Section 8.6: As-built Certification Requirements for SCMs in the City of Durham

8.6.1 As-built Program Description

A. Introduction

A licensed North Carolina Professional Engineer (NCPE), who is competent in the design and construction of stormwater control measures (SCMs), as well as who has observed and inspected the stormwater facility during construction, is required to submit an SCM As-built Certification (“Certification”) of the constructed SCM after it has been completed. It is understood that sometimes the certifying engineer may not be the same engineer that designed the original SCM. The Certification consists of the provision of as-built drawings and supporting information demonstrating that the SCM was constructed in a manner that accomplishes its designed functions and should provide years of adequate service without substantial reconstruction.

B. Program Objectives

The overall objectives of the City’s As-built Program are three-fold:

1. To ensure the quality of SCMs being constructed in the City is satisfactory.
2. To improve customer service by decreasing review times for Certifications through standardized submittals.
3. To reduce the workload of construction compliance assessments by requiring the as-built engineer to be the primary point of contact and inspector during construction.

C. Steps in As-built Process

The steps in the as-built process begin at the point after clearing and grubbing and prior to construction commencement. This is typically when construction drawings are approved and a pre-construction meeting is held:

1. Preconstruction Meeting – An SCM preconstruction meeting must be held with Stormwater Development Review prior to the start of SCM construction. This meeting is to include the construction contractor, design/as-builting engineer(s), and geotechnical engineer as needed. The owner/developer may also attend if they wish. This meeting is required prior to the issuance of water and sewer permits, or for a residential subdivision, prior to final plat approval; however it can and usually does occur earlier in the development process. However, if the SCM has an earthen embankment dam and it will be constructed and used temporarily as a sedimentation and erosion control device, it is necessary to hold the SCM preconstruction meeting prior to the dam being constructed.

To schedule, call the Stormwater Development Review SCM Technician at 919-560-4326 Ext. 30238 a minimum of three business days prior to the desired meeting date.

Please note that a separate preconstruction meeting regarding utilities, etc., must be scheduled with the City of Durham Engineering Inspections. Click request form at http://durhamnc.gov/667/Engineering-Inspections or email pwenginspections@durhamnc.gov 48 hours prior to the desired pre-con time.

2. Construction Inspections

   a. By the certifying engineer: The North Carolina licensed professional engineer who will certify the as-builds, or someone directly under the supervision of that engineer, must inspect at a minimum the installation of the critical SCM components detailed in Section 8.6.2. The critical components applicable to a project’s specific SCM will be discussed during the project’s stormwater preconstruction meeting. It is therefore the responsibility of the contractor to inform the certifying engineer at least 48 hours before these components are being installed.
b. **By the City:** As allowed by his/her workload, the Stormwater Development Review SCM Technician will inspect the installation of all critical SCM components (see Section 8.6.2). The contractor must inform the SCM Technician 48 hours prior to the installation of each key component – call (919) 560-4326, ext. 30238, or e-mail StormwaterBMPs@durhamnc.gov. Note that these inspections are courtesy inspections, not pass/fail inspections, to help ensure construction is reasonably progressing in an acceptable manner so issues noted during the inspection can be more easily remedied and not become major problems at the end. If the SCM Technician is unavailable for an inspection, the contractor should proceed with the work while the certifying engineer inspects and adequately documents that the work was done per the plans.

3. **Geotechnical Certification** – This certification must be submitted within four weeks of the construction of the dam being completed. See Section 8.6.4 for this form.

4. **As-built Submittal** – The certifying engineer shall submit the as-built package only after construction of the SCM is complete. This includes at least 85% establishment of all vegetation associated with the SCM, such as wetland plants, grass on embankment dam, slopes, access, etc., as well as ensuring the drainage area to the facility is stabilized.

5. **As-built Review** – Once the as-built package has been submitted, Stormwater Development Review’s review will be due within 10 business days. The review will include a field inspection of the SCM. If the reviewer has comments on either the documentation package or the field inspection, the as-built package will be returned to the certifying engineer with a comment letter or redlines detailing deficient items.

6. **As-built Resubmittal** – All resubmittals of as-built packages must include a response to comment document telling how each of Stormwater Development Review’s comments on the previous submittal has been addressed.

7. **As-built Approval and SCM Deemed Complete** – Once the as-built package is approved and the SCM is deemed complete, Stormwater Development Review will:
   a. Release any construction securities associated with the SCM,
   b. Release full Certificate of Occupancy for all related building permits, and
   c. Issue a Certificate of Completion for the SCM.

**D. SCM As-built Package Submittal**

The consultant shall provide the SCM as-built submittal package to the Public Works Service Desk in the Development Services Center, located on the ground floor of City Hall (101 City Hall Plaza, Durham, NC 27701).

1. **Initial Submittal**
   The first submittal package shall consist of all of the following:
   - SCM As-built Drawing Submittal Checklist.
   - Fee = $100 base fee/SCM + 4% technology surcharge.
   - 1 paper set of as-built documents per SCM – all hard copy documents must be in a binder, with a separate binder for each SCM. See Section 8.6.4 for a list of required documents.
   - 1 CD, DVD, or USB drive with digital copies of all required files.

2. **Resubmittals**
   For resubmittals, the following must be included:
   - SCM As-built Checklist.
   - Any previously redlined plans or documents.
   - Comment response documents.
   - The binder with revised copies of those items for which paper copies are required.
   - Digital files.

   For comment response, the following are required:
• For written comments, a written response document.
• For redlines, provide a note next to the redline explaining how the redline was addressed. If it was addressed on a different sheet, the note must state which sheet.

3. Digital Files
Digital copies of the required files must be in the following format:

• SCM photos: .jpg, .tif or .gif format.
• Cost accounting: Excel (.xls or .xlsx) format.
• O&M Manual: MS Word (.doc or .docx) or Excel (.xls or .xlsx) format.
• Drainage area: AutoCAD.dwg format; ESRI ArcGIS .shp, .shx or .dbf formats.
• All other documents: .pdf format.

The files shall be organized into folders named and numbered exactly according to the following convention shown below. Any folders that are not applicable should be marked “NA” after the folder name and left empty.

1. Executed General Certification
2. Executive Summary
3. As-built Drawings
4. As-built Survey
5. SCM Drainage Area Map
6. SCM Design Summary Sheet
7. As-built Hydrologic Modeling
8. SCM Field Checklist
9. Photos
10. Planting Certification Letter
11. O&M Manual (if not previously reviewed and approved during construction drawing review)
12. SCM Cost Accounting
13. Geotechnical Certification (if not previously submitted within 4 weeks of dam completion)
14. Materials Certification
15. Recorded Easement Plat

E. Expectations for Successful As-built Submittals

1. Completeness
The Certification must be complete, and shall include the following documents in hard copy and electronic formats. Note: all documents on the electronic CD, DVD, or USB Flash Drive must be in PDF format unless indicated otherwise below.

1. An executed “General Certification.”
2. An Executive Summary.
3. The as-built drawings for the SCM with an executed General Certification on each drawing.
4. The as-built survey plot, including all spot shots, of the SCM and SCM Access and Maintenance Easement, signed and sealed by a Land Surveyor licensed in North Carolina.
5. The drainage area map that delineates the drainage area to the SCM as presented in the approved construction drawings or Stormwater Impact Analysis, with redline markups for any as-built drainage area
deviations from the design area. If the engineer has verified there is no difference between the design and the as-built drainage area map, then a clear statement to that effect must be included on the map.

6. Design summary sheet for the facility as approved with the construction drawings, with redline/strikeout changes to show any corrections for the as-built SCM.

7. As-built hydrologic modeling inputs and results.

8. The SCM-specific Field Checklist required by the City.

9. Color digital photographs of all SCM components during their construction and after their completion.

10. The landscape company’s letter certifying the installation of the specific plants at the SCM as required by the approved construction drawings or approved field changes.

11. The Operations and Maintenance Manual for the SCM (electronic file: MS Word format, or if using the NC DEQ template, Excel format). The O&M Manual should now be submitted prior to construction drawing approval. However, if the as-builts are for an older SCM for which the O&M Manual was not included with the construction drawings, it must be included in the as-built package.

12. One (1) copy of a cost accounting for the construction of the SCM (electronic file: Excel format). Note: If the cost accounting results in an amount 110% or greater than the original construction estimate (Engineer’s Opinion of Probable Cost), an additional payment into the City’s Stormwater Facility Replacement Fund will be required if this form of financial guarantee was utilized. This additional payment for one-fourth of the amount greater than 100% of the original approved construction estimate, must be made prior to Certification approval. If construction cost accounting with sufficient supporting documentation results in an amount 90% or less than the original construction estimate, then a stormwater facility replacement payment refund will be provided for one-fourth the amount less than 100%. The refund must be requested in writing and submitted no later than one month after the SCM completion certificate is issued.

13. An original signed and sealed Geotechnical Certification with all supporting geotechnical and materials testing documentation. The Geotechnical Certification should now be submitted within 30 calendar days of the dam embankment construction being completed. However, if the as-builts are for an older SCM for which the embankment construction was already completed, it must be included in the as-built package.

14. An original signed and sealed Materials Certification, with all supporting documentation, for SCMs with filter media.

15. A copy of the recorded plat showing the SCM and SCM Access and Maintenance Easement.

2. Field Changes

All changes made in the field to the SCM design must be approved by the design engineer and Stormwater Development Review before the change is implemented. The construction contractor, design engineer, as-built certifying engineer or geotechnical engineer must contact Stormwater Development Review to ascertain whether the change:

- Is allowable as a field change that must be reflected on the as-builts but does not require a formal revision of the approved construction drawings, or
- Is significant enough to warrant a formal resubmittal of the construction drawings to obtain official review and approval of the change.

