SWPPP Design Guidance

Case Study C for a Residential Development in MS4 Area w/ NNI

NYC DEP BEPA PERM

Part I: November 2025
Part II: December 2025

Objective

To provide an overview of design methodology that can be used on projects that require a Stormwater Construction Permit and stormwater management practices (SMPs).

- Using a case study for reference, this presentation is intended to communicate the appropriate design methodology for establishing and complying with stormwater management permit requirements.

- The presentation will also refer to supporting documentation and calculations that are key to the design process.

- This presentation was given in two parts, as listed below:
  - SWPPP Design Workshop Part I took place on November 18, 2025.
  - SWPPP Design Workshop Part I took place on December 9, 2025.

  Published slides have been compiled into a single deck for clarity.

Overview

1. **Introduction & Case Study Overview**
2. **SWPPP Design Process (Part I)**
   - Permit Applicability
   - Criteria Applicability
   - Geotechnical Planning
   - SMP Siting
   - Required Site-Wide Criteria
3. **SWPPP Design Process (Part II)**
   - Tier 1 & 2 SMP Design
   - Tier 3 SMP Design (MS4 Only)
   - Confirming all Requirement are Met
4. **Questions**

NYC Environmental Protection

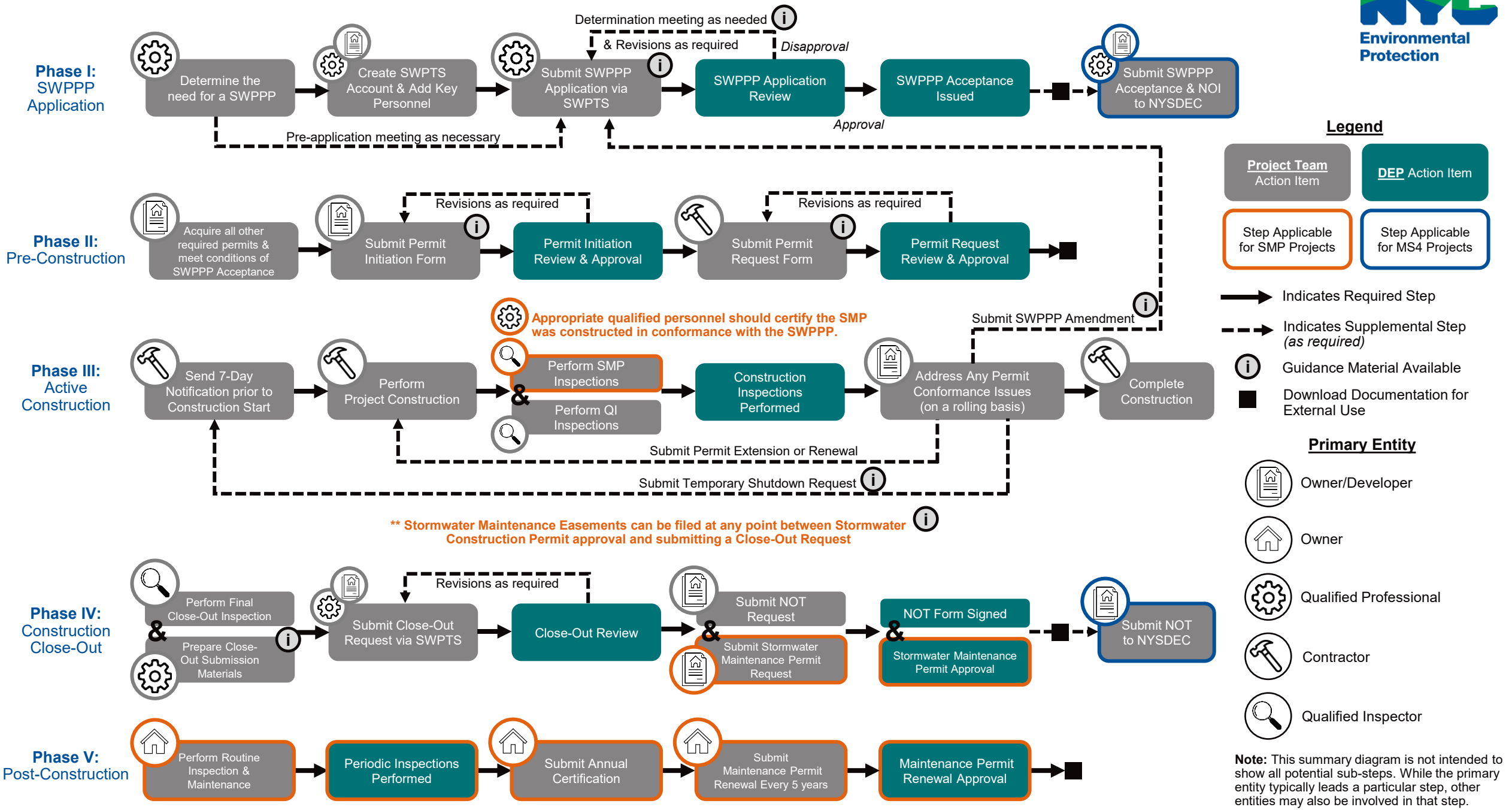
Introduction
& Case Study Overview

NYC Environmental Protection

NYC DEP STORMWATER PERMITTING PROCESS SUMMARY DIAGRAM

Version: January 21, 2026

NYC Environmental Protection



Legend

- **Project Team** Action Item
- **DEP** Action Item
- Step Applicable for SMP Projects
- Step Applicable for MS4 Projects
- Indicates Required Step
- Indicates Supplemental Step *(as required)*
- Guidance Material Available
- Download Documentation for External Use

Primary Entity

- Owner/Developer
- Owner
- Qualified Professional
- Contractor
- Qualified Inspector

Note: This summary diagram is not intended to show all potential sub-steps. While the primary entity typically leads a particular step, other entities may also be involved in that step.

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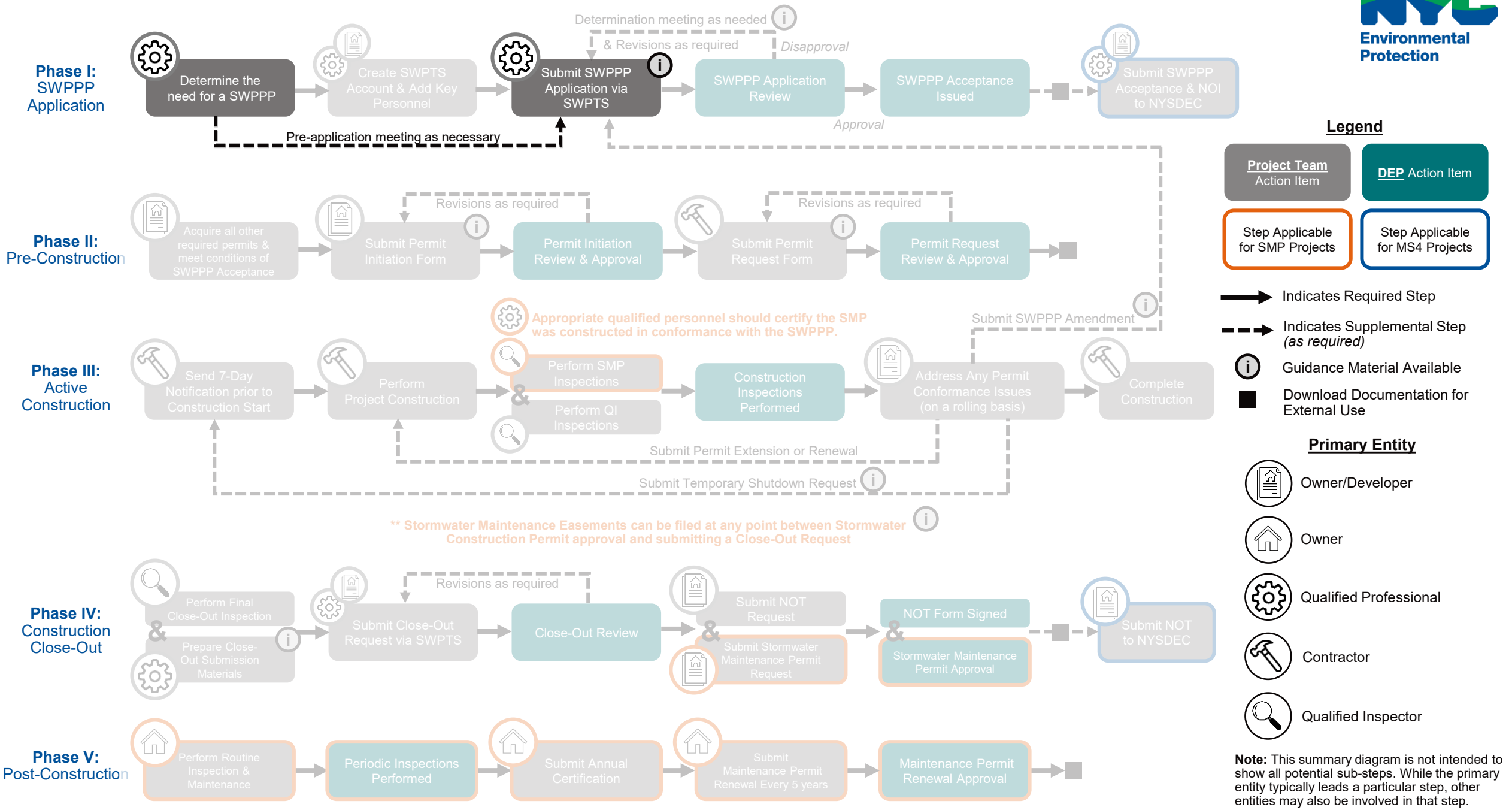

