

Post Construction Verification Documentation Requirements for Stormwater BMPs

**DNREC
Sediment and Stormwater Program**

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PREAMBLE

This guidance document consists of material extracted from the Post Construction Stormwater BMP Standards & Specifications. All of the material contained in the document has been reviewed and approved by DNREC staff and by the Regulatory Advisory Committee (RAC). The distinction between mandatory and voluntary language has been made pursuant to the ruling of the Court in *Baker v. DNREC*. Pursuant to the Court's ruling, all standards and criteria and other provisions of the former Technical Guidance Document that mandate compliance have been incorporated into the official Regulations. These provisions appear in **bold** font here for the convenience of users, together with the supporting advisory materials in regular font.

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1.0 Infiltration Practices

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the infiltration practice has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

Allowable tolerances for infiltration practices are as follows:

- **The constructed top of bank elevation may be no lower than the design elevation for top of bank.**
- **The constructed area of the infiltration surface shall be no less than 90% of the design surface area.**
- **The constructed volume of the infiltration practice surface storage shall be no less than 90% of the design volume.**
- **The constructed elevation of any structure shall be within 0.15 foot of the design.**

In the event that an allowable tolerance is exceeded the system shall be reconstructed or modified to the approved design unless supplemental calculations demonstrate compliance.

2.0 Bioretention

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the bioretention practice has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

Allowable tolerances for bioretention practices are as follows:

- **The constructed top of bank elevation may be no lower than the design elevation for top of bank.**
- **The constructed area of the bioretention surface shall be no less than 90% of the design surface area.**
- **The constructed volume of the bioretention storage shall be no less than 90% of the design volume.**
- **The constructed elevation of any structure shall be within 0.15 foot of the design.**

In the event that an allowable tolerance is exceeded the system shall be reconstructed or modified to the approved design unless supplemental calculations demonstrate compliance.

3.0 Permeable Pavement

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the permeable pavement has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

Allowable tolerances for permeable pavement are as follows:

- **The constructed permeable pavement surface area shall be no less than the design permeable pavement surface area.**
- **The contributing drainage area as constructed shall be no greater than the design contributing drainage area.**
- **The constructed storage volume of the reservoir layer shall be no less than 90% of the design volume.**
- **The constructed elevation of the overdrain or any structure shall be within 0.15 foot of the design.**

In the event that the allowable tolerances are exceeded for permeable pavement surface area or volume or structure elevations, supplemental calculations and provisions of adequate maintenance must be submitted to the approval agency to determine if the permeable pavement, as constructed, meets the design requirements.

4.0 Vegetated Roofs

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the Vegetated Roof has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for Vegetated Roofs are as follows:

- **Growth media thickness within 15% of design thickness.**
- **Plant density no less than specified on the planting plan.**
- **No less than 66% of the total contributing drainage area shall be Vegetated Roof.**

The post construction verification shall confirm that temporary or permanent irrigation has been installed in accordance with the approved plan. Certification of growth media shall be submitted with post construction verification.

5.0 Rainwater Harvesting

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the rainwater harvesting practice has been constructed in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Items to be checked and verified are as follows:

- **Presence of a pretreatment device.**
- **Capacity of any cisterns matches the design plan.**
- **For ponds, the constructed volume shall be no less than 90% of the design volume.**
- **For continuous systems, all pumps, controls, and other appurtenances installed in accordance with the plan.**
- **For irrigation systems, area of coverage is within ninety percent of that shown on the plan.**

6.0 Restoration Practices

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the restoration practice has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

7.0 Rooftop Disconnection

Post Construction Verification.

Post construction verification may be provided through visual inspection by the construction reviewer. When proper construction of the disconnection area is questioned, the construction reviewer may request for spot grade elevations to be surveyed at the beginning and end of the delineated disconnection area, including spot grades at intervals necessary to determine that the design criteria have been met. **The post construction verification for Rooftop Disconnection shall visually verify that no impervious surface exists within the rooftop disconnection area.**

8.0 Vegetated Channels

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents as follows to demonstrate that the vegetated channel has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency:

- **Spot elevations of top of bank, bottom of bank, and centerline of the vegetated channel every 25 feet throughout the length of the channel**
- **Additional spot elevations that demonstrate positive downstream drainage beyond the end of the vegetated channel**
- **Cross section of the vegetated channel at the midpoint**
- **Photo documentation of the vegetated channel depicting the channel bottom width and verification of achievement of the required 90% vegetated cover**

The constructed slope, bottom width, depth, and length of the vegetated channel shall be within 90% of the design geometrics for those parameters.