If Stormwater Development Review determines the change is allowable as a field change, a written communication will be sent to this effect. A copy of this written communication shall be included in the as-built package to show that the change was previously approved as a field change.

Should non-compliant changes be made without pre-approval by Stormwater Development Review, the burden is on the certifying engineer to demonstrate that the non-compliant item still meets its intended purpose and is therefore acceptable. The engineer must include both of the following in as-built Executive Summary and the “Additional Comments” box at the end of the relevant Field Checklist:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings.
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.
3. Site Inspections

The licensed professional engineer who will certify the as-builts, or someone directly under the supervision of that engineer, must inspect at a minimum the installation of the critical SCM components detailed in Section 8.6.2. In addition, the certifying engineer must personally complete a final SCM inspection in order to be able to complete the Field Checklist for a specific SCM.

However, Stormwater Development Review staff will inspect SCM construction as allowed by their schedules, and, as part of the review of the as-built submittal, Stormwater Development Review staff will perform a field inspection of the SCM and project site.

4. Common/significant Issues Preventing Approval of As-builts

The following items are often the cause of as-built packages not being approved:

- **Missing Documentation** – Items that are in the list of required documentation and are applicable to the project must be included in the submittal package. If items are missing, either the package will be rejected at intake, or comments will be made about the missing items. Engineers certifying as-built packages should not assume that certain items are not applicable to, or required for, the particular SCM they are certifying unless the description of the item indicates such.

- **Incomplete Geotechnical Certification** – Frequently, the construction of an SCM dam is done early in the project. By the end of the project, certain documents required as part of the geotechnical documentation have been misplaced, or the geotechnical engineer or engineering company involved in testing dam compaction or other geotechnical items is no longer involved. As a result, the geotechnical engineer who ends up certifying the items on the Geotechnical Certification will not certify all of the items on the form.

An incomplete Geotechnical Certification is unacceptable to the City of Durham. The City is requiring an assurance that the dam and associated appurtenances have been properly constructed and are in sound condition. If there are no geotechnical records available from the actual construction of the dam, the certifying geotechnical engineer must do enough post-construction testing to be able to make this certification.

For this reason, the City now requires that the Geotechnical Certification be submitted for our review within 30 calendar days of the dam construction being completed.

- **Failure of Contractors to Notify Certifying Engineer and Stormwater Development Review SCM Technician in Advance of Key Component Installation** – Key SCM components not being correctly installed or being installed with deviations from the plans is typically due to the certifying engineer not being present during the installation of those key components. And that is typically due to contractors not notifying the certifying engineer in advance of the installation of the key SCM components. This may result in the key component needing to be reinstalled or reworked in order to meet the plan specifications and obtain City approval.

- **Other Required Testing Not Performed** – If the water tightness testing for underground detention units or infiltration testing for bioretention areas is not performed or does not yield acceptable results, the SCM as-builts will not be approved. This also applies to any other testing required by the City to be specified on the construction drawings.

- **SCM Vegetation** – The City requires that all SCM vegetation (e.g., grass on dam embankments, slopes and within SCM Access and Maintenance Easement, wetland plants on pond aquatic shelf or in wetland zones, wetland/wet meadow plantings) be established to an 85% standard.

For grass, this means that every square foot of the SCM surface to be planted in grass has achieved at least 85% coverage with the prescribed type of permanent grass. Grass that is not sufficiently established frequently allows erosive conditions to develop.

For aquatic shelves or wetland planting zones, this means that 85% of the plants specified in the planting plan are healthy and thriving. If the plants are young and dormant, achievement of the “healthy and thriving” standard may be difficult to verify, so proof of purchase and planting process per the plant vendor’s recommendations must be provided, including pictures.

See Section 8.6.3 for additional information on establishment of vegetation.
• **Stabilization of SCM Drainage Area** – A minimum of 85% of the drainage area of an SCM must be adequately stabilized (e.g., with vegetation, mulch, impervious surface), and any remaining disturbed areas in the drainage area must have sufficient alternate erosion and sediment controls (E&SC) in place to mitigate against the deposition of sediment in the facility. Although gravel surfaces are considered stabilized for the purposes of E&SC, the City does not consider ABC or other stone with a lot of screenings/fines to be stabilized if it lies within an SCM drainage area.

It is highly recommended that 100% of the drainage area to filtration-type SCMs (e.g., sand filters, bioretention areas) be **completed** per the plans prior to allowing stormwater runoff to enter these SCMs. If excess sediment enters these SCMs, they can become clogged and will not drain at a sufficient rate. As-builts will not be approved if this is the case. A **completed** drainage area means that all of the permanent surfaces and landscape plantings approved in the site plan have been installed.

### 8.6.2 Critical Components of SCMs

In order to certify the SCM as-builts, the certifying engineer should at a minimum inspect all the critical components discussed below. As allowed by his/her workload, the Stormwater Development Review SCM Technician will also inspect the installation of all critical SCM components. See below for a list of critical components by SCM type.

It is highly recommended that the contractor inform the SCM Technician 48 hours prior to the installation of a critical component – call (919) 560-4326, ext. 30238, or e-mail StormwaterBMPs@durhamnc.gov. Note that these inspections are courtesy inspections to help identify issues, rather than pass/fail inspections. These inspections are intended to help ensure construction is reasonably progressing in an acceptable manner so issues noted during the inspection can be more easily remedied and not become major problems at the end. If the SCM Technician is unavailable for an inspection, the contractor should proceed with the work while the certifying engineer inspects and adequately documents that the work was done per the plans.

### A. Wet Detention Basin, Stormwater Wetland, Dry Detention Basin, Bioretention and Aboveground Sand Filter Critical Components

**Key Trench Excavation**: An onsite inspection while excavation is open is required to confirm consistency with approved construction design plan.

**Principal spillway pipe and associated components**: An inspection of the interior of the pipe prior to covering/backfilling is needed to: verify proper alignment of joints, proper bedding, and wrapping of joints in NCDOT Type II filter fabric. In addition, the following are considered critical components associated with the principal spillway pipe:

- **Concrete Cradle**: must be inspected after any required formwork is installed and prior to concrete being poured.
- **Anti-Seep Collars**: must be inspected after any required formwork is installed and prior to concrete being poured.
- **Seepage Diaphragm**: all stages of construction must be inspected, beginning with forms or trench for filter material. Must include inspection of any seepage conveyance pipe. Note: seepage diaphragms are usually built in two or more stages.

**Outlet structure(s) and associated anti-flotation ballast**: Provide two working days’ notice once riser has been set, after any required formwork is installed, and prior to any portion of the concrete anti-flotation ballast being poured.

**Any site-constructed reinforced concrete structures (such as spillways, weir walls, retaining walls, inlet and outlet structures, etc.)**: Provide two working days' notice for construction oversight inspection of reinforcing steel placement and formwork prior to concrete pours.

### B. Sand Filter and Bioretention Critical Components

**Subgrade or constructed foundation**: An onsite inspection prior to covering it with materials, etc., is required.

**Outlet structure or riser device in combination with connecting underdrains**: An oversight inspection is required. Note that no filter socks are to be placed on underdrains. Additionally, no filter fabric shall be placed between media layers in
bioretention areas. The contractor is to provide notification when both have been installed and prior to placing any gravel/sand/media over or around any of the components.

**Principal spillway pipe:** An inspection prior to covering/backfilling to verify proper alignment of joints and verify proper bedding is required.

**Any site-constructed reinforced concrete structures (such as spillways, weir walls, retaining walls, outlet structures, etc.):** Provide two working days’ notice for construction oversight inspection of reinforcing steel placement and formwork prior to concrete pours.

**Filter media:** Sand, gravel, or proprietary media must be verified to be per the specification in the plans prior to placement. No substitutions of specified material shall be allowed without design engineer and Stormwater Development Review approval. Pay particular attention to the minimum thickness of each layer, overall depth, and conformity to the approved construction plans.

An infiltration/permeability test is required for the installed media in a bioretention area.

### C. Underground Detention Critical Components

**Subgrade or constructed foundation:** An onsite inspection prior to covering it with materials, etc., is required.

**Precast unit, bottom portion:** If the device is precast it will often come in two pieces, a top and a bottom. The installation of the bottom portion of the device prior to the top being set in place requires an oversight inspection.

A 24-hour water tightness test is required for underground detention units.

### D. Level Spreader Critical Components

**Any concrete structures (such as flow splitters, bypass structures, weir walls, level spreader lip):** 48 hours notification is required prior to installation of these items.

### E. Rainwater Harvesting System Critical Components

**Underground cisterns:** An onsite inspection of the subgrade or constructed foundation is required.

**Water tank and any connecting pipes:** The installation of these items requires inspection prior to backfill if they are below ground.

**Pumps and timers or other automated devices:** These devices are to be field tested and proven functional. Field demonstration of these devices is required prior to City approval.

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### 8.6.3 Vegetation Establishment

Vegetation establishment is the single biggest obstacle to completing an SCM to City as-built standards. The City requires all SCM vegetation (e.g., grass on dam embankments, slopes and within SCM Access and Maintenance Easement, wetland plants on pond aquatic shelf or in wetland zones, wetland/wet meadow plantings) to be established to an 85% standard.

For grass, this means that every square foot of the SCM surface to be planted in grass has achieved at least 85% coverage with the prescribed type of grass. Grass that is not sufficiently established frequently allows erosive conditions to develop.

For aquatic shelves or wetland planting zones, this means that 85% of the plants specified in the planting plan are healthy and thriving. If the plants are young and dormant, achievement of the “healthy and thriving” standard may be difficult to verify. In this case, as-built approval will be delayed until a point in time when the plans begin to green up and leaf out.
Vegetation establishment issues that Stormwater Development Review has often seen are:

- Vegetation is not established to the 85% standard discussed above, but the certifying engineer submits the as-builts anyway.