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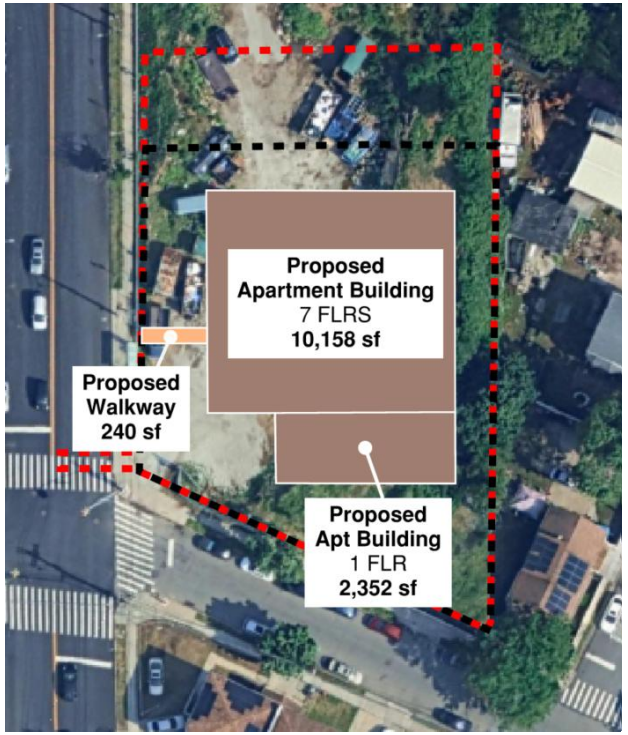
Introduction

Overview of Case Study Scope

Vacant lot that drains to the Municipal Separate Storm Sewer System (MS4) is being developed into an apartment building

***Concept Map**: Existing Site*



***Concept Map:** Proposed Development*

Introduction

Important Notes

The SWPPP Design process is highly nuanced and project-specific.

This workshop discusses applicability triggered by the following case study parameters:

- ✓ Disturbance occurs on-site and on adjacent lot (with same owner)
- ✓ New impervious area is proposed
- ✓ Development activity modifies site hydrology
- ✓ Project discharges to a municipal separate storm sewer system

This workshop is <u>not</u> intended to:

- ✗ Represent all possible design scenarios
- ✗ Cover all regulated elements of the NYC DEP Stormwater Permitting Program
- ✗ List all required supporting documentation

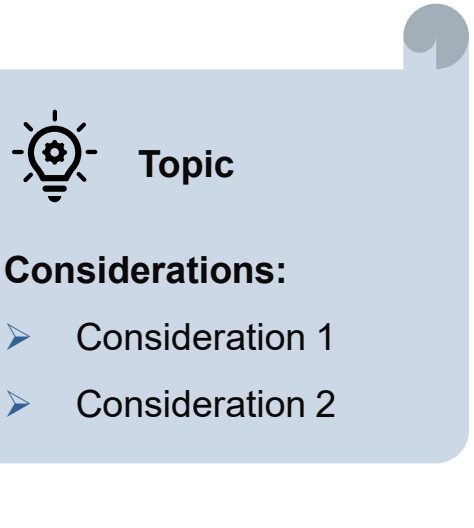
Introduction

Important Notes

The SWPPP Design process is highly nuanced and project-specific.

"Considerations" slides were added for various topics throughout the presentation to:

- Help communicate nuances in the design process
- Provide general guidance on elements that may be outside the scope of the case study



Introduction
Visual Examples

Throughout this workshop, example **Concept Maps** will be used to communicate a design concept visually.

- Contents inform SWPPP design components, including drawings, calculations, and construction processes
- Representations of design elements are schematic
- Maps are tagged with the term “Preliminary” when the plan will change throughout the design process

Concept Map: *Site Contributing Area (Preliminary)*

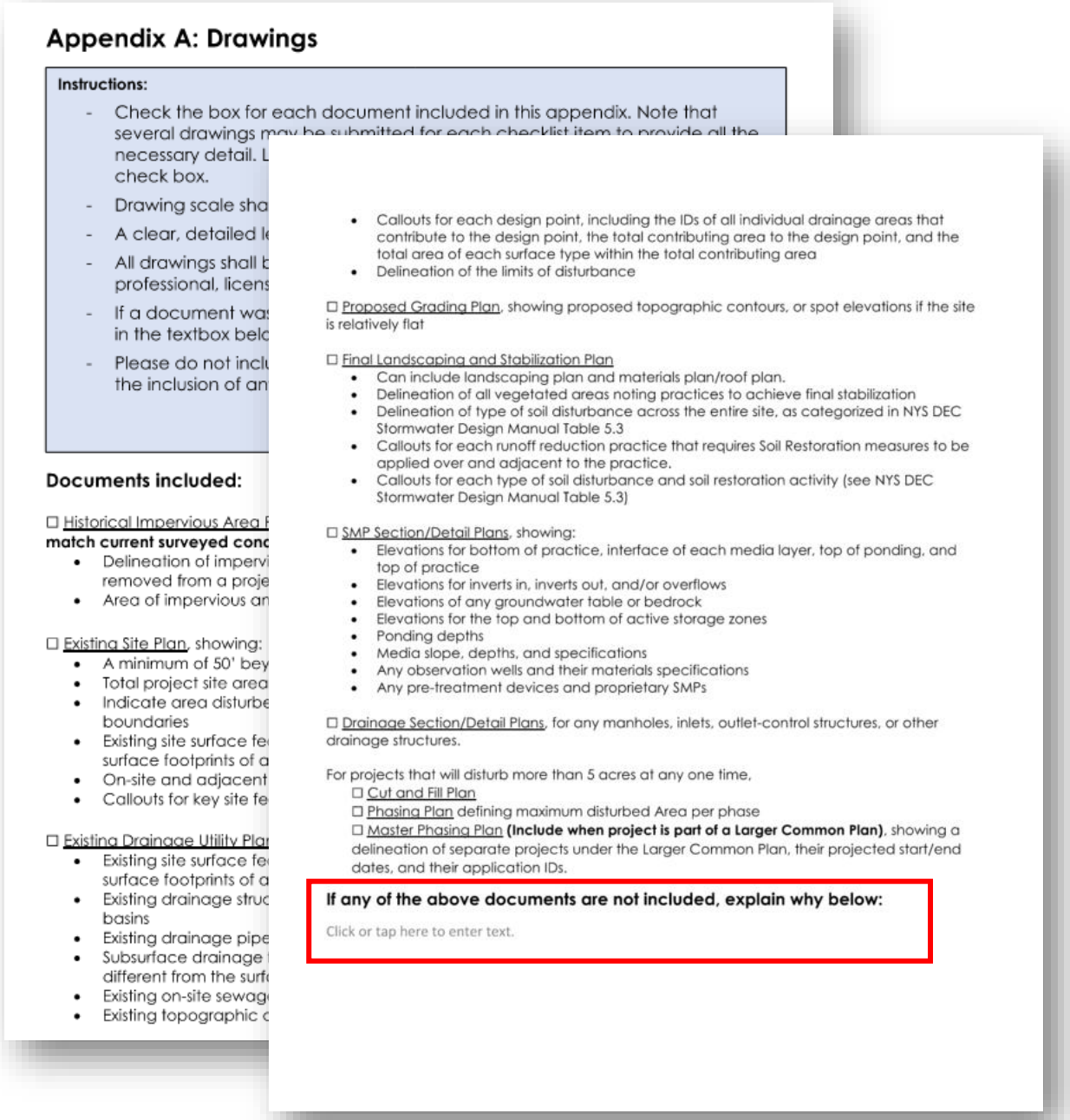
Introduction

Visual Examples

The **Concept Maps** shown throughout this presentation do not include the level of detail required in SWPPP submissions.