In the event that the constructed allowable tolerances are exceeded for the vegetated channel, supplemental calculations shall be submitted to determine if the vegetated channel, as constructed, meets the design requirements. The computed residence time rounded to the nearest minute shall be no less than the minimum design residence time.

Performance of a vegetated channel shall be evaluated by the Department or Delegated Agency if requested in writing to determine if reconstruction of a vegetated channel that exceeds allowable tolerances is necessary.

9.0 Sheet Flow to Vegetated Filter Strip or Vegetated Open Space

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit Post Construction Verification Documents at the discretion of the Department or Delegated Agency as follows to demonstrate that the Vegetated Filter Strip or Vegetated Open Space has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. The following items, as applicable, shall be included in the Post Construction Verification Documentation for Sheet Flow Practices:

- **Dimensions of Vegetated Filter Strips (length and width).**
- **Area of Vegetated Open Space.**
- **Cross-slope.**
- **Elevations of any structural components, such as gravel diaphragms or engineered level spreaders.**
- **Photo documentation of the grassed filter strip or grassed open space providing verification of achievement of the required 90% vegetated cover.**

Constructed allowable tolerances for vegetated filter strips and vegetated open spaces, if disturbed, shall be within the tolerances of design geometrics for the following parameters:

- **Slope shall be no greater than 2% steeper than design slope**
- **Length shall be no less than 90% of design length**
- **Width shall be no less than 90% of design width**
- **Elevations of any structural components shall be within 0.15 feet of design elevation**

In the event that the constructed allowable tolerances are exceeded for the vegetated filter strip, supplemental calculations shall be submitted to determine if the vegetated filter strip, as constructed, meets the minimum residence time. The computed residence time rounded to the nearest minute shall be no less than the minimum design residence time.

Performance of a vegetated filter strip shall be evaluated by the Department or Delegated Agency if requested in writing to determine if reconstruction of a vegetated filter strip that exceeds allowable tolerances is necessary.

10.0 Detention Practices

Post Construction Verification.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the Detention Practice has been constructed within allowable tolerances and in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

Allowable tolerances for Dry Detention Pond and Dry ED Basin are as follows:

- The constructed top of bank elevation may be no lower than the design elevation for top of bank.
- The constructed volume of the dry pond surface storage shall be no less than 90% of the design volume.
- The constructed elevation of any structure shall be within 0.15 foot of the design.

Allowable tolerances for Underground Detention Facilities are as follows:

- Grate and invert elevations of all structures, including weirs shall be within 0.15 foot of the design.
- Diameter of all pipes or dimensions of chambers within underground detention facility shall be as shown on the plan.
- Dimension of any weirs shall be within 10% of the design.

When the allowable tolerances are exceeded for volume or structure elevations, supplemental calculations must be submitted to the approval agency to demonstrate that the Detention Practice, as constructed, meets the design requirements.

11.0 Stormwater Filtering Systems

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the stormwater filtering system has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for stormwater filtering systems are as follows:

- **The constructed surface area of the filter bed shall be no less than 90% of the design surface area.**
- **The constructed volume of the surface storage shall be no less than 90% of the design volume.**
- **Depth of filter media shall be no less than 12 inches.**
- **The constructed elevation of any structure shall be within 0.15 foot of the design.**

12.0 Constructed Wetlands

Post Construction Verification Documentation.

Upon facility completion, the owner shall submit Post Construction verification documents to demonstrate that the Constructed Wetlands has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for Constructed Wetlands practices are as follows:

- **The constructed top of bank elevation may be no lower than the design elevation for top of bank.**
- **The constructed volume of the Constructed Wetlands surface storage shall be no less than 90% of the design volume.**
- **The constructed volume of the gravel substrate storage for Submerged Gravel Wetlands shall be no less than 90% of the design volume.**
- **The constructed elevation of any structure shall be within 0.15 foot of the design.**

When the allowable tolerances are exceeded for Constructed Wetlands surface area or volume or structure elevations, supplemental calculations must be submitted to the approval agency to determine if the Constructed Wetlands, as constructed, meets the design requirements.

13.0 Wet Ponds

Post Construction Verification Documentation.