  Insufficient topsoil has been provided for grass, sod, and wetland plants to root into.

  Sod is not rooted in, but merely placed on top of the soil. Sod has not been watered until it is rooted in and subsequently dies.

  If the grass is seeded, rather than sodded, 85% of the seeded area must have germinated. Grass seed that is sowed and then is either washed away or does not germinate with sufficient coverage will not result in a determination that the SCM has been satisfactorily complete. In many instances it has been observed that the straw mulching or matting is not adequately tacked or secured, thus allowing it to be easily displaced or bypassed. It has been further observed that supplemental watering does not take place during critical times of establishment.

  Wetland plants are often eaten by geese when they are young. If this occurs prior to the as-builts being approved, the wetland plants must be replanted and must become established enough to be deemed healthy and thriving.

- It is the wrong season for establishing vegetation. For young wetland plants that are planted during the dormant season, it is very difficult to tell whether they are dormant or dead until the weather warms and the growing season commences.

  If grass is not sufficiently established and it is the wrong planting season for the type of grass specified, approval of the as-builts will be delayed until the appropriate growing season comes around and full establishment can be verified.

- Undesirable vegetation has taken hold rather than the required vegetation. Water primrose and algae in ponds or wetlands indicate excess fertility in the drainage area and too high a concentration of nutrients in the SCM water. Cattails are also undesirable and may take over a pond or wetland, crowding out the desirable plants. Undesirable vegetation must be removed before the SCM can be deemed complete. This also pertains to permanent grass where either a temporary grass is established or invasive weeds out-compete it.

Tips for establishing desired wetland vegetation for wet ponds and wetlands:

- To prevent geese from eating the wetland plants, a grid pattern of string with flagging over the wetland plant areas, as well as sedimentation and pest exclusion fencing around SCM to keep geese out will help.

- Zigzag planting pattern of the aquatic shelf and wetland plant zones are more successful in getting plants established than is a straight-line planting pattern.

- It is more important to put the wetland plants in the correct zones per as-built surveyed elevations than per the design layout on plans. Even a few inches of elevation difference can be key when determining zones. This requires careful surveying of the wetland plant zones prior to planting.

- Using the outlet structure, flood the pond/wetland for a few weeks prior to planting the desired vegetation – this will help kill off undesirable vegetation. Then open the bottom drain valve or otherwise use the outlet structure to drain the pond down somewhat below the permanent pool elevation. While the exposed soil is still mucky, plant the wetland plants. Keep the water level relatively low until the plants are well-established, then raise it to the normal pool level using the outlet structure controls.

- In the first two weeks after planting, the wetland plants will likely undergo “transplant shock.” After that (provided they are planted during growing season), they should start to green up. However, this is when geese do the most damage.

- If planting in cooler weather when the plants are dormant, they will not need much water. However, in warmer weather, the plants may need to be watered daily if the water level in the impoundment dictates.
8.6.4 Certification Forms and Documents

The following forms are required for each Certification:

- General As-Built and Construction Certification. This form is required for all Certifications.
- Geotechnical Certification for Dams. This is required for all Certifications of SCMs that include an earthen dam and must be submitted immediately after completion of the dam and all outlet conveyances within the dam. Failure to submit within 30 days of dam completion will be considered a public safety issue, which will affect the future release of building permits and/or certificates of occupancy for the project.
- Materials Certification for SCMs with filter media.
- Field Checklists for individual SCMs, as applicable:
  - Field Checklist for Dry Ponds, Wet Ponds, Constructed Wetlands
  - Field Checklist for Open Sand Filters
  - Field Checklist for Closed Sand Filters
  - Field Checklist for Underground Detention Systems
  - Field Checklist for Closed Sand Filter with Underground Detention
  - Field Checklist for Bioretention Areas
  - Field Checklist for Level Spreader-Vegetated Filter Strip Systems
  - Field Checklist for Vegetated Water Quality Swales
  - Field Checklist for Rainwater Harvesting Systems
  - Field Checklist for Permeable Pavement
  - Field Checklist for Filterra® Units
  - Field Checklist for StormFilter® by Contech
  - Field Checklist for Silva Cell Suspended Pavement with Bioretention

The above forms are provided on the following pages. Field Checklists for SCMs not mentioned above will be developed as new types of SCMs are approved for use in the City of Durham.
General As-Built and Construction Certification

Based upon (1) my observation of the construction of this facility, (2) my review of the as-built survey data, (3) my review of the drainage area treated or managed by the facility, and (4) my analysis of the hydraulic performance of the constructed facility, I hereby certify that the (A) hydrologic and hydraulic, (B) geometric, (C) public safety, (D) facility access, (E) drainage area\(^1\), and (F) vegetative elements of the constructed facility are in compliance with the requirements of the facility as set forth in the approved Construction Drawings, approved design documents, and/or any approved modifications. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the facility.

Note 1: The drainage area treated by the facility must, at a minimum, be equivalent to the area proposed for treatment in the approved construction drawings. In addition, a minimum of 85% of the drainage area to the facility must be adequately stabilized (e.g., with vegetation, mulch, impervious surface), and any remaining disturbed areas in the drainage area must have sufficient alternate controls in place to limit the deposition of sediment in the facility. If these drainage area requirements are not met, the Certification will be disapproved.

The following supporting documents are included in the formats required below. Note: All digital files must be in Adobe Acrobat (.pdf) format unless indicated otherwise below.

1. [Digital only] An executed “General Certification.”
2. [Digital only] An Executive Summary describing the results of the as-built process, including any field changes and the results of remodeling the SCM under as-built conditions. Any item not meeting any minimum requirement and requesting to be accepted shall clearly be noted and the certifying engineer shall provide the following:
   a. A description of how the non-compliant item deviates from the standards and/or approved construction drawings.
   b. An explanation of why this deviation should be acceptable and how the deviation still meets the intended purpose behind the requirement.
3. [Paper and digital] As-built Drawings: One (1) copy of the approved construction drawings for the SCM with redline/strikeout changes to show any changes for the as-built SCM. All approved construction drawing sheets signed by Stormwater must be included, but the full set of construction drawings is not required or desired. All sheets must contain the executed General Certification, i.e., the statement in the box above must appear on the as-built drawings and must be signed and sealed by the certifying engineer.
4. [Digital only] The as-built survey, including all spot shots, of the SCM. Note that the survey plot must be signed and sealed by a Land Surveyor licensed in North Carolina. The plot must also include spot shots for all grade changes/break points and critical inverts, and all field values for elevations and dimensions shown on the approved construction drawings must be verified by the surveyor.

In addition, the access to the facility and top of the dam shall be surveyed sufficiently to assess whether it is a minimum of 10 feet wide, and has a maximum centerline grade and cross-slope of fifteen percent (15%) and ten percent (10%) respectively.

The following Field Survey Certification Statement must be included on the as-built survey plot:
5. [Paper and digital] One (1) copy of the drainage area map that delineates the drainage area to the SCM as presented in the approved construction drawings or Stormwater Impact Analysis, with redline markups for any as-built drainage area deviations from the design area. The area in square feet or acres for both the design and the as-built drainage areas should be quantified on the map.

The entire as-built drainage area does not need to be formally surveyed, but the ridge lines do need to be verified. Roof drain connections should be verified to ensure that roof drainage is routed as determined at the design stage.

If the engineer has verified there is no difference between the design and the as-built drainage area map, then a clear statement to that effect must be included on the map.

6. [Digital only] One (1) copy of the design summary sheet for the facility as approved with the construction drawings, with redline/strikeout changes to show any corrections for the as-built SCM.

7. [Digital only] One (1) copy of the hydrologic modeling inputs and results, using as-built data for the drainage area and SCM.

8. [Paper and digital] An original completed copy of the signed and sealed SCM-specific Field Checklist required by the City. A complete Checklist shall contain no non-compliant items. Note: If, while completing the Checklist, a non-compliant item is noted at an SCM by the certifying engineer, a Certification for that SCM should not be submitted until the non-compliant item has been brought into compliance.

If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, the engineer must include both of the following in the “Additional Comments” box at the end of the Field Checklist:

a. A description of how the non-compliant item deviates from the standards and/or approved construction drawings.

b. An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

Final approval of a non-compliant item shall be based primarily on supporting justification. However, also factored into the City’s approval or disapproval are:

- Consistency – whether or not the City has approved this type of non-compliance at other SCMs, and
- Experience – whether this type of non-compliance has been approved previously and then over time has proved to be inadvisable.

9. [Digital only] Color photographs of all SCM components (as shown on approved SCM plan and detail sheets) during their construction and after their completion. This includes an overall view of the SCM and individual components to include the dam, emergency spillway, riser, outfall structure, outfall area, impoundment area, access way, etc. (electronic format: .jpeg, .gif or .tiff).

10. [Digital only] One (1) copy of the landscape company’s letter certifying the installation of the specific plants at the SCM as required by the approved construction drawings or approved field changes. This letter must be on the company’s letterhead, must list all of the plant species planted, and how many of each were planted. In lieu of listing all species and the number planted, the landscape company may attach to the letter the purchase receipts or bills of lading for the plants.
11. [Digital only] One (1) copy of an Operations and Maintenance Manual for the SCM (electronic file: MS Word format, or if using the NC DEQ template, Excel format). The O&M Manual should now be submitted prior to construction drawing approval. However, if the as-built is for an older SCM for which the O&M Manual was not included with the construction drawings, it must be included in the as-built package.