SWPPP submissions must include:

- All documents listed in Appendix A of the SWPPP template, in the form of engineering drawings that include all contents listed in bullets under each plan.
- If a plan was not included, a justification that states the reason it is not necessary



Appendix A: Drawings

Instructions:

- Check the box for each document included in this appendix. Note that several drawings may be submitted for each checklist item to provide all the necessary detail. L
check box.
- Drawing scale sha
- A clear, detailed le
- All drawings shall b
professional, licens
- If a document wa
in the textbox belo
- Please do not incl
the inclusion of an

Documents included:

☐ Historical Impervious Area
match current surveyed cond
- Delineation of imperv
removed from a proje
- Area of impervious ar

☐ Existing Site Plan, showing:
- A minimum of 50' bey
- Total project site area
- Indicate area disturbe
boundaries
- Existing site surface fe
surface footprints of a
- On-site and adjacent
- Callouts for key site fe

☐ Existing Drainage Utility Plan
- Existing site surface fe
surface footprints of a
- Existing drainage struc
basins
- Existing drainage pipe
- Subsurface drainage
different from the surf
- Existing on-site sewag
- Existing topographic c

- Callouts for each design point, including the IDs of all individual drainage areas that contribute to the design point, the total contributing area to the design point, and the total area of each surface type within the total contributing area
- Delineation of the limits of disturbance

☐ Proposed Grading Plan, showing proposed topographic contours, or spot elevations if the site is relatively flat

☐ Final Landscaping and Stabilization Plan
- Can include landscaping plan and materials plan/roof plan.
- Delineation of all vegetated areas noting practices to achieve final stabilization
- Delineation of type of soil disturbance across the entire site, as categorized in NYS DEC Stormwater Design Manual Table 5.3
- Callouts for each runoff reduction practice that requires Soil Restoration measures to be applied over and adjacent to the practice.
- Callouts for each type of soil disturbance and soil restoration activity (see NYS DEC Stormwater Design Manual Table 5.3)

☐ SMP Section/Detail Plans, showing:
- Elevations for bottom of practice, interface of each media layer, top of ponding, and top of practice
- Elevations for inverts in, inverts out, and/or overflows
- Elevations of any groundwater table or bedrock
- Elevations for the top and bottom of active storage zones
- Ponding depths
- Media slope, depths, and specifications
- Any observation wells and their materials specifications
- Any pre-treatment devices and proprietary SMPs

☐ Drainage Section/Detail Plans, for any manholes, inlets, outlet-control structures, or other drainage structures.

For projects that will disturb more than 5 acres at any one time,
☐ Cut and Fill Plan
☐ Phasing Plan defining maximum disturbed Area per phase
☐ Master Phasing Plan **(Include when project is part of a Larger Common Plan)**, showing a delineation of separate projects under the Larger Common Plan, their projected start/end dates, and their application IDs.

If any of the above documents are not included, explain why below:

Click or tap here to enter text.

SWPPP Design Process

NYC Environmental Protection

Permit Applicability

Permit Applicability

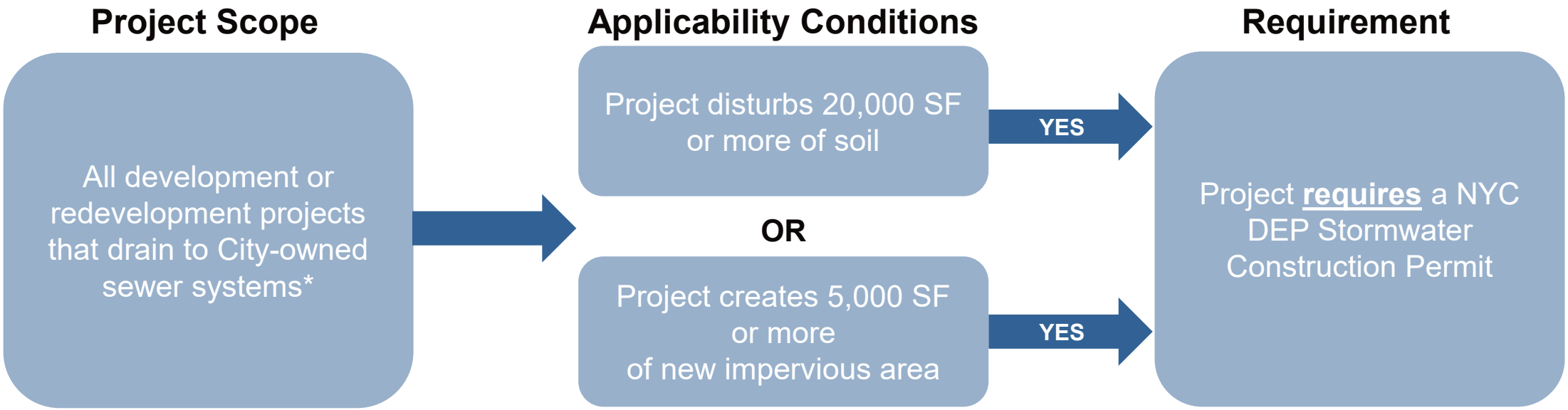
<u>Goal:</u> Determine whether a project needs a Stormwater Construction Permit

Key Questions

- Can the development project drain to an NYC-owned sewer system?
- How much soil is disturbed?
- How much new impervious cover is created?

Permit Applicability

Stormwater Construction Permit Applicability Flow Chart



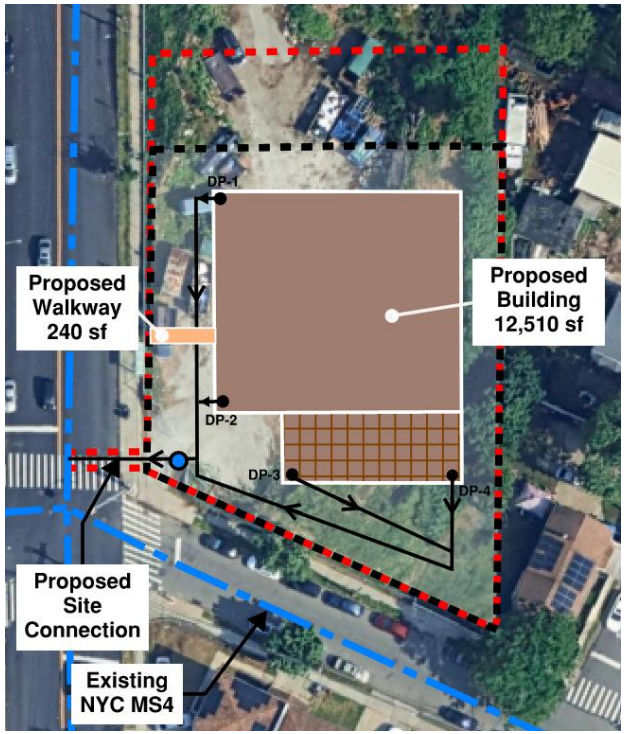
**Direct discharges to Waters of the State of New York from or through NYC-Owned properties may also be considered covered development projects that require a Stormwater Construction Permit.*

Permit Applicability

Can the development project drain to an NYC-owned sewer system?

Vacant lot that drains to the Municipal Separate Storm Sewer System (MS4) ✓
is being developed into an apartment building

***Concept Map**: Existing Site*



***Concept Map:** Proposed Development & Sewer Connection*

Permit Applicability

Can the development project drain to an NYC-owned sewer system?

Confirming Sewershed Type & Connectivity

Considerations:

- If the proposed project is re-using an existing sewer connection, confirmation must be completed to verify where the existing site discharge point connects to the NYC sewer system.
- Confirmation of connectivity and discharge point to the NYC sewer system is especially important if there are both combined sewer and municipal separate storm sewer systems adjacent to the site.
- A dye test shall be performed to confirm the existing discharge point to the NYC sewer system.
- If a sewer card exists verifying the existing sewer connection and it is clear from record drawings and field observation that the existing drainage system flows in one direction to the NYC sewer system, then a dye test can be avoided.

Permit Applicability

How much soil is disturbed?