Upon project completion, the owner shall submit Post Construction verification documents to demonstrate that the wet pond has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

Allowable tolerances for wet pond practices are as follows:

- **The constructed top of bank elevation may be no lower than the design elevation for top of bank.**
- **The constructed volume of the wet pond surface storage shall be no less than 90% of the design volume.**
- **The constructed elevation of any structure shall be within 0.15 foot of the design.**

When the allowable tolerances are exceeded for wet pond surface area or volume or structure elevations, supplemental calculations must be submitted to the approval agency to determine if the wet pond, as constructed, meets the design requirements.

14.0 Soil Amendments

Post Construction Verification Documentation.

Upon project completion, the owner shall submit Post Construction verification documents, including but not limited to compost delivery tickets and photo documentation of construction, to demonstrate that the soil amendment has been constructed within in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

15.0 Proprietary Practices

Post Construction Verification Documentation.

Upon project completion, the owner shall submit Post Construction verification documents to demonstrate that the Proprietary Device has been installed in accordance with manufacturer's recommendations.

16.0 Source Controls

There are no specific Post Construction Verification Documentation requirements for Source Controls.

17.0 Afforestation

Post Construction Verification Documentation.

Following planting, a period of maintenance and monitoring will begin. The afforestation planting will be considered successful if the survival of trees at the end of the second year is at least 200 combined live, planted or volunteer trees per acre. Final stabilization shall meet EPA requirements at the end of the second year.

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**PCVD Submittal Checklists
for Select Stormwater BMPs**

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STORMWATER MANAGEMENT FACILITY **POST CONSTRUCTION VERIFICATION DOCUMENT** **SUBMITTAL CHECKLIST**



Submittal Requirements

- ☐ Post Construction Verification Document survey plan in accordance with the items of this Checklist
- ☐ Supporting calculations in accordance with the items of this Checklist
- ☐ A copy of the completed Post Construction Verification Document Submittal Checklist
- ☐ Stormwater Management Facility Construction Checklist completed during construction of the facility, if applicable
- ☐ Geotechnical engineer's report, if applicable

Post Construction Verification Document Plan Requirements

All Plans:

- ☐ Plans must be submitted on minimum 24" x 36" sheets
- ☐ Provide a location map on the plan
- ☐ Provide a north arrow on the plan

The title block must include:

- ☐ Project name indicating "Post Construction Verification Document" in the plan title
- ☐ Name, address, telephone and fax numbers of the individual preparing the plan
- ☐ Scale of plan (maximum plan scale accepted will be 1"=50')
- ☐ Date of the survey
- ☐ Hundred, County, and State
- ☐ Street address of the project site
- ☐ Signature and seal of Delaware Registered Professional Engineer or Professional Land Surveyor

Delineate and properly label the following (as applicable):

- ☐ Roads adjoining the stormwater management facility
- ☐ Property lines adjacent to the stormwater management facility
- ☐ Easements (i.e. drainage, utility, access, etc.) adjacent to the stormwater management facility

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



2.0 Bioretention

Provide the following as it relates to the bioretention facility's surface area and available storage:

- ☐ Post construction verification contours of the bioretention facility, including any forebays, at 1-foot intervals
- ☐ A minimum of two cross sections showing elevations, inside slopes, top width and backslope, as applicable (to scale). Cross sections should be taken through inlet and outlet structures as applicable.
- ☐ Lowest top of bank elevation ****The constructed top of bank elevation may be no lower than the design elevation for top of bank.*
- ☐ Calculations of the surface area of the bioretention soil surface. ****The constructed area of the bioretention surface shall be no less than 90% of the design surface area.*
- ☐ Calculations of the volume of the bioretention facility as constructed with incremental storage and cumulative storage volumes in cubic feet for each one-foot elevation contour. ****The constructed volume of the bioretention storage shall be no less than 90% of the design volume.*

Provide the following information related to the inlet and outlet structures within the bioretention facility. ****The constructed elevation of any structure shall be within 0.15 foot of the design:*

- ☐ Diameter and material of all inlet and outlet pipes
- ☐ Invert elevations of all inlet and outlet pipes
- ☐ Dimensions (length, width, depth, d50) for all areas of rock outlet protection
- ☐ Dimensions and material of overflow structures
- ☐ Profile through principal spillway showing inverts and dimensions of all pipes, weirs, orifices, risers and other appurtenances, as applicable (to scale)
- ☐ Cross-section of emergency spillway (to scale)
- ☐ Profile through emergency spillway (to scale)

****When the allowable tolerances are exceeded for bioretention facility surface area or volume or structure elevations, supplemental calculations must be submitted to determine if the bioretention facility, as constructed, meets the design requirements. Submit the following:*

- ☐ Calculations of outflow from the bioretention facility for all design storms. Routing computations must be based on the constructed volumes and elevations for the facility.
- ☐ Calculations demonstrating that the design requirements have been met in the constructed condition.