12. [Digital only] One (1) copy of a cost accounting for the construction of the SCM (electronic file: Excel format). Note: If the cost accounting results in an amount 110% or greater than the original construction estimate (Engineer’s Opinion of Probable Cost), an additional payment into the City’s Stormwater Facility Replacement Fund will be required if this form of financial guarantee was utilized. This additional payment, for one-fourth of the amount greater than 100% of the original approved construction estimate, must be made prior to Certification approval. If construction cost accounting with sufficient supporting documentation results in an amount 90% or less than the original construction estimate, then a stormwater facility replacement payment refund will be provided for one-fourth the amount less than 100% with a written request submitted no later than one month after the SCM completion certificate is issued.

13. [Digital only] An original signed and sealed Geotechnical Certification with all supporting geotechnical and materials testing documentation. The Geotechnical Certification should now be submitted within 30 calendar days of the construction of the dam embankment being completed. Failure to submit within 30 calendar days of dam completion will be considered a public safety issue, which will affect the future release of building permits and/or certificates of occupancy for the project. However, if the as-built is for an older SCM for which the embankment construction was already completed, it must be included in the as-built package.

14. [Digital only] An original signed and sealed Materials Certification, with all supporting documentation, for SCMs with filter media.

15. [Digital only] A copy of the recorded plat showing the SCM and SCM Access and Maintenance Easement.

Name: ____________________________________________ Date: __________

NCPE Seal:
Geotechnical Certification for Dams and Seepage Controls

Note: This certification statement must be provided for all earthen embankment dams and must be executed by a licensed North Carolina Professional Engineer (NCPE) with experience in the design and construction of small earth dams of a nature similar in scope to that certified to in this certification. For all dams with greater than 5 feet of depth of water impounded in it at normal water level, this certification must be executed by a licensed NCPE with geotechnical engineering expertise. Periodic observations of construction and a final assessment for design compliance by the certifying engineer or personnel under their direct charge is required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation, monitoring, and testing of the construction of the dam and seepage controls (if applicable) for this facility, I hereby certify that the constructed facility is in compliance with the geotechnical requirements as set forth in the approved Construction Drawings, approved design documents, and any approved modifications.

The following supporting documents are included in electronic formats (Note: All documents in the electronic files must be in PDF format unless indicated otherwise below):

1. [Digital only] Copies of all dam embankment material composition and density testing paperwork, including a map that labels all points where the dam and dam foundation areas were tested. Note: Insufficient testing in the zones over and around the principal outlet works for the dam will render this certification invalid.

2. [Digital only] Copies of all concrete compressive strength testing paperwork for any cast-in-place concrete items associated with the construction of the dam. Testing is required for structural components such as reinforced concrete dams/weir walls, concrete emergency spillways, poured-in-place underground detention facilities, etc.

3. [Digital only] One (1) copy of the purchase receipt for any principal spillway pipe that is Class IV or greater. The purchase receipt should identify the ASTM specifications governing the manufacture of the pipe.

4. [Digital only] Colored digital photographs showing the dam foundation areas, the riser, the principal spillway pipe, the concrete cradle, the seepage diaphragm, relief drains, etc., as those items were being prepared and installed (electronic format: .jpg, .gif or .tif).

5. [Digital only] One (1) copy of the certifying engineer’s resume that demonstrates required geotechnical engineering expertise when the dam is impounding greater than 5 feet of water at normal water level.

Name: ___________________________________________ Date: ________

NCPE Seal:
Materials Certification for SCMs with Filter Media
(except Filterras® and StormFilters®)

SCM Facility Name

Note: This certification statement must be executed by a licensed North Carolina Professional Engineer with experience in the design, use, identification, and materials testing of SCMs with filter media. Observation of the installation of the filter media used in this SCM will be required to complete this certification.

CERTIFICATION STATEMENT

Based upon my observation and monitoring of the installation of the filter media used in this facility, and based on my testing of the media or my review of the media test results, I hereby certify that the filter media used in this constructed facility is in compliance with the filter media requirements of the facility, as set forth in the approved Construction Drawings, approved design documents, and any approved modifications.

The following supporting documents are included in hard copy and electronic file formats (Note: All electronic files must be in PDF format unless indicated otherwise below):

1. [Digital only] One (1) copy of the materials testing paperwork for the materials used in the filter media section, that demonstrates compliance with the following requirements:
   a. For sand filters: cleaned, washed, coarse concrete sand such as ASTM C33. The sand particles shall be less than 2 mm average diameter.
   b. For bioretention areas and Silva Cells:
      i. Media gradation and composition as specified on the plans.
      ii. Phosphorus Index less than 30.
      iii. In-situ infiltration rate of one to six inches per hour.

2. [Digital only] One (1) copy of the purchase receipts or bill of lading for the materials used in the filter media section.

3. [Digital only] Color photographs that document the installation of each layer of the filter media, including the underdrain portion (and cleanouts) of the filter media section, used in this facility (electronic format: .jpg, .gif, or .tif).

Name: ____________________________________________ Date: ____________

NCPE Seal:
Date(s) of Certification Assessment: ____________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: _________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include both of the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings.
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Open Space

- The SCM and access way(s) are located entirely on open space property (residential areas only). [Note: This restriction shall not apply to inlet pipes/channels.]

B. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.

- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the facility.

C. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.

- The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.

- Unobstructed maintenance vehicle access has been provided to the control structure and all inlets, and access to the facility and top of the dam meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide.
  - It has a maximum centerline grade of fifteen percent (15%).
  - It has a maximum cross-slope of ten percent (10%).

- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
D. Inlets and Forebay

- Riprap energy dissipators and sediment forebays have been installed at the inlets in accordance with the construction drawings.
- All inlet pipes have been installed with appropriate end treatments and curtain walls in accordance with the construction drawings.
- All inlet pipes are well homed and securely attached/grouted to their headwalls/flared end sections. The joints are smoothly finished with no evidence of gaps, cracks, and spalling.
- All accumulated sediment and other debris in the sediment basins, riprap energy dissipators, and forebay/s has been removed.
- Forebay berm has been constructed in accordance the approved construction drawings, and top of berm is no deeper than one foot below permanent pool.

E. Impoundment Area

- The narrowest width of the aquatic shelf is ________.
- The positioning of the aquatic shelf is in accordance with the construction drawings.
- All accumulated sediment and other debris in the pond floor has been removed.
- 85% of the plants shown on the planting plan for the SCM are thriving.
- The SCM has a minimum length:width ratio of 1.5:1.

F. Dam Embankment

- The key trench has been installed per the approved construction drawings.
- All seepage control devices (anti-seep collars, concrete cradles, filter diaphragms, etc.) have been installed in accordance with the approved construction drawings.
- The narrowest top of dam width is ________.
- The steepest slope on the upstream face of the dam is ________.
- The steepest slope on the downstream face of the dam is ________.
- Based on manual rod probings of the dam, particularly in the zones over and around the principal spillway pipe, the dam appears to have been well compacted.
- The dam and dam foundation, groin, toe, and abutment areas are completely free of trees, landscaping, and other woody growth.
- The dam has been fine graded and is free of ruts, erosion, wood, construction debris, etc.
- 85% of the SCM slopes (cut slopes and dam embankment) and dam foundation, groin, toe, and abutment areas has achieved a healthy stand of grass. The dam is not overgrown and there is no undesirable vegetation.
- No evidence of seepage was noted on the downstream face of the dam.

G. Emergency Spillway

- The narrowest width of the control section is ________.
- The side slopes of the control section are [Left] ________ and [Right] ________.
- The size, shape, and alignment of the exit channel are in accordance with the construction drawings.
- Armoring has been installed in accordance with the construction drawings.
The spillway has been fine graded and is free of ruts, erosion, etc.
Excluding the hard-surfaced armored area, 85% of the spillway has achieved a healthy stand of grass. The spillway is not overgrown and there is no undesirable vegetation.

H. Riser/Control Structure

- The riser/control structure is reinforced concrete.
- The diameter or opening dimensions of the riser is/are ________.
- A top, peak-roofed trash rack has been provided and bolted down to the riser.
- A trash rack access hatch (minimum 2’ × 3’) and steps down the inside of the riser have been provided.
- At least one side of the riser is accessible by foot during permanent pool conditions and direct access from dam embankment is provided.
- A drawdown valve with an accessible operating mechanism has been provided in accordance with the approved construction drawings.
- The riser structure and all appurtenant devices (plug valve, etc.) appear to be sound.
- For precast structures, the barrel sections were installed with gasketted joints, adjacent riser barrel sections have been bolted together with stainless steel strapping, and there is no evidence of leakage at the joints.
- All orifices, siphons, ports, and weirs were installed in accordance with the construction drawings.
- The anti-flotation ballast has been provided in accordance with the construction drawings.
- A placed concrete invert to the invert out of the principal spillway pipe has been provided.
- The riser is free of debris or obstructions.

I. Principal Spillway Pipe

- The principal spillway pipe (PSP) is reinforced concrete.
- The diameter of the PSP is ________.
- The principal spillway pipe was wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.
- Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.
- No piping (loss of soil) is evident around the PSP.

J. Outfall Structure

- The outfall structure is per the approved construction drawings and there is no evidence of stability issues.
- The outfall structure has been constructed with a curtain wall, if required.
- The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, or spalling.

K. Outfall Area

- If required, a level spreader-vegetated filter strip system or energy dissipator has been provided in accordance with the construction drawings.
- The outfall area and downstream channel(s)/receiving area appears stable (no evidence of erosion or head-cutting), and all accumulated silt and debris has been removed.
Field Checklist

for

Open Sand Filters

Date of Certification Assessment: ____________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the sediment chamber or sand filter.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.
- The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
- Unobstructed maintenance vehicle access has been provided to the control structure and all inlets, and access to the facility and top of the dam meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide.
  - It has a maximum centerline grade of fifteen percent (15%).
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.