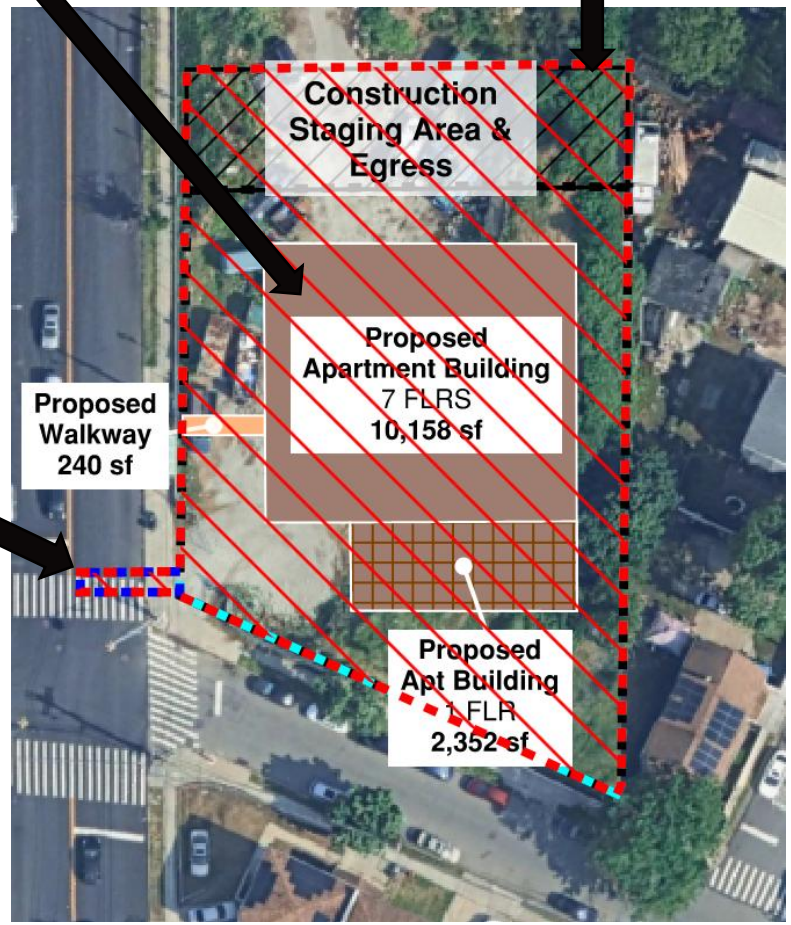
Disturbed areas are characterized as soil disturbed by development activities such as clearing, grading, excavation, demolition & construction

Disturbed areas include construction support activities, such as construction staging areas, stockpiling, egress, etc.

Note: Disturbance extending outside of the property boundary (within an easement or the right-of-way) must be accounted for in overall disturbance value.

LEGEND

- Property Limits: *26,330 sf*
- On-Site Disturbance: *32,639 sf*
- ROW Disturbance: *235 sf*
- Proposed Apartment Building
- Proposed Walkway
- Construction Staging & Egress Areas
- Limit of Disturbance: *32,874 sf*



Concept Map: *Soil Disturbance*

Permit Applicability

How much soil is disturbed?

Estimating Soil Disturbance

Considerations:

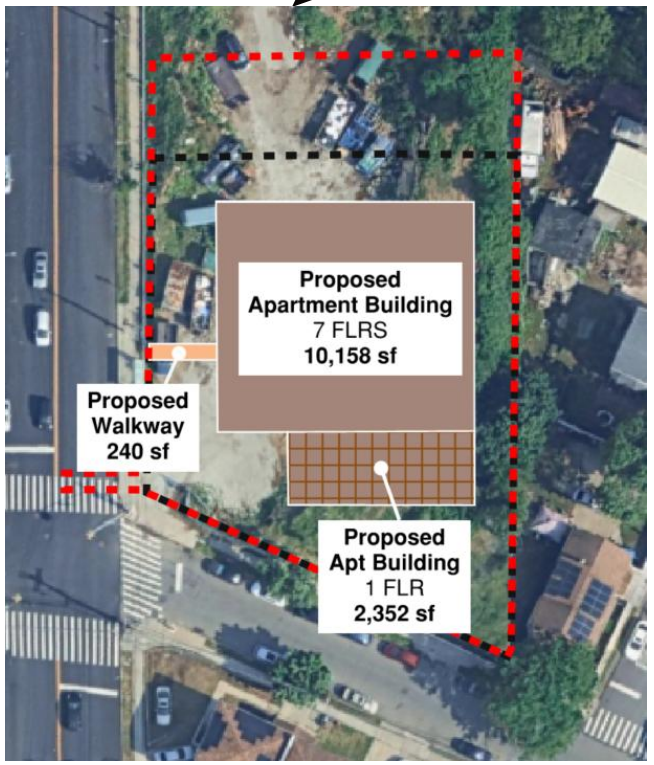
- To avoid delays and costs associated with SWPPP amendments, estimate soil disturbance conservatively
- Planned limits of work itself, as well as construction support activities.
- In some cases, all areas within the contract limit lines should be included if the contractor is likely to disturb as part of construction support.
- Projects that are close to the 20,000-sf threshold should consider submitting a SWPPP to avoid significant delays if the contractor disturbs more than anticipated.
- Disturbance extending outside of the property boundary (within an easement or the right-of-way) must be accounted for in overall disturbance value. If there are both on-site and ROW disturbance, they must be identified separately in the SWPPP and plans.

Permit Applicability

How much new impervious cover is created?

Change in impervious cover is calculated from pre- to post- development conditions for the disturbed area.

***Concept Map**: Existing Site*



***Concept Map:** Proposed Development*

Permit Applicability

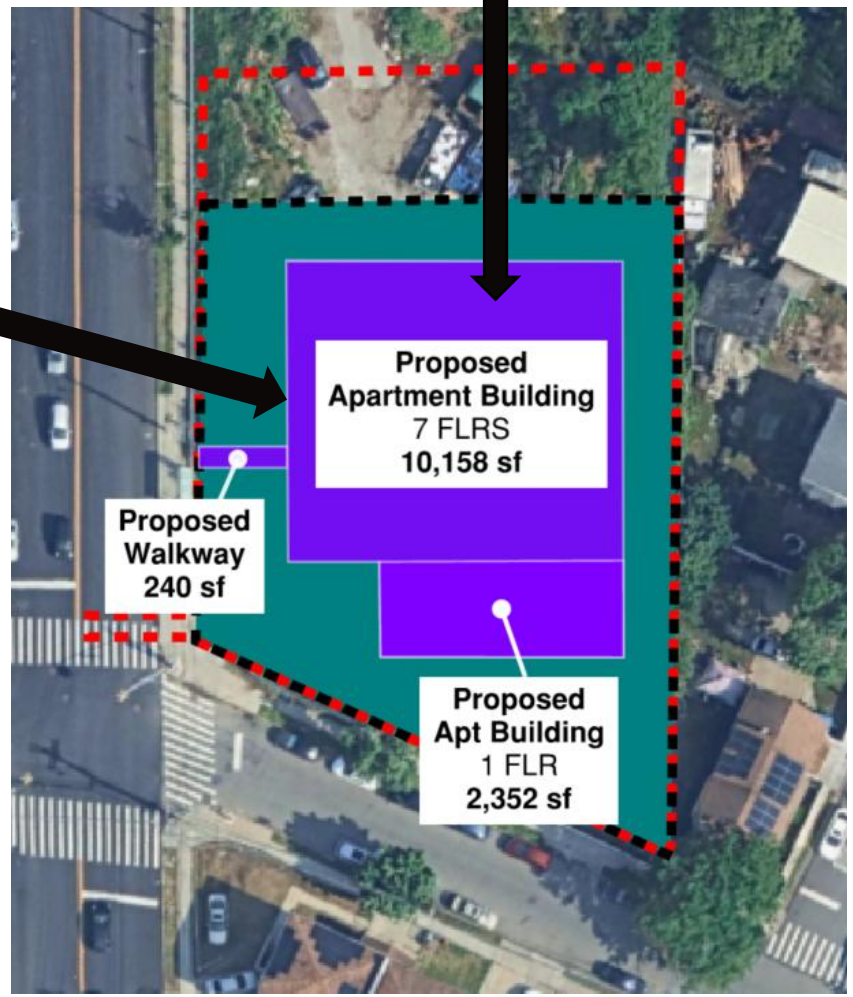
How much new impervious cover is created?

Impervious area are hard surfaces that cannot effectively infiltrate rainfall, such as rooftops, pavements, sidewalks, and driveways.

Change in impervious cover is calculated from pre- to post- development conditions for the disturbed area.