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



8.0 Vegetated Channels

Provide the following as it relates to the vegetated channels's slope and cross section. ****The constructed slope, bottom width, depth, and length of the vegetated channel shall be within 90% of the design geometrics for those parameters:*

- ☐ Spot elevations of top of bank, bottom of bank, and centerline of the vegetated channel every 25 feet throughout the length of the channel.
- ☐ Additional spot elevations that demonstrate positive downstream drainage beyond the end of the vegetated channel.
- ☐ Cross section of the vegetated channel at the midpoint.
- ☐ Photo documentation of the vegetated channel depicting the channel bottom width and verification of achievement of the required 90% vegetated cover.

****When the allowable tolerances are exceeded for the vegetated channel slope, supplemental calculations must be submitted to determine if the vegetated channel, as constructed, meets the design requirements. The computed residence time rounded to the nearest minute shall be no less than the minimum design residence time. Submit the following:*

- ☐ Calculations demonstrating that the design requirements have been met in the constructed condition.

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



9.0 Vegetated Filter Strips or Open Space

Provide the following as it relates to the vegetated filter strips or open space:

- ☐ Dimensions of Vegetated Filter Strips (length and width). ****Length and width shall be no less than 90% of the design geometrics.*
- ☐ Area of Vegetated Open Space. ****Length and width shall be no less than 90% of the design geometrics.*
- ☐ Cross-slope. ****Slope shall be no greater than 2% steeper than design slope.*
- ☐ Elevations of any structural components, such as gravel diaphragms or engineered level spreaders. ****Elevations of any structural components shall be within 0.15 feet of design elevation.*
- ☐ Photo documentation of the grassed filter strip or grassed open space providing verification of achievement of the required 90% vegetated cover.

****When the allowable tolerances are exceeded for the filter strip slope, or the drainage area or flow length exceeds the design, supplemental calculations must be submitted to determine if the filter strip, as constructed, meets the design requirements. Submit the following:*

- ☐ Calculations demonstrating that the design requirements have been met in the constructed condition.

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



10.A Dry Detention Pond
10.B Dry Extended Detention Basin

Provide the following as it relates to the stormwater management pond's storage volume:

- ☐ Surveyed contours of the constructed stormwater management pond including forebays, micropools, and elevations below permanent pool at 1- or 2-foot intervals based on the datum of the approved plan. (One-foot contours will generally be expected for projects located in Kent and Sussex Counties. For sites with greater elevation differences (+20' across the site) such as is often found in New Castle County, 2-foot contours will be accepted.)
- ☐ Pond bottom elevations on a fifty-foot grid with high and low points noted
- ☐ Lowest top of bank elevation at fill for embankment/combination pond or lowest top of bank elevation for excavated pond. ****The constructed top of bank elevation may be no lower than the design elevation for top of bank.*
- ☐ Actual cross section showing elevations, inside slopes, benching, top width and backslope, as applicable (to scale).
- ☐ Calculations of the volume of the pond as constructed with incremental storage and cumulative storage volumes in cubic feet for each one-foot elevation contour. ****The constructed volume of the dry pond surface storage shall be no less than 90% of the design volume.*

Provide the following information related to the inlet and outlet structures within the stormwater facility. ****The constructed elevation of any structure shall be within 0.15 foot of the design:*

- ☐ Diameter and material of all inlet and outlet pipes
- ☐ Invert elevations of all inlet and outlet pipes
- ☐ Dimensions (length, width, depth, d50) for all areas of rock outlet protection
- ☐ Dimensions and material of outfall structures
- ☐ Profile through principal spillway showing inverts and dimensions of all pipes, weirs, orifices, risers and other appurtenances, as applicable (to scale)
- ☐ Cross-section of emergency spillway (to scale)
- ☐ Profile through emergency spillway (to scale)

*** *When the allowable tolerances are exceeded for volume or structure elevations, supplemental calculations must be submitted to the approval agency to demonstrate that the Detention Facility, as constructed, meets the design requirements. Submit the following:*

- ☐ Calculations of outflow from the stormwater management pond for all design storms. Routing computations must be based on the post construction verification survey volumes and elevations for the facility.