C. Sediment Chamber (Forebay)

- The sediment chamber minimum size has been installed in accordance with the construction drawings.
• The depth of the sediment chamber is as specified in the construction drawings.
• The top of the forebay berm has been installed level, and 100% of the berm has either achieved a healthy stand of turf grass or been armored in accordance with the construction drawings.
• All accumulated sediment and other debris in the sediment chamber has been removed.
• All inlet pipes have been installed with appropriate end treatments, including curtain walls, in accordance with the approved construction drawings.
• All inlet pipes are well homed and securely attached/grouted to their headwalls/flared end sections. The joints are smoothly finished with no evidence of gaps, cracks, and spalling.

D. Sand Chamber

• The sand chamber minimum size has been installed in accordance with the approved construction drawings.
• The sand chamber has been constructed such that the maximum head above the sand layer is in accordance with the approved construction drawings.
• The required sand, choking stone or filter fabric, and gravel layer(s) have been installed in accordance with the approved construction drawings, and there is no sediment in the sand chamber.
• The underdrain system has been installed in accordance with the approved construction drawings. All underdrain joints have glued watertight connections.
• Solid underdrain cleanouts have been installed in accordance with the approved construction drawings. Screw-on type (or otherwise approved) cleanout caps have been provided for all cleanout pipes.
• All side slopes leading to the sand chamber are no steeper than 3:1.
• Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.
• Even flow distribution into the sand chamber has been provided in accordance with the construction drawings and is not creating scour in the sand chamber.
• The filter has been observed by the certifying engineer on ____________ [fill in date] to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings.

E. Dam Embankment

• The narrowest top of dam width is ________.
• The steepest slope on the upstream face of the dam is ________.
• The steepest slope on the downstream face of the dam is ________.
• Based on manual rod probings of the dam, particularly in the zones over and around the principal spillway pipe, the dam appears to have been well compacted.
• The dam and dam foundation, groin, toe, and abutment areas are completely free of trees, landscaping, and other woody growth.
• The dam has been fine graded and is free of ruts, erosion, etc.
• 85% of the SCM slopes (cut slopes and dam embankment) and dam foundation, groin, toe, and abutment areas have achieved a healthy stand of grass. The dam is not overgrown and there is no undesirable vegetation.
• No evidence of seepage was noted on the downstream face of the dam.

F. Emergency/Outlet Spillway

• The narrowest width of the control section is ________.
• The side slopes of the control structure are [Left] ________ and [Right] ________.
• The size, shape, and alignment of the exit channel are in accordance with the construction drawings.
• Armoring has been installed in accordance with the construction drawings ________.
• The spillway has been fine graded and is free of ruts, erosion, etc.
• Excluding the hard-surfaced armored area, 85% of the spillway has achieved a healthy stand of grass. The spillway is not overgrown and there is no undesirable vegetation.

G. Riser/Control Structure

• The riser/control structure is reinforced concrete.
• The diameter or opening dimensions of the riser is/are ________.
• A top, peak-roofed trash rack has been provided and bolted down to the riser, or, if the riser is of a different configuration, it has been constructed in accordance with the construction drawings.
• A trash rack access hatch (minimum 2’ × 3’) and steps down the inside of the riser have been provided.
• The riser structure and all appurtenant devices appear to be sound.
• The riser is free of debris or obstructions.
• For precast structures, the barrel sections were installed with gasketted joints, adjacent riser barrel sections have been bolted together with stainless steel strapping, and there is no evidence of leakage at the joints.
• All orifices, siphons, ports, and weirs were installed in accordance with the construction drawings.
• The anti-flotation ballast has been provided in accordance with the construction drawings.
• A placed concrete invert to the invert out of the principal spillway pipe (PSP) has been provided.

H. Principal Spillway Pipe

• The PSP is reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.
• The diameter of the PSP is ________.
• The principal spillway pipe was wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.
• Based on a visual inspection, it appears that the joints of the PSP were homed reasonably well, and it appears that no joints are leaking.
• No piping (loss of soil) is evident around the PSP ________.

I. Outfall Structure and Outfall Area

• The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
• If not discharging to a storm sewer system:
  • The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
  • Energy dissipation has been provided in accordance with the construction drawings.
  • The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.
• If discharging to a storm sewer system, the receiving manhole appears stable and all accumulated silt and debris has been removed.
Field Checklist
for
Closed Sand Filters

Date of Certification Assessment: __________________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: _________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the sediment chamber or sand filter.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.
- The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
- Unobstructed maintenance vehicle access has been provided to the control structure and all inlets, and access to the facility and top of the dam meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide,
  - It has a maximum centerline grade of fifteen percent (15%) and
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
- A Bilco®-type door (or approved equivalent) has been placed at the inlets and at the control structure. Access points that occur in areas subject to vehicular traffic are of the traffic bearing type.
• All access ways into the unit(s) have steps or ladders installed as shown on the construction drawings. Access ways do not decrease in size from the opening at ground level. Internal sections of the access way are not offset from the opening at the ground level.
• Provided openings do not inhibit confined space entry procedures for safety.
• All internal sections of the unit can be accessed from an approved access way.
• Access to all flow control valves (and/or valve operating handles) is provided from dry areas. Unit can be drained to accommodate maintenance activities and inspections. Method to drain unit appropriately described within operation and maintenance manual.

C. Sediment Chamber

• The sediment chamber minimum size has been installed in accordance with the construction drawings.
• The depth of the sediment chamber is as specified in the approved construction drawings.
• The ports and weirs that drain the sediment chamber into the sand chamber have been installed in accordance with the construction drawings.
• Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.
• The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.
• All accumulated sediment and other debris in the sediment chamber has been removed.
• All valves, pipe connections, and chamber section joints are sealed and are watertight.

D. Sand Chamber

• The sand chamber minimum size has been installed in accordance with the construction drawings.
• The sand chamber has been constructed such that the maximum head above the sand layer is in accordance with the approved construction drawings.
• The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.
• The required sand, choking stone or filter fabric, and gravel layer(s) have been installed in accordance with the approved construction drawings, and there is no sediment in the sand chamber.
• The underdrain system has been installed in accordance with the approved construction drawings.
• Solid underdrain cleanouts have been installed in accordance with the construction drawings.
• All underdrain joints have glued watertight connections. Screw-on type (or otherwise approved) cleanout caps have been provide for all cleanout pipes.
• All valves, pipe connections, and chamber section joints are sealed and are water tight.
• Even flow distribution into the sand chamber has been provided in accordance with the construction drawings and is not creating scour in the sand chamber.
• The bottom of the structure is located at least one foot above the seasonal high water table.
• The filter has been observed by the certifying engineer on ____________ [fill in date] to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings.

E. Control Structure and Principal Spillway Pipe

• The control structure is reinforced concrete.
• The dimensions of the structure are ________.
• The structure and all appurtenant devices appear to be sound.
• The structure is free of debris or obstructions.
• The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.
• All orifices, siphons, ports, and weirs were installed in accordance with the construction drawings.
• The PSP is reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.
• The diameter of the PSP is ________.
• The principal spillway pipe was wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.
• Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.
• Access into the control structure and the sediment and sand chambers has been provided in accordance with the construction drawings.

F. Outfall Structure and Outfall Area

• The control structure has been installed in accordance with the construction drawings.
• The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
• If not discharging to a storm sewer system:
  o The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
  o Energy dissipation has been provided in accordance with the construction drawings.
  o The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.
• If discharging to a storm sewer system, the receiving manhole appears stable and all accumulated silt and debris has been removed.

Additional Comments by Certifying Engineer:
Field Checklist

for

Underground Detention Systems

Date of Certification Assessment: _______________________
Assessing and Certifying NCPE: ___________________________ Seal: _______________________
SCM Facility Name: ________________________________________
Access Address: ____________________________________________
PIN/s of Parcel/s Where the Facility is Sited: _____________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:
• A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
• An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

• The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
• The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the underground detention system.

B. Easements and Accessibility

• The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.
• The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
• Unobstructed maintenance vehicle access has been provided to the control structure and all inlets, and access to the facility and top of the dam meets the following conditions per field observation and survey spot shot data:
  o It is a minimum of 10 feet wide.
  o It has a maximum centerline grade of fifteen percent (15%).
  o It has a maximum cross-slope of ten percent (10%).
• Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
• Manhole access has been provided at the four corners of the system. All access manholes are reinforced concrete manholes conforming to the construction drawings.
• Traffic bearing cleanouts have been provided at 100-foot intervals, with a minimum of two provided in each pipe run. Manhole access structures may be counted as cleanouts.

• A Bilco®-type door (or approved equivalent) has been placed at the inlets and at the control structure for the underground detention system. Access points that occur in areas subject to vehicular traffic are of the traffic bearing type.

• All access ways into the unit(s) have steps or ladders installed as shown on the construction drawings. Access ways do not decrease in size from the opening at ground level. Internal sections of the access way are not offset from the opening at the ground level.

• Provided openings do not inhibit confined space entry procedures for safety.

• All internal sections of the unit can be accessed from an approved access way.

• Access to all flow control valves (and/or valve operating handles) is provided from dry areas. Unit can be drained to accommodate maintenance activities and inspections. Method to drain unit appropriately described within operation and maintenance manual.

C. Underground Storage Chambers/Pipes

• The correct size, linear footage, and materials for the system have been installed in accordance with the construction drawings.

• The storage pipes and/or precast structures were installed to manufacturer specifications and in accordance with the approved construction drawings.