LEGEND

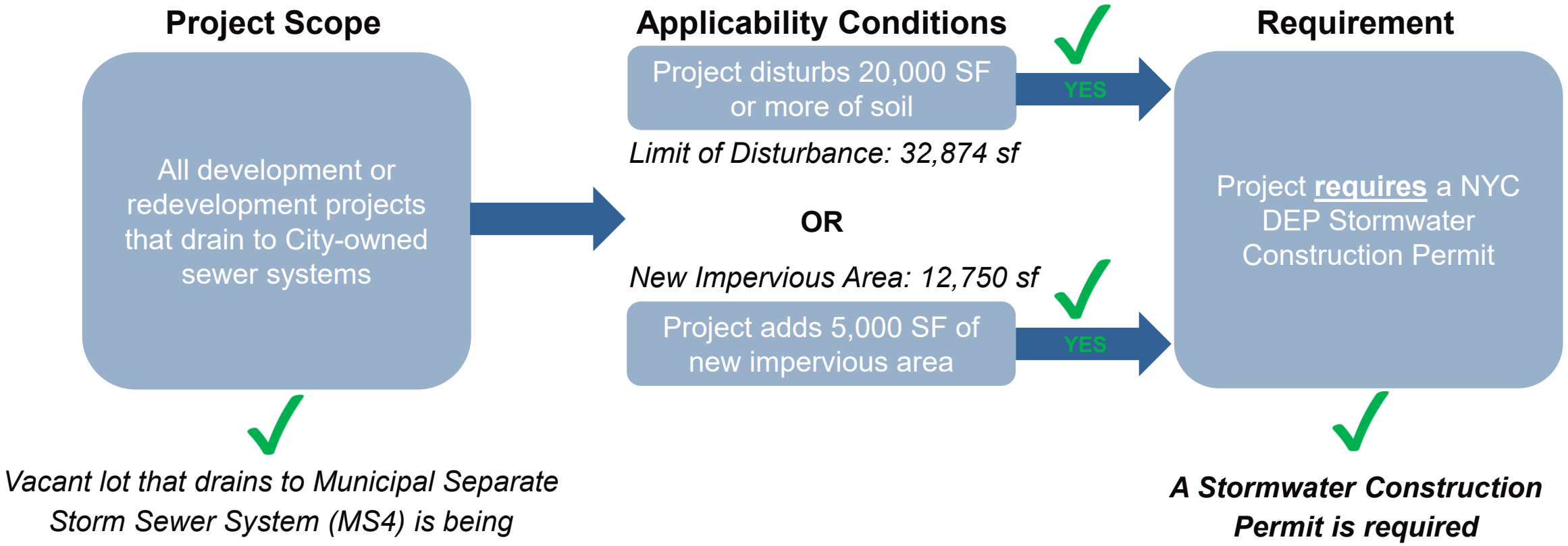
- Property Limits: *26,330 sf*
- Total Disturbance: *32,874 sf*
- Existing Structures (N/A)
- Existing Pervious in Disturbed Area: *26,330 sf*
- Existing Impervious in Disturbed Area (N/A)
- New Impervious in Disturbed Area: *12,750 sf*



Concept Map: *Change in Impervious Area*

Permit Applicability

Stormwater Construction Permit Applicability Flow Chart



Permit Applicability

<u>Goal:</u> Determine whether a project needs a Stormwater Construction Permit

Key Questions

- Can the development project drain to an NYC-owned sewer system?
- How much soil is disturbed?
- How much new impervious cover is created?

A Stormwater Construction Permit is required for this project.

Criteria Applicability

Criteria Applicability

<u>Goal:</u> Establish which stormwater management criteria apply to my project

Key Questions

- Are Erosion & Sediment Controls required?
- Are long-term SMPs required?
- Do any MS4-Only criteria apply?

CSS & MS4 | MS4 Only

Criteria Applicability

Criteria Regulated under Stormwater Construction Permits

When a Stormwater Construction Permit is applicable, a Stormwater Pollution Prevention Plan (SWPPP) **must** be prepared. The contents of the SWPPP will depend on which of the following criteria apply:

During Construction

Erosion & Sediment Control (ESC)

Goal: Designed to minimize discharge of pollutants during construction activities

Post-Construction

Water Quality (WQ)

Goal: Aims to manage runoff from small, frequent storm events that can impact water quality

Runoff Reduction (RR)

Goal: Aims to preserve natural hydrologic functions

Sewer Operations (V_V & Q_{DRR})

Goal: Aims to manage runoff from larger storm events to maintain optimal flow rates in the City sewer system

No-Net Increase (NNI)

Goal: Aims to reduce pollutants of concern in MS4 areas that discharge to an impaired waterbody

Channel Protection (Cp_V)

Goal: To protect stream channels from erosion and prevent flooding

Overbank and Extreme Flood Control (Q_P & Q_F)

Goal: To prevent an increase in the frequency and magnitude floods

ESC | WQ_V | RR_V | V_V Q_{DRR} | NNI | Cp_V | Q_P Q_F

Criteria Applicability

Are Erosion & Sediment Controls required?

Erosion and Sediment Control criteria are **always** required.

ESC | WQ_V | RR_V | V_V Q_{DRR} | NNI | Cp_V | Q_P Q_F

Criteria Applicability

Are long-term SMPs required?

NYC SWM Table 2.2 lists covered development projects that only require the implementation of ESC during construction, and therefore “ESC-Only” SWPPP.

If **any** proposed activities on a project are not listed within this table, long-term stormwater management is required as well as ESC. In this case, an “ESC&SMP” SWPPP must be prepared.

Notes:

Projects should cross reference this table with the 2025 CGP Appendix B Table 1.

Table 2.2. Covered development projects that require the preparation of a SWPPP that includes only erosion and sediment control (ESC) requirements.

Covered Development Activity
Installation of underground, linear utilities such as gas lines, fiber-optic cable, cable TV electric, telephone, sewer mains, and water mains
Environmental enhancement projects, such as wetland mitigation projects, stormwater retrofits and stream restoration projects
Pond construction
Linear bike paths running through areas with vegetative cover, including bike paths surfaced with an impervious cover
Cross-country ski trails and walking/hiking trails
Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are not park of residential, commercial or institutional development
Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that include incidental shoulder or curb work along an existing highway to support construction of the sidewalk, bike path or walking path
Slope stabilization projects
Slope flattening that changes the grade of the site, but does not significantly change the runoff characteristics
Spoil areas that will be covered with vegetation
Vegetated open space projects (i.e. recreational parks, lawns, meadows, fields, downhill ski trails) excluding projects that alter hydrology from pre- to post-development conditions
Athletic fields (natural grass) that do not include the construction or reconstruction of impervious area and do not alter hydrology from pre to post development conditions
Demolition project where vegetation will be established, and no redevelopment is planned
Overhead electric transmission line project that does not include the construction of permanent access roads or parking areas surfaced with impervious cover
Temporary access roads, median crossovers, detour roads, lanes, or other temporary impervious areas that will be restored to pre construction conditions once the construction activity is complete
Road reconstruction projects where the total soil disturbance from all activities is less than 1-acre

ESC | WQ_V | RR_V | V_V Q_{DRR} | NNI | Cp_V | Q_P Q_F

Criteria Applicability

Are long-term SMPs required?

NYC SWM Table 2.3 is a non-exhaustive list of covered development projects that require long-term stormwater management, as well as ESC.

These projects require an “ESC&SMP” SWPPP.

Notes:

Projects should cross reference this table with the 2025 CGP Appendix B Table 2.

Table 2.3. Covered development projects that require the preparation of a SWPPP that includes ESC requirements, as well as WQ and RR requirements.

Covered Development Activity
Single family home directly discharging to one of the impaired segments listed in Appendix 2 of the MS4 Permit
Single family home that disturbs five (5) or more acres of land
Single family residential subdivisions directly discharging to one of the impaired segments listed in Appendix 2 of the MS4 Permit
Single family residential subdivisions Multi-family residential developments; includes duplexes, townhomes, condominiums, senior housing complexes, apartment complexes, and mobile home parks
Airports
Amusement parks
Breweries, cideries, and wineries, including establishments constructed on agricultural land
Cemeteries that include the construction or reconstruction of impervious area (>5% of disturbed area) or alter that hydrology from pre to post development conditions
Commercial developments
Churches and other places of worship
Permanent access roads, parking areas, substations, compressor stations and well drilling pads, surface with impervious cover, and constructed as part of an over-head electric transmission line project, wind-power project, call tower project, oil or gas well drilling project, sewer or water main project or other linear utility project
Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are part of a residential, commercial, or institutional development
Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are part of a highway construction or reconstruction project
All other covered development projects that include the construction or reconstruction of impervious area or alter the hydrology from pre and post development conditions, and are not listed in Table 2.2

ESC | WQ_V | RR_V | V_V Q_{DRR} | NNI | Cp_V | Q_P Q_F

Criteria Applicability

Are long-term SMPs required?

Case Study Scope: A vacant lot is being developed into an apartment building

✗ Construction of apartment buildings (i.e. multi-family residential developments) are not listed in NYC SWM Table 2.2

✓

Table 2.2. Covered development projects that require the preparation of a SWPPP that includes only erosion and sediment control (ESC) requirements.