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



10.C Underground Detention Facilities

Provide the following information related to the structural elevations and dimensions of the underground storage facility.

- ☐ Grate and invert elevations of all structures. ****Grate and invert elevations of all structures, including weirs shall be within 0.15 foot of the design.*
- ☐ Invert and diameter of all pipes or chambers within underground storage system that is accessible following construction. ****Diameter of all pipes or dimensions of chambers within underground detention facility shall be as shown on the plan.*
- ☐ Dimensions of any weirs within underground structures. ****Dimension of any weirs shall be within 10% of the design.*

*** *When the allowable tolerances are exceeded for volume or structure elevations, supplemental calculations must be submitted to the approval agency to demonstrate that the Detention Facility, as constructed, meets the design requirements. Submit the following:*

- ☐ Calculations of outflow from the stormwater management pond for all design storms. Routing computations must be based on the post construction verification survey volumes and elevations for the facility.

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



11.0 Sand Filters

Provide the following information related to the structural elevations and dimensions of the sand filter.

- ☐ Chamber dimensions of sedimentation (wet) chamber and filtration (sand) chamber. If modular units are used, chamber dimensions must be provided for all units. ****The constructed surface area of the filter bed shall be no less than 90% of the design surface area.*
- ☐ Grate elevations at all four corners of the sand filter. If modular units are used, provide corner elevations of each modular unit. ****The constructed volume of the surface storage shall be no less than 90% of the design volume.*
- ☐ Internal weir elevations between the two chambers. ****The constructed elevation of any structure shall be within 0.15 foot of the design.*
- ☐ Water surface elevation in the sedimentation chamber.
- ☐ Sand surface elevation in the filtration chamber. ****Depth of filter media shall be no less than 12 inches.*
- ☐ Overflow catch basin dimensions, grate elevation and invert elevation.
- ☐ Pipe material and diameter of discharge pipe from overflow catch basin.

STORMWATER MANAGEMENT FACILITY
POST CONSTRUCTION VERIFICATION DOCUMENT
SUBMITTAL CHECKLIST



13.0 Wet Ponds

Provide the following as it relates to the stormwater management pond's storage volume:

- ☐ Surveyed contours of the constructed stormwater management pond including forebays, micropools, and elevations below permanent pool at 1- or 2-foot intervals based on the datum of the approved plan. (One-foot contours will generally be expected for projects located in Kent and Sussex Counties. For sites with greater elevation differences (+20' across the site) such as is often found in New Castle County, 2-foot contours will be accepted.)
- ☐ Pond bottom elevations on a fifty-foot grid with high and low points noted
- ☐ Lowest top of bank elevation at fill for embankment/combination pond or lowest top of bank elevation for excavated pond. ****The constructed top of bank elevation may be no lower than the design elevation for top of bank.*
- ☐ Actual cross section showing elevations, inside slopes, benching, top width and backslope, as applicable (to scale).
- ☐ Elevation of permanent pool, if applicable.
- ☐ Calculations of the volume of the pond as constructed with incremental storage and cumulative storage volumes in cubic feet for each one-foot elevation contour. ****The constructed volume of the wet pond surface storage shall be no less than 90% of the design volume.*

Provide the following information related to the inlet and outlet structures within the stormwater facility. ****The constructed elevation of any structure shall be within 0.15 foot of the design:*

- ☐ Diameter and material of all inlet and outlet pipes
- ☐ Invert elevations of all inlet and outlet pipes
- ☐ Dimensions (length, width, depth, d50) for all areas of rock outlet protection
- ☐ Dimensions and material of outfall structures
- ☐ Profile through principal spillway showing inverts and dimensions of all pipes, weirs, orifices, risers and other appurtenances, as applicable (to scale)
- ☐ Cross-section of emergency spillway (to scale)
- ☐ Profile through emergency spillway (to scale)

****When the allowable tolerances are exceeded for wet pond surface area or volume or structure elevations, supplemental calculations must be submitted to the approval agency to determine if the wet pond, as constructed, meets the design requirements. Submit the following:*

- ☐ Calculations of outflow from the stormwater management pond for all design storms. Routing computations must be based on the post construction verification survey volumes and elevations for the facility.