• The foundational support for and the backfill around the storage structure(s) have been placed in accordance with the construction drawings.

• All inlet pipes have been installed in accordance with the construction drawings.

• The system remains watertight per City of Durham requirements, and a memo from the certifying engineer describing the date and method of certification is attached.

• The surface or sub-surface bypass to safely convey the 100-year, 24-hour post-development storm event or the maximum storm has been installed in accordance with the construction drawings.

• All accumulated sediment and other debris in the system has been removed.

• All valves, pipe connections, and chamber section joints are sealed and are water tight.

D. Control Structure and Principal Spillway Pipe

• The control structure is reinforced concrete.

• The dimensions of the structure are ________.

• The structure and all appurtenant devices appear to be sound.

• The structure is free of debris or obstructions.

• The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.

• All orifices, siphons, ports, and weirs were installed in accordance with the construction drawings.

• The surface or sub-surface bypass designed to safely convey the 100-year, 24-hour post-development storm event or the maximum storm has been installed in accordance with the approved construction drawings.

• The PSP is reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.

• The diameter of the PSP is ________.

• The principal spillway pipe was wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.
Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.

Steps down the inside of the access manholes have been provided in accordance with the construction drawings.

E. Outlet and Outfall

- The control structure has been installed in accordance with the construction drawings.
- The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
- If not discharging to a storm sewer system:
  - The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
  - Energy dissipation has been provided in accordance with the construction drawings.
  - The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.
- If discharging to a storm sewer system, the receiving manhole appears stable and all accumulated silt and debris has been removed.

Additional Comments by Certifying Engineer:
Field Checklist

for

Closed Sand Filter with Underground Detention

Date of Certification Assessment: ______________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: _________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: _______________________

CHECKLIST

All items in this checklist must be compliant. If an item is not applicable, write “N/A” next to the item. If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the sediment chamber or sand filter.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.
- The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
  - It is a minimum of 10 feet wide,
  - It has a maximum centerline grade of fifteen percent (15%) and
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.

C. Internal Accessibility

- A Bilco®-type door (or approved equivalent), or other approved access ways, has been provided as shown on the construction drawings. Access points that occur in areas subject to vehicular traffic are of the traffic bearing type.
- All access ways into the unit(s) have steps or ladders installed as shown on the construction drawings. Access ways do not decrease in size from the opening at ground level. Internal sections of the access way are not offset from the opening at the ground level.
- Provided openings do not inhibit confined space entry procedures for safety.
- All internal sections of the unit can be accessed from an approved access way.
- Access to all flow control valves (and/or valve operating handles) is provided from dry areas. Unit can be drained to accommodate maintenance activities and inspections. Method to drain unit appropriately described within operation and maintenance manual.

**D. Sediment Chamber/Underground Detention Chamber**

- The sediment chamber/underground detention chamber minimum size has been installed in accordance with the construction drawings.
- The depth of the sediment chamber/underground detention chamber is as specified in the approved construction drawings.
- The ports and weirs that drain the sediment chamber into the sand chamber have been installed in accordance with the construction drawings.
- Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.
- The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.
- All accumulated sediment and other debris in the sediment chamber has been removed.
- All valves, pipe connections, and chamber section joints are sealed and are water tight.

**E. Sand Chamber**

- The sand chamber minimum size has been installed in accordance with the construction drawings.
- The sand chamber has been constructed such that the maximum head above the sand layer is in accordance with the approved construction drawings.
- The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.
- The required sand, choking stone or filter fabric, and gravel layer(s) have been installed in accordance with the approved construction drawings, and there is no sediment or debris in the sand chamber.
- The underdrain system has been installed in accordance with the approved construction drawings. All underdrain joints have glued watertight connections.
- Solid underdrain cleanouts have been installed in accordance with the construction drawings. Screw-on type (or otherwise approved) cleanout caps have been provide for all cleanout pipes.
- Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.
- Even flow distribution into the sand chamber has been provided in accordance with the construction drawings and is not creating scour in the sand chamber.
- The bottom of the structure is located at least one foot above the seasonal high water table.
- The filter has been observed by the certifying engineer on [fill in date] to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings.
- All valves, pipe connections, and chamber section joints are sealed and water tight connections.

**F. For Separate (Connected by Pipes Only) Control Structure and Principal Spillway Pipe/Pipe Connections**

- The weir control structure is reinforced concrete.
- The dimensions of the structure match the approved construction drawings.
The structure and all appurtenant devices appear to be sound.

The structure is free of debris or obstructions.

The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.

All orifices, valves, siphons, ports, and weirs were installed in accordance with the construction drawings.

Unless otherwise approved on the construction drawings, all pipes entering and exiting the system are reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.

The diameters of all pipes are as specified on the construction drawings.

If the principal spillway pipe is NOT discharging to a downstream drainage system, the principal spillway pipe is wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.

Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.

Access into the control structure has been provided in accordance with the construction drawings.

All valves and pipe connections are sealed and water tight connections.

G. For Co-located/Internal Control Structure and Principal Spillway Pipe/Pipe Connections

The control structure walls are reinforced concrete.

The dimensions of the structure match the approved construction drawings.

The structure and all appurtenant devices appear to be sound.

The structure is free of debris or obstructions.

All orifices, valves, siphons, ports, and weirs were installed in accordance with the construction drawings.

(Unless otherwise approved on the construction drawings) All pipes entering and exiting the system are reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.

The diameters of all pipes are as specified on the construction drawings.

If the principal spillway pipe is NOT discharging to a downstream drainage system, the principal spillway pipe is wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.

Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.

Access into the control structure has been provided in accordance with the construction drawings.

All valves and pipe connections are sealed and water tight connections.

H. Outfall Structure and Outfall Area

If not discharging to a storm sewer system:

- The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
- The principal spillway pipe is securely attached/grouted to the headwall or flared end section and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
- Energy dissipation has been provided in accordance with the construction drawings.
- The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.

If discharging to a storm sewer system,
The receiving manhole has no visible signs of deficiencies and all accumulated silt and debris has been removed.

The principal spillway pipe is securely attached/grouted to the downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.

Additional Comments by Certifying Engineer:
Field Checklist

for

Bioretention Areas

Date of Certification Assessment: ____________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the forebay/sediment basin or bioretention area.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement. The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
- Unobstructed maintenance vehicle access has been provided to the control structure and all inlets, and access to the facility and top of the dam meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide.
  - It has a maximum centerline grade of fifteen percent (15%).
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.

C. Inlet/Flow Distribution Area

- A pre-treatment device or area has been provided at each inlet in accordance with the construction drawings.
- All accumulated sediment and other debris in the pre-treatment areas has been removed.
Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.

The flow into the bioretention cell is evenly distributed across the cell in accordance with the construction drawings, and there is no scour at the inlets or within the bioretention cell.

All inlet pipes have been installed with curtain walls and appropriate end treatments in accordance with the approved construction drawings.

D. Bioretention Cell

For bioretention areas with an internal water storage (IWS) zone, the depth of the IWS zone is as shown in the approved construction drawings.

The surface area of the bioretention cell is in accordance with the approved construction drawings.

The required bioretention mulch, soil mix, choking stone and gravel layers have been installed in accordance with the approved construction drawings, and there is no sediment in the bioretention cell.

The underdrain system has been installed in accordance with the approved construction drawings. All underdrain joints have glued watertight connections.

Solid underdrain cleanouts have been installed in accordance with the approved construction drawings. Screw-on type (or otherwise approved) cleanout caps have been provided for all cleanout pipes.

All vegetated side slopes leading to the bioretention cell are no steeper than 3:1.

85% of the plantings or grass sod specified in the approved construction drawings is thriving/established.

The bioretention cell has been observed on ____________ [fill in date] by the certifying engineer to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings.

E. Dam Embankment

The narrowest top of dam width is ________.

The steepest slope on the upstream face of the dam is ________.

The steepest slope on the downstream face of the dam is ________.

Based on manual rod probeings of the dam, particularly in the zones over and around the principal spillway pipe, the dam appears to have been well compacted.

The dam and dam foundation, groin, toe, and abutment areas are completely free of trees, landscaping, and other woody growth.

The dam has been fine graded and is free of ruts, erosion, etc.

85% of the SCM slopes (cut slopes and dam embankment) and dam foundation, groin, toe, and abutment areas have achieved a healthy stand of grass. The dam is not overgrown and there is no undesirable vegetation.

No evidence of seepage was noted on the downstream face of the dam.

F. Emergency Spillway

The narrowest width of the control section is ________.

The side slopes of the control section are [Left] ________ and [Right] ________.

The size, shape, and alignment of the exit channel are in accordance with the construction drawings.

Armoring has been installed in accordance with the construction drawings.

The spillway has been fine graded and is free of ruts, erosion, etc.
Excluding the hard-surfaced armored area, 85% of the spillway has achieved a healthy stand of grass. The spillway is not overgrown and there is no undesirable vegetation.

G. Riser/Control Structure and Principal Spillway Pipe

- The riser/control structure is reinforced concrete.
- The diameter or opening dimensions of the riser/control structure is/are ________.
- A top, peak-roofed trash rack has been provided and bolted down to the riser, or, if the riser is of a different configuration, it has been constructed in accordance with the construction drawings.
- The riser/control structure and all appurtenant devices appear to be sound.
- The riser/control structure is free of debris or obstructions.
- For precast structures, the barrel sections were installed with gasketted joints, adjacent riser barrel sections have been bolted together with stainless steel strapping, and there is no evidence of leakage at the joints.
- All orifices, siphons, ports, and weirs were installed in accordance with the construction drawings.
- The anti-flotation ballast has been provided in accordance with the construction drawings.
- A placed concrete invert to the invert out of the principal spillway pipe (PSP) has been provided.
- The PSP is reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.
- The diameter of the PSP is ________.
- An access hatch (minimum 2’ x 3’) and steps down the inside of the riser/control structure have been provided in accordance with the construction drawings.
- The principal spillway pipe was wrapped with a layer of geotextile filter fabric on the outside of each pipe joint.
- Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.