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Road reconstruction projects where the total soil disturbance from all activities is less than 1-acre

ESC | WQ_V | RR_V | V_V Q_{DRR} | NNI | Cp_V | Q_P Q_F

Criteria Applicability

Are long-term SMPs required?

Case Study Scope: A vacant lot is being developed into an apartment building

✓ Listed in NYC SWM Table 2.3

✓

Table 2.3. Covered development projects that require the preparation of a SWPPP that includes ESC requirements, as well as WQ and RR requirements.

Covered Development Activity
Single family home directly discharging to one of the impaired segments listed in Appendix 2 of the MS4 Permit
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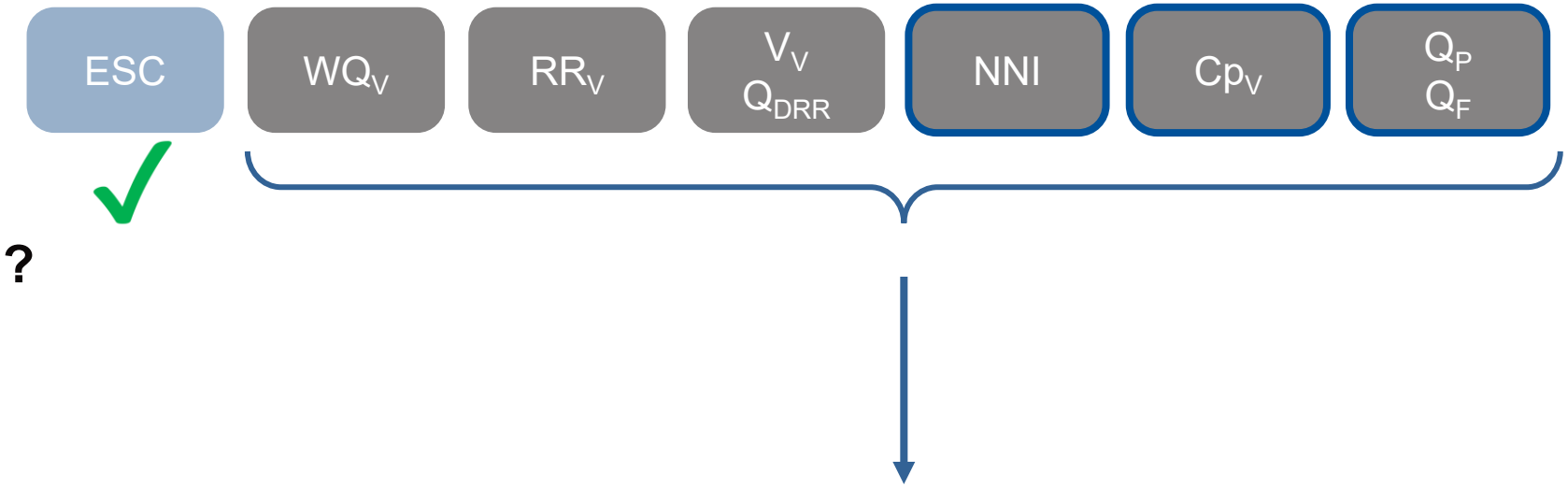
Criteria Applicability

Are long-term SMPs required?



Case Study Scope: A vacant lot is being developed into an apartment building

✗ Construction of apartment buildings are not listed in NYC SWM Table 2.2

&

✓ Listed in NYC SWM Table 2.3

Project requires an "ESC&SMP" SWPPP.

Once this is established, projects must check for the applicability of each of the long-term stormwater management criteria.

Criteria Applicability

Are long-term SMPs required?

WQv and RRv apply to **all** projects that require long-term stormwater management, and therefore an "**ESC&SMP" SWPPP.**

Criteria Applicability

Are long-term SMPs required?

Sewer Operations criteria apply when a site can discharge to City sewers.

ESC ✓ | WQ_V ✓ | RR_V ✓ | V_V Q_{DRR} ✓ | NNI | Cp_V | Q_P Q_F

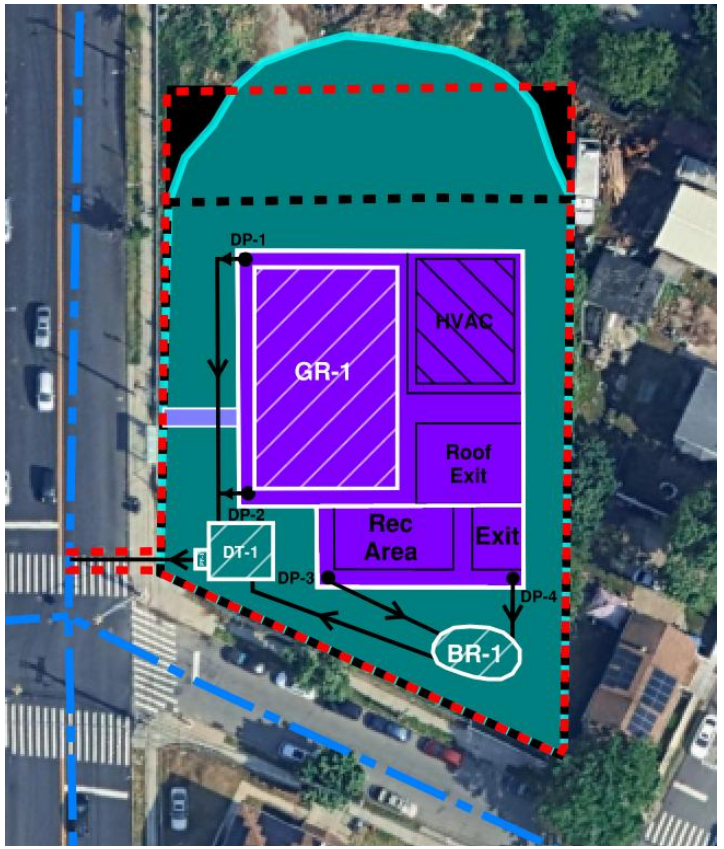
Criteria Applicability

Are long-term SMPs required?

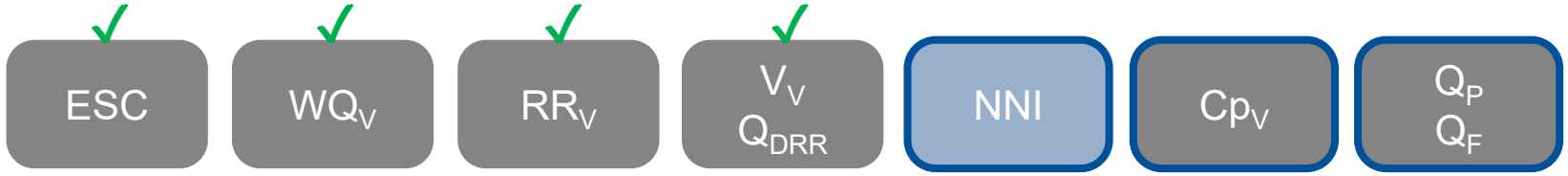
Apply when project can discharge to a City-owned

LEGEND

- Limit of Property: *26,330 sf*
- Total Disturbance: *32,874 sf*
- Total Drainage Area: *33,174 sf*
- Existing Structures (N/A)
- Grass Area
- Building Area
- Walkway Area
- Non-Contributing Areas in LOD
- DP- # Drainage Point and ID
- Proposed Inlet and Drainage
- NYC Municipal Separate Storm Sewer System (MS4)



Concept Map: *Proposed Cover and Contributing Area Drainage (Preliminary)*

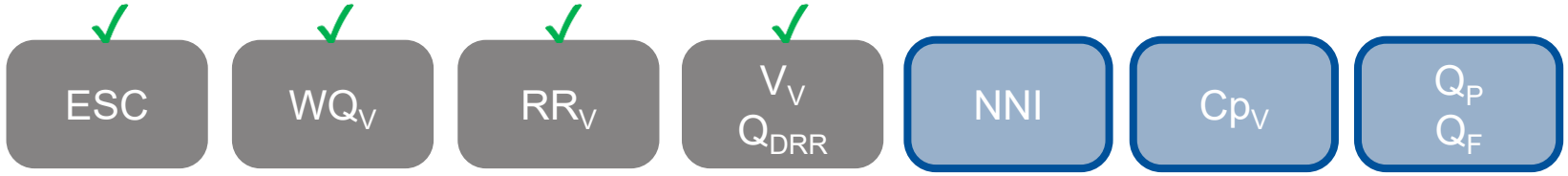


Criteria Requirements

Do any MS4-Only criteria apply?

