prior to backfilling, provide at least 2 inches of slack above the attachment points to prevent the liner from tearing due to backfill and settling. After backfilling, verify that liner is attached to a concrete perimeter wall according to design specifications.

# Underdrain System

## 7.1 – Underdrain Pipe

Verify that the underdrain pipe meets design specifications, especially the size and number of slots.

## 7.2 – Underdrain Wrapping

Verify that the underdrain is NOT wrapped (directly) in geotextile fabric to avoid clogging of the underdrain.

## 7.3 – Underdrain Filter

Verify that filter material placed around the underdrain meets the gradation specifications called out in the design. Provide a copy of the filter material gradation test results to design reviewer.

## 7.4 – Cleanout Locations

Verify that at least one cleanout is provided for each underdrain lateral.

## 7.5 – Cleanout Pipe

Verify that cleanout pipes are NOT perforated to avoid short-circuiting of runoff through the cleanout pipes.

## 7.6 – Cleanout Covers

Verify that cleanout covers are installed and watertight.

## 7.7 – Orifice Plate

Verify that the orifice plate is installed at the outlet point of the underdrain system, per design specifications.

# Filter Media

## 8.1 – Filter Media Composition and Mixing

Verify that the filter media meets the material specifications called for in the design. Also verify that the filter media was “machine mixed” by the supplier to assure a homogeneous media. Provide documentation of materials and mixing used by the supplier to the design reviewer.

## 8.2 – Filter Media Installation

Verify that the appropriate depth of filter media is installed and that the top of the filter media is relatively flat to assure an even distribution of runoff over the entire filter media.

# Containment Wall

## 9.1 – Containment Wall

Verify that containment wall is continuous and level so that runoff can pond evenly throughout the bioretention cell.

## 9.2 – Protection from Vehicles

Verify that containment wall provides protection from vehicle traffic/parking, if the bioretention cell is located adjacent to a roadway or parking lot.

# Final Landscaping

## 10.1 – Sand-Grown Sod

If design specifications call for sod as final landscaping, verify that sod is “sand-grown” sod, not “clay-grown” sod. Clay-grown sod is most common, but will reduce the infiltration rate of runoff and create standing water problems.

## 10.2 – Wood/Rock Mulch

If design specifications call for mulch (either rock or wood), verify that mulch is distributed evenly on top of the filter media and at least 2 inches below the inlet invert elevation or forebay overflow elevation. If mulch is placed higher than inlet/forebay over flow elevation, runoff will not be able to enter the bioretention cell. Also verify that wood mulch is “shredded” to avoid displacement of the mulch from ponding runoff.

## 10.3 – Plantings and Vegetation

Verify that plantings and vegetation meet landscaping design specifications.

## 10.4 – Weed Barrier

Verify that NO weed barrier is placed on top of the filter media. Weed barrier will reduce the infiltration rate of runoff and create standing water problems.

## 10.5 – Irrigation

Verify that temporary and/or permanent irrigation is installed according to landscape design plans, to assure establishment of plantings and vegetation.

# Close Out

## 11.1 – Upstream Catchment Stabilization

Verify that construction activities in the upstream catchment have been completed and that landscaped areas have been properly vegetated or otherwise stabilized, prior to removing temporary sediment control BMPs. If the upstream catchment is not stabilized, the bioretention filter media may clog rapidly and require complete replacement of filter media.

## 11.2 – Snow Storage Signage

If bioretention cell is located adjacent to roadway or parking lot, verify that signage is installed to notify snow removal personnel that snow cannot be stored on top of the bioretention cell. If design specifications do not call for signage, consult with design reviewer to determine if signage is required.

**Construction Inspection Checklist for Bioretention Cells**

**Project: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Site: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Inspector: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item/Activity** | **Pass** | **Fail** | **N/A** | **Date** | **Notes** |
| **Pre-Construction** | | | | | | |
| 1.1 | Pre-construction meeting held to discuss BMP installation, inspection and checklist |  |  |  |  |  |
| 1.2 | BMP perimeter verified and staked |  |  |  |  |  |
| **Excavation** | | | | | | |
| 2.1 | Heavy equipment did not travel over bioretention cell during excavation |  |  |  |  |  |
| 2.2 | Bottom of cell was “ripped” after excavation |  |  |  |  |  |
| 2.3 | Bottom of cell is flat and level |  |  |  |  |  |
| 2.4 | Excavated area is protected/surrounded by sediment/runoff control BMPs during construction |  |  |  |  |  |
| 2.5 | Infiltration rate verified (“full-infiltration” design only) |  |  |  |  |  |
| **Inlet** | | | | | | |
| 3.1 | Upstream catchment drains to inlet |  |  |  |  |  |
| 3.2 | Inlet invert elevation is at least 2 inches above containment wall/berm |  |  |  |  |  |

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| **Forebay/Energy Dissipation** | | | | | | |
| 4.1 | Forebay overflow elevation at least 2 inches above filter media |  |  |  |  |  |
| 4.2 | Forebay has concrete bottom |  |  |  |  |  |
| 4.3 | Rip rap meets specifications and erosion control matting placed beneath rip rap |  |  |  |  |  |
| **Outlet/Overflow Structure** | | | | | | |
| 5.1 | Overflow elevation and distance above filter media is verified |  |  |  |  |  |
| **Impermeable Liner** | | | | | | |
| 6.1 | Liner meets design specifications, is at least 30 mil thick and has no tears |  |  |  |  |  |
| 6.2 | Liner is attached to concrete perimeter wall according to design specification and has at least 2 inches slack prior to backfill |  |  |  |  |  |
| **Underdrain System** | | | | | | |
| 7.1 | Verify that underdrain pipe is per design specifications |  |  |  |  |  |
| 7.2 | Verify that underdrain is NOT wrapped in geotextile fabric |  |  |  |  |  |
| 7.3 | Verify that underdrain filter material gradation meets design specifications |  |  |  |  |  |
| 7.4 | Verify at least one cleanout is provided per underdrain lateral |  |  |  |  |  |
| 7.5 | Verify that cleanout pipe is not perforated |  |  |  |  |  |
| 7.6 | Verify that cleanouts covers are installed and watertight |  |  |  |  |  |
| 7.7 | Verify that orifice plate is installed at underdrain discharge point, per design specifications |  |  |  |  |  |
| **Filter Media** | | | | | | |
| 8.1 | Verify that filter media composition is per design specifications and was “machine mixed” by supplier prior to delivery |  |  |  |  |  |
| 8.2 | Verify depth of filter media installed and flat surface |  |  |  |  |  |
| **Containment Wall** | | | | | | |
| 9.1 | Verify that containment wall/berm is continuous and level |  |  |  |  |  |
| 9.2 | Verify that containment wall provides protection from vehicles |  |  |  |  |  |
| **Final Landscaping** | | | | | | |
| 10.1 | Verify that sod (if used) is NOT clay-grown sod |  |  |  |  |  |
| 10.2 | Verify final mulch elevation is at least 2 inches below inlet elevation. Verify that wood mulch (if used) is “shredded”. |  |  |  |  |  |
| 10.3 | Vegetation is planted according to landscape design specifications |  |  |  |  |  |
| 10.4 | Verify that weed barrier is not installed |  |  |  |  |  |
| 10.5 | Verify that irrigation is installed (if necessary) according to design specifications |  |  |  |  |  |

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| **Close Out** | | | | | | |
| 11.1 | Verify that upstream catchment stabilized prior to diverting runoff into bioretention cell |  |  |  |  |  |
| 11.2 | Verify that signage is installed according to design specifications |  |  |  |  |  |