H. Outfall Structure and Outfall Area

- The control structure has been installed in accordance with the construction drawings.
- The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
- If not discharging to a storm sewer system:
  - The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
  - Energy dissipation has been provided in accordance with the construction drawings.
  - The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.
- If discharging to a storm sewer system, the receiving manhole appears stable and all accumulated silt and debris has been removed.
Field Checklist

for

Level Spreader-Vegetated Filter Strip Systems

Date of Certification Assessment: _____________________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as indicated in the construction drawings.
- The drainage area to the facility is 100% stabilized.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement. The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
- Unobstructed maintenance vehicle access has been provided to the control structure and level spreader, and meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide.
  - It has a maximum centerline grade of fifteen percent (15%).
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.

C. Flow Splitter

- The flow splitter (FS) structure is reinforced concrete.
- The FS diameter or opening dimensions is/are ________.
• The FS appears to be sound.
• All orifices, ports, pipes, and weirs have been installed in accordance with the construction drawings.
• The FS is free of debris or obstructions.
• If a high-flow bypass has been provided, energy dissipation prior to entering the bypass channel has been installed in accordance with the approved construction drawings.

D. Forebay

• A forebay, with an armored spillway to the blind channel-linear wetland, has been installed in accordance with the construction drawings.
• All accumulated sediment and other debris in the forebay has been removed.

E. Blind Swale

• The size, shape, width, and depth of the blind swale are in accordance with the construction drawings.
• 85% of the wetland/wet meadow plantings proposed in blind swale are thriving.
• All accumulated sediment and other debris in the blind swale have been removed.

F. Level Spreader Lip

• The level spreader lip (LSL) is reinforced concrete unless specified otherwise in the approved construction drawings.
• The LSL is of the length approved in the construction drawings.
• The LSL structure/leveler plate is level, and there are no locations where concentrated flows are discharging across the crest of the structure.
• The ends of the LSL have been contoured, with appropriate reinforcement, into the existing topography, and flows are not exiting the blind swale around the ends of the LSL.
• A minimum 3-foot width of a 3-inch layer of washed #57 stone has been installed immediately downstream of the LSL, and the surface elevation of this stone layer is approximately 2 inches below the crest of the LSL.

G. Vegetated Filter Strip (VFS)

• The length, width, gradient, cross-slope, and vegetation for each component of the VFS are in accordance with the construction drawings.
• Flow across the VFS is even, and sheet flow is sustained throughout the length of the VFS.
• For an engineered filter strip (EFS), the entire EFS was covered with a 6-inch layer of topsoil prior to the installation of sod.
• For an EFS, the sod installed was grown in a non-clayey environment.
• For an EFS, 100% of the EFS and all slopes draining to the EFS have achieved a healthy stand of turf grass
• Velocities across the VFS are not causing erosion either within or downstream of the VFS.
• For riparian buffers, the vegetation in the VFS was not disturbed during LS construction, unless such disturbance was approved specifically in the site plan and construction drawings.
H. Bypass Channel

- Bypass flows that are directed into a natural draw do not appear to be eroding the natural draw (i.e., banks of the draw not becoming incised, no sediment deposition in or at end of draw).

- Bypass flows are being directed into a reinforced bypass conveyance (either a channel or a pipe) in accordance with the approved plans. Any deviation from or revision to the approved plans is documented by engineering calculations demonstrating that, per 15A NCAC 02H .1003(5), the bypass channel does not cause erosion downslope of the discharge point during the peak flow from the 10-year storm event.

**Additional Comments by Certifying Engineer:**
Field Checklist

for

Vegetated Water Quality Swales

Date of Certification Assessment: ____________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

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If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
- 85% of the drainage area to the facility is completely stabilized, and no excess sediment is discharging into the facility.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.
- The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
- Unobstructed maintenance vehicle access has been provided to the swale and meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide,
  - It has a maximum centerline grade of fifteen percent (15%) and
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
C. Inlets to Swale

- All inlets have end treatments in accordance with the construction drawings.
- Riprap stilling basins have been installed at the inlets in accordance with the construction drawings.
- All accumulated sediment and other debris in the stilling basins has been removed.

D. Grass Swale

- The swale length, width, shape, gradient, and side slopes are in accordance with the construction drawings.
- The maximum longitudinal slope is in accordance with the construction drawings and is less than or equal to 5%.
- There are no visible signs of erosion, either in or downstream of the swale.
- All accumulated sediment and other debris in the swale has been removed.
- 85% of the swale vegetation is well established and is of the type specified in the construction drawings.
- The check dams (if any) have been constructed in accordance with the construction drawings.

Additional Comments by Certifying Engineer:
Field Checklist

for

Rainwater Harvesting Systems

Date of Certification Assessment: ____________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.
- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the rainwater harvesting system.

B. Easements

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement. The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.
- Unobstructed maintenance vehicle access has been provided to all components of the rainwater harvesting system, and meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide,
  - It has a maximum centerline grade of fifteen percent (15%) and
  - It has a maximum cross-slope of ten percent (10%).
- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
- For dedicated uses that involve the irrigation of landscaped or natural areas or other SCMs, the distribution system to said uses are located entirely in a recorded SCM easement.
C. Access

- Suitable operation and maintenance access as well as structural replacement access has been provided from a public right-of-way for the RHS tanks and the distribution systems as indicated in the construction drawings.

D. RHS Tanks

- The size, material, and location of the tanks are in accordance with the construction drawings.
- The initial inflow system (that which directly conveys rainfall runoff to the storage tanks), including any debris and mosquito screens, has been constructed in accordance with the approved construction drawings.
- The overflow system, which routes inflow volumes in excess of the storage tank system capacity to discharge, is discharging non-erosively to the endpoint specified in the approved construction drawings.
- A maintenance drain valve has been provided in accordance with the construction drawings.
- Access to the inside of the tanks has been provided in accordance with the construction drawings.

E. Distribution Systems

- The distribution systems, which include all pumps, pipes, electrical components, tubing, wiring, valves, controllers, sensors, backflow preventers, filters, and sprinkler heads, as applicable, have been installed in accordance with the construction drawings.
- The certifying engineer observed on __________ [fill in date] the proper operation of each component to ensure that each operates in accordance with the manufacturers operations manual as intended in the design documents.

F. Clear and Dedicated Uses

- The RHS delivers harvested rainwater to the “clear and dedicated uses” as specified in the Site Plans and the construction drawings.

Additional Comments by Certifying Engineer:
Field Checklist

for

Permeable Pavement

Date of Certification Assessment: __________________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ____________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized, result in insufficient on-site treatment to meet regulatory requirements, or impair its long term functionality by diverting non-approved pervious area to it.

- The drainage area to the facility is completely stabilized, and no excess sediment is discharging onto the permeable pavement.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.

- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.

C. Permeable Pavement Surface

- The structural boarder of the permeable pavement has been installed as shown on the construction drawings.

- Run on areas and/or other built upon areas draining onto or into the permeable pavement are as specified on the construction drawings.

- The surface of the permeable pavement is smooth and uniform. Brick pavers do not rock or move when stepped upon or when vehicle loads are applied. Porous asphalt/concrete is not cracked or deformed in a manner which emphasizes deficiencies with subgrade/base/pavement, or pieces of the pavement do not break off when stepped upon or when vehicle loads are applied. There are no depressions or ruts in the surface.
• The surface slope of the permeable pavement does not exceed 6% unless approved construction drawings allow for greater.

• For brick pavers, the fine media as specified on the construction drawings is present between the bricks and is not clogged with sediment and/or debris. Spacing between the pavers is as specified on the construction plans.

• The surface area of the pavement is as shown on the construction drawings.

• Underdrain cleanouts (if installed) have traffic rated caps. The cleanout sections are constructed from solid wall pipe. Underdrain cleanout caps are water tight.

• The permeable pavement educational/warning signage has been installed (except for single family residences).

• The surface or sub-surface bypass to safely convey the 100-year, 24-hour post-development storm event or the maximum storm has been installed in accordance with the construction drawings.

• All accumulated sediment and other debris has been removed.

• Parking striping and other markings are installed as specified on the construction drawings and do not excessively clog the surface pores of the permeable pavement.

• The permeable pavement system has been observed on ______________ [fill in date] by the certifying engineer to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings. It will also safely pass the 10-year, 24-hour storm event via infiltration, bypass, or detention and release.

• Run on from adjacent pervious areas have been directed away from the permeable pavement surface to the maximum extent practicable and in accordance with approved construction drawings.

• Hotspots where toxic pollutants are stored or handled are not located where spills or stormwater runoff from these areas enter sections of the permeable pavement.

• Any manufacture specific requirements for the type of permeable pavement installed have been followed.

**D. Observation Wells**

• The observation well(s) have been provided. If a tier system is utilized, then one observation well is required per tier.

• Traffic rated cap(s) are provided.

• The observation well pipe is perforated.

• The water level shown in the bottom of the observation well is in accordance with the type of permeable pavement (IWS or non IWS).

• Observation well is as deep as the subgrade surface and at least as deep as the pavement structure per the approved construction drawings.

**E. Stone Base**

• Washed aggregate of the standard size number as specified on the approved construction drawings is incorporated into the pavement structure

• The stone thickness(es) is equal to or greater than the thickness(es) on the approved construction drawings.