No-Net-Increase criteria apply when a project meets **all** of the following conditions:

1. Project disturbs 20,000 SF or more of soil, or creates 5,000 sf or more of new impervious area ✓
2. Project increases site imperviousness ✓
3. Project discharges to MS4 system → Must be confirmed.
4. Project discharges to an impaired waterbody



Criteria Requirements

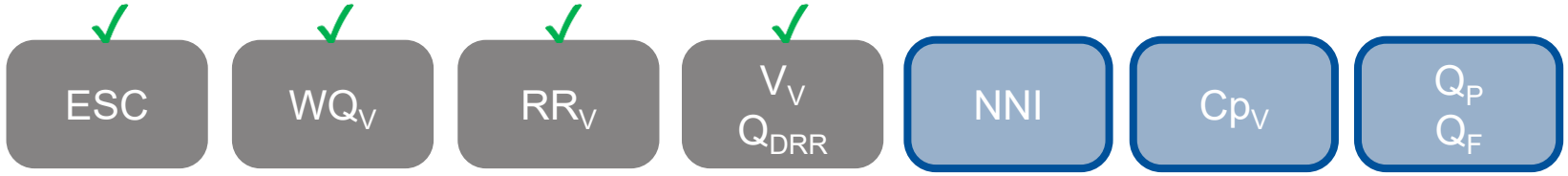
Do any MS4-Only criteria apply?

The following steps may be used to determine the sewershed type:

3a. Locate project on NYC DEP MS4 Interactive Map

3b. Confirm findings by requesting official record via NYC DEP PARIS

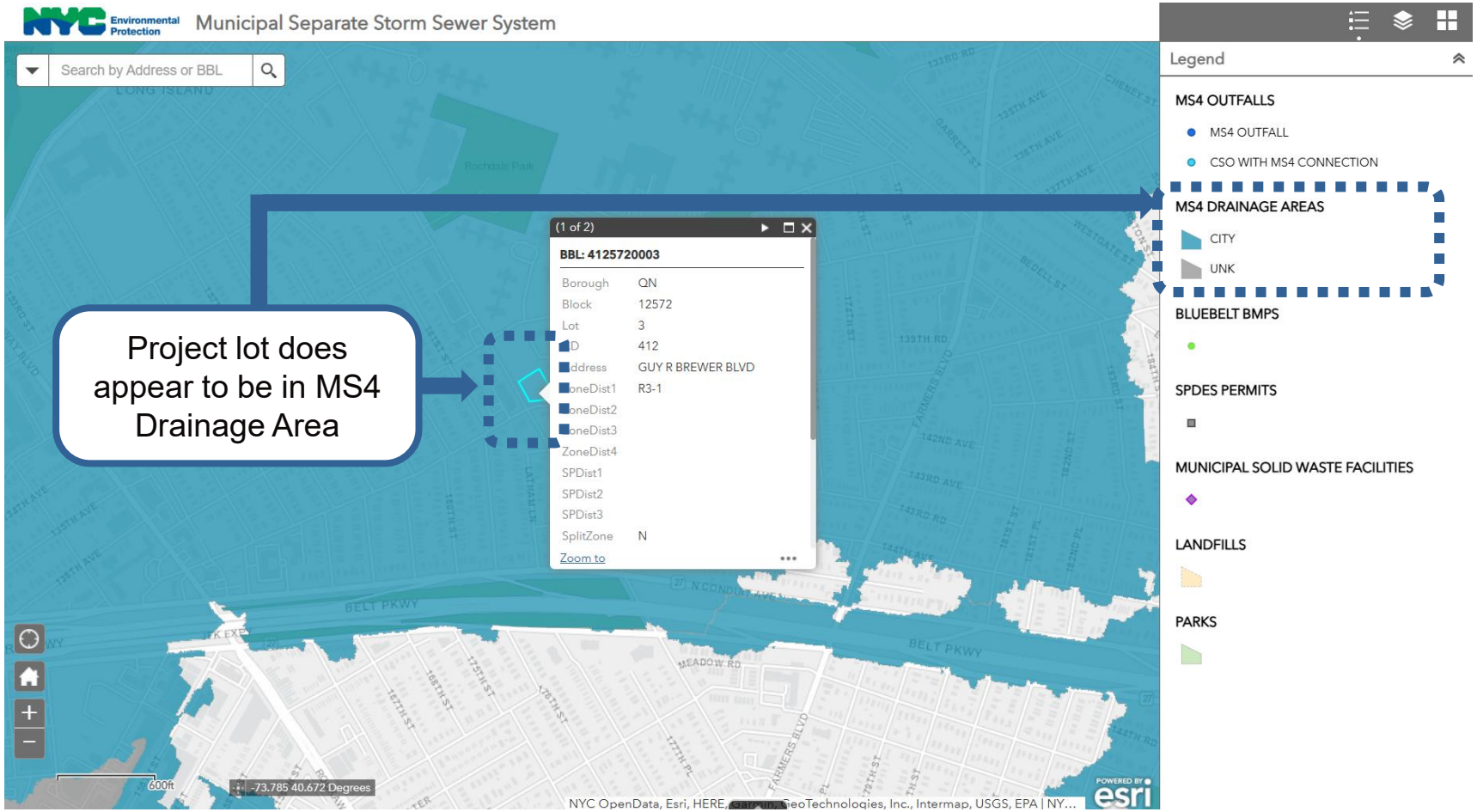
3c. Resolve any inconsistencies by requesting a Pre-Application Meeting with DEP (as needed)



Criteria Requirements

Do any MS4-Only criteria apply?

3a. Locate project on [NYC DEP MS4 Interactive Map]



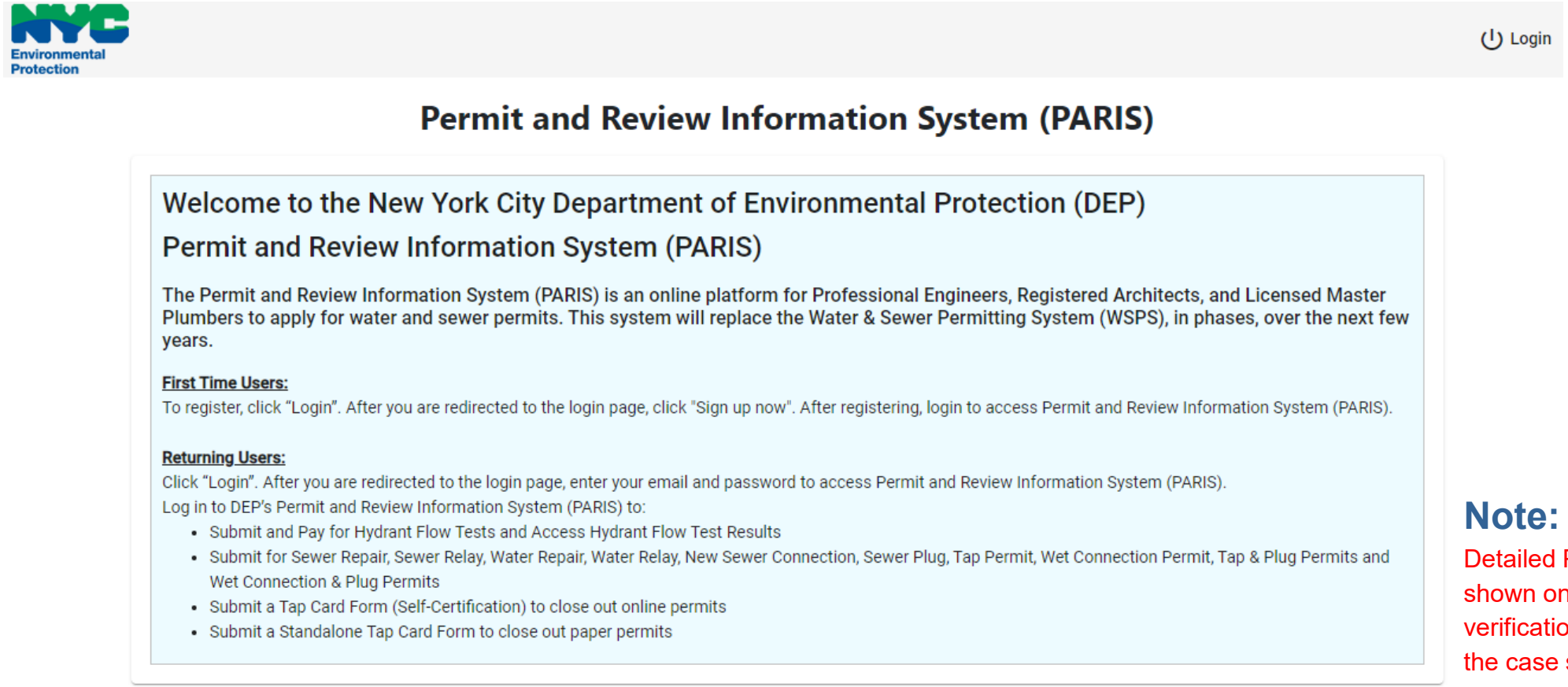
Notes:

- MS4 Interactive Map provides approximate boundaries for areas discharging to MS4 system and impaired waterbodies.
- It is helpful in determining an MS4 area's receiving waterbody and impairment.
- In some cases, the ownership and discharge area is inaccurate or unknown and must be verified separately.

Criteria Requirements

Do any MS4-Only criteria apply?

3b. Confirm findings by requesting official record via NYC DEP PARIS



Note:

Detailed PARIS steps are not shown on this slide, but verification was completed for the case study.

Criteria Requirements

Do any MS4-Only criteria apply?

3c. Resolve any inconsistencies by requesting a "SWPPP Pre-Application Meeting" with DEP via the Stormwater Permit Inquiry Form (as needed)

NYC Environmental Protection

Stormwater Permits Inquiry

You can reach out to the Stormwater Permits Team by submitting your contact information and inquiry below. Be sure to have look at the Stormwater Permit FAQs before submitting your inquiry.

Name *

First Last

Email *

Phone Number

####

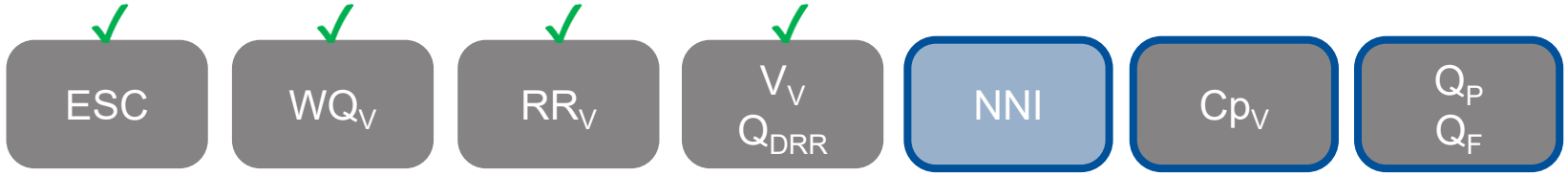
Subject *

Requesting a SWPPP Pre-Application Meeting

If you have questions related to multiple subjects, please submit a separate form for each subject.

Submit

This site is protected by reCAPTCHA Enterprise and the Google Privacy Policy and Terms of Service apply.

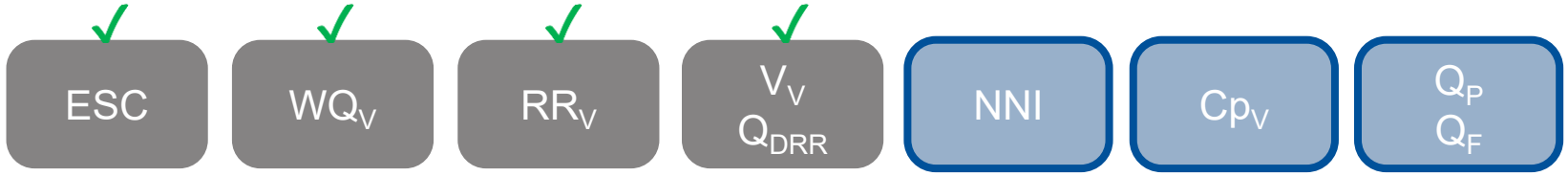


Criteria Requirements

Do any MS4-Only criteria apply?

No-Net-Increase criteria apply when a project meets **all** of the following conditions:

1. Project disturbs 20,000 SF or more of soil, or creates 5,000 sf or more of new impervious area ✓
2. Project increases site imperviousness ✓
3. Project discharges to MS4 system ✓
4. Project discharges to an impaired waterbody → Must be confirmed.



Criteria Requirements

Do any MS4-Only criteria apply?

The following steps may be used to determine applicable waterbody impairments:

4a. Locate project on NYC DEP MS4 Interactive Map

4b. Click on the associated MS4 Drainage Area shape to identify the corresponding MS4 outfall ID

4c. Locate the identified MS4 outfall location

4d. Cross reference outfall location with NYS DEC Environmental Resource Mapper and confirm the receiving waterbody

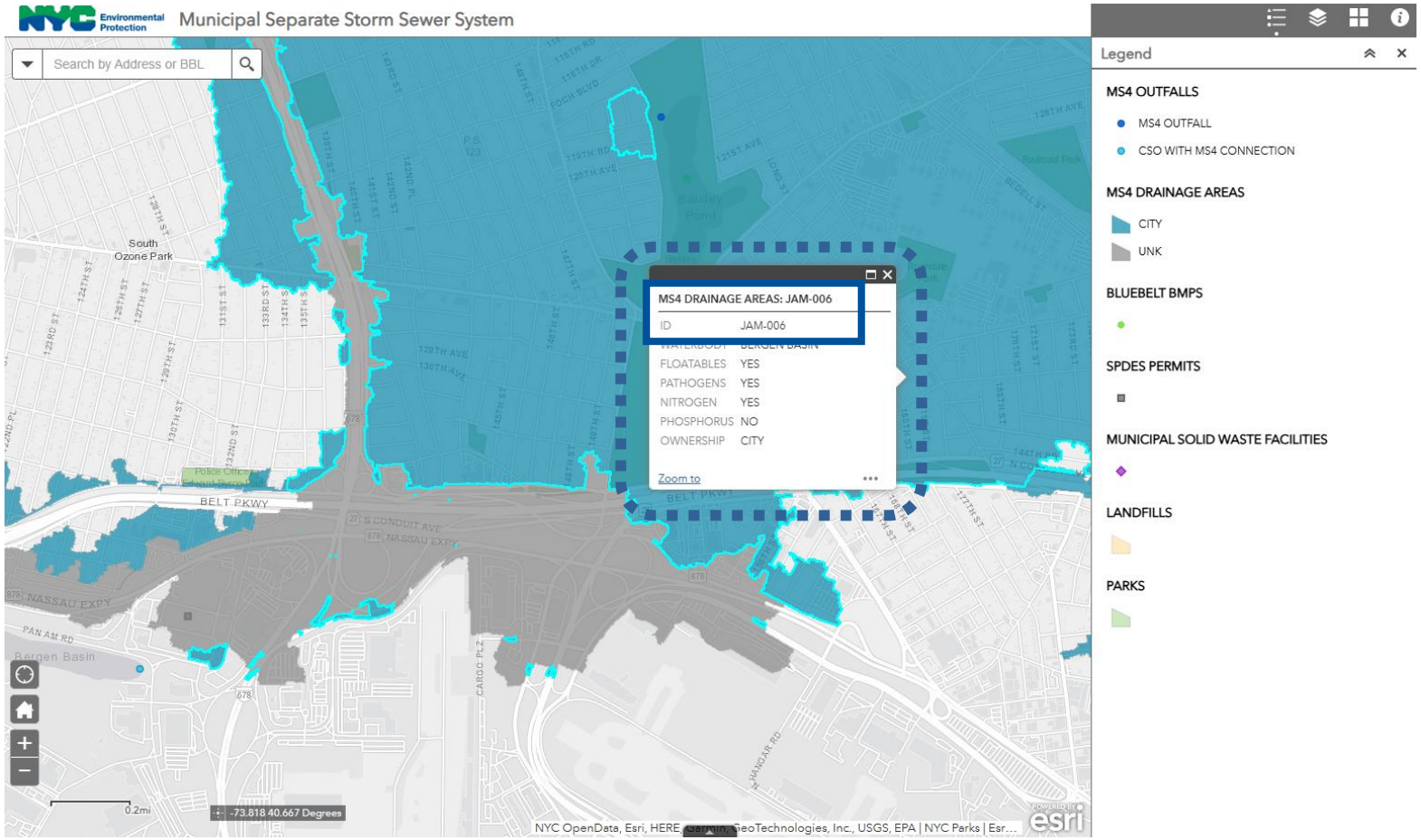
4e. Refer to NYC DEP SWM Table 2.4 to determine pollutants of concern in receiving waterbody

Criteria Requirements

Do any MS4-Only criteria apply?

4a. Locate project on [NYC DEP MS4 Interactive Map]

4b. Click on the associated MS4 Drainage Area shape to identify the corresponding MS4 outfall ID



Notes:

- MS4 Interactive Map provides approximate boundaries for areas discharging to MS4 system and impaired waterbodies.
- The MS4 Map waterbody impairment information must be confirmed with the NYS DEC Environmental Mapper and NYC SWM Table 2.4.
- In some cases, the ownership and discharge area is inaccurate or unknown and must be verified separately.