• Subgrade slope under the stone base has a slope less than or equal to 2% or as the approved construction drawings.
• Baffles with appropriate sized weirs/orifices have been placed between tiered subgrade/stone base in accordance with approved construction drawings.

F. Control Structure and Principal Spillway Pipe

• The control structure is reinforced concrete.
• The dimensions of the structure match the size specified on the construction drawing.
• The structure and all appurtenant devices appear to be sound.
• The structure is free of debris or obstructions.
• The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.
• All orifices, valves, siphons, ports, and weirs were installed in accordance with the construction drawings.
• The PSP is reinforced concrete with a minimum pipe strength conforming to ASTM C-76 Class III standards.
• The diameter of the PSP is as specified on the construction drawings.
• Based on a visual inspection, it appears that the joints of the PSP were “homed” reasonably well, and it appears that no joints are leaking.
• Steps down the inside of the structures (if required) have been provided in accordance with the construction drawings.

G. Outlet and Outfall

• The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
• If not discharging to a storm sewer system:
  - The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
  - Energy dissipation has been provided in accordance with the construction drawings.
  - The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.
• If discharging to a storm sewer system, the receiving manhole appears stable and all accumulated silt and debris has been removed.

Additional Comments by Certifying Engineer:
Field Checklist

for

Filterra® Units

Date of Certification Assessment: ____________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ______________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.

- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the Filterra® unit.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement. The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.

- Unobstructed maintenance vehicle access has been provided to the Filterra® unit and meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide,
  - It has a maximum centerline grade of fifteen percent (15%) and
  - It has a maximum cross-slope of ten percent (10%).

- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
C. Inlet

- The Filterra® Top Curb (TC) and Flowline (FL) elevations are higher than the bypass TC and FL elevations in accordance with the construction drawings.
- All accumulated sediment and other debris in the pre-treatment areas has been removed.
- Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.

D. Filterra® Unit

- The size and location of the installed Filterra® unit is in accordance with the construction drawings.
- The required Filterra® media mix, including the mulch layer, has been installed in accordance with the construction drawings, and there is no sediment in the concrete container/planter.
- The invert of the installed Filterra® unit is in accordance with the construction drawings.
- The underdrain system with cleanout has been installed in accordance with the approved construction drawings.
- The Filterra® plant specified in the approved construction drawings has been installed and is thriving.
- The Filterra® unit has been activated by the manufacturer.
- The manufacturer has provided a Filterra® Media Quality Assurance Certificate.
- Grates and covers are installed and show no signs of damage.

E. Outlet

- The outlet structure has been installed in accordance with the construction drawings.
- Positive drainage of the Filterra® unit is provided by the effluent treatment pipe.

Additional Comments by Certifying Engineer:
Field Checklist

for

StormFilter® by Contech

Date of Certification Assessment: _________________________
Assessing and Certifying NCPE: ___________________________ Seal:
SCM Facility Name: ____________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: _______________________________

CHECKLIST

All items in this checklist must be compliant.  
If an item is not applicable, write “N/A” next to the item.  
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.

- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the StormFilter® vault.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement.

- The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.

- Unobstructed maintenance vehicle access has been provided to the StormFilter® and meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide,
  - It has a maximum centerline grade of fifteen percent (15%) and
  - It has a maximum cross-slope of ten percent (10%).

- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
• Access into the control structure and the StormFilter® vault has been provided in accordance with the construction drawings.

C. StormFilter® Vault

• A sediment sump with minimum dimensions of 4’ diameter by 2’ deep has been constructed prior to the vault in accordance with the approved construction drawings.

• A StormFilter® vault of the correct dimensions has been installed in accordance with the approved construction drawings.

• The foundational support for and the backfill around the structure have been placed in accordance with the construction drawings.

• The correct number of StormFilter® cartridges has been installed in accordance with the approved construction drawings.

• The StormFilter® cartridges installed are of the correct height per the approved construction drawings.

• A sealed overflow assembly has been installed in accordance with the approved construction drawings.

• There is no sediment in the StormFilter® vault.

• All piping into and out of the StormFilter® vault is reinforced concrete pipe.

• The diameter of the principal spillway pipe (PSP) is ________.

• Based on a visual inspection, it appears that the joints of the pipes into and out of the vault have been acceptably "homed", and there is no evidence that any joint is leaking.

• A letter from Contech has been provided certifying that:
  
  o The correct size restrictor disc has been installed in order to achieve the design flow rate of 1 GPM/ft² of media surface (restrictor disc is purple for 1 GPM/ft²).

  o The correct StormFilter® media has been installed in accordance with the approved construction drawings (white cartridge cap for perlite, blue cartridge cap for PhosphoSorb®).

  o The letter includes the date, and project name and address.

• Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.

• The filter has been observed by the certifying engineer on ___________ [fill in date] to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings.

D. Outfall Structure and Outfall Area

• The outfall structure (if not tied into the existing stormwater drainage system) is constructed of reinforced concrete and has been constructed in accordance with the approved construction drawings.

• The outfall piping is constructed of reinforced concrete and has been constructed in accordance with the approved construction drawings.

• The outfall area appears stable, and all accumulated silt and debris has been removed.
Field Checklist

for

Silva Cell Suspended Pavement with Bioretention

Date of Certification Assessment: _________________________
Assessing and Certifying NCPE: _______________________________ Seal:
SCM Facility Name: ___________________________________________
Access Address: _________________________________________________________
PIN/s of Parcel/s Where the Facility is Sited: ____________________________

CHECKLIST

All items in this checklist must be compliant.
If an item is not applicable, write “N/A” next to the item.
If the engineer believes the non-compliant item still meets its intended purpose and is therefore acceptable, he/she must include the following in the “Additional Comments” box at the end of this form:

- A description of how the non-compliant item deviates from the standards and/or approved construction drawings, and
- An explanation of why this deviation is acceptable and how the deviation still meets the intended purpose behind the requirement.

A. Drainage Area

- The drainage area to the facility is as per the design documents, or if there are deviations from the design drainage area, these deviations do not render the SCM undersized or result in insufficient on-site treatment to meet regulatory requirements.

- The drainage area to the facility is completely stabilized, and no excess sediment is discharging into the Silva Cell.

B. Easements and Accessibility

- The SCM access way as constructed matches what is shown on the recorded final plat and is fully contained in the SCM Access and Maintenance Easement. The SCM Access and Maintenance Easement is clear of obstructions and traversable by anticipated maintenance equipment.

- Unobstructed maintenance vehicle access has been provided to the control structure and all inlets, and access to the facility and top of the dam meets the following conditions per field observation and survey spot shot data:
  - It is a minimum of 10 feet wide.
  - It has a maximum centerline grade of fifteen percent (15%).
  - It has a maximum cross-slope of ten percent (10%).

- Unless it has been surfaced with gravel, asphalt, concrete, etc., in accordance with approved construction drawings, 85% of the SCM Access and Maintenance Easement has achieved a healthy stand of grass.
C. Pretreatment

- Pretreatment devices have been installed in accordance with the approved construction drawings, and are accessible for maintenance.
- All accumulated sediment and other debris in the pretreatment devices has been removed.
- Any flow splitters or bypass systems have been constructed in accordance with the approved construction drawings.
- The flow into the Silva Cell is evenly distributed across the cell in accordance with the construction drawings.

D. Silva Cell

- The number and size of installed Silva Cell units (decks, bases, posts) is in accordance with the approved construction drawings.
- If applicable, any barriers or other devices to prevent water from migrating out of the Silva Cell have been installed in accordance with the approved construction drawings.
- The depth of the internal water storage zone is as shown in the approved construction drawings.
- The surface area of the Silva Cell is in accordance with the approved construction drawings.
- All aggregates used above the Silva Cell decks as bedding, base or sub-base layers were double washed and free of fine particles and debris at the time of installation.
- The required soil mix, choking stone and gravel layers have been installed in accordance with the approved construction drawings, and there is no sediment in the Silva Cell.
- The underdrain system has been installed in accordance with the approved construction drawings. All underdrain joints have glued watertight connections.
- Solid underdrain cleanouts have been installed in accordance with the approved construction drawings. Screw-on type (or otherwise approved) cleanout caps have been provided for all cleanout pipes.
- The volume of storage above the filter media surface and within the aggregate layers above the Silva Cell decks is equal to or greater than the design volume, but not more than 18 inches.
- All of the trees specified in the approved construction drawings are thriving.
- The Silva Cell has been observed on [fill in date] by the certifying engineer to draw down the runoff from the first inch of rainfall (minimum) in a manner consistent with that specified in the approved construction drawings.

E. Flow Splitter or Flow Bypass

- For inlets in the right-of-way, a catch basin or overflow inlet is located downslope of those inlets to ensure bypass or overflows will not create flooding.
- For flow splitters:
  - The flow splitter is reinforced concrete and has been installed in accordance with the approved construction drawings.
  - All orifices, ports, pipes, and weirs have been installed in accordance with the construction drawings.
- The flow splitter is free of debris or obstructions.
- The flow splitter is accessible for maintenance.

**F. Outfall Structure and Outfall Area**

- The control structure has been installed in accordance with the construction drawings.
- The principal spillway pipe is securely attached/grouted to the headwall or downstream manhole, and this joint is smoothly finished with no evidence of gaps, cracks, and spalling.
- If not discharging to a storm sewer system:
  - The outfall structure has been installed in accordance with the construction drawings and there is no evidence of stability issues.
  - Energy dissipation has been provided in accordance with the construction drawings.
  - The outfall area and downstream channel(s)/receiving area appear stable, and all accumulated silt and debris has been removed.
- If discharging to a storm sewer system, the receiving manhole appears stable and all accumulated silt and debris has been removed.

| Additional Comments by Certifying Engineer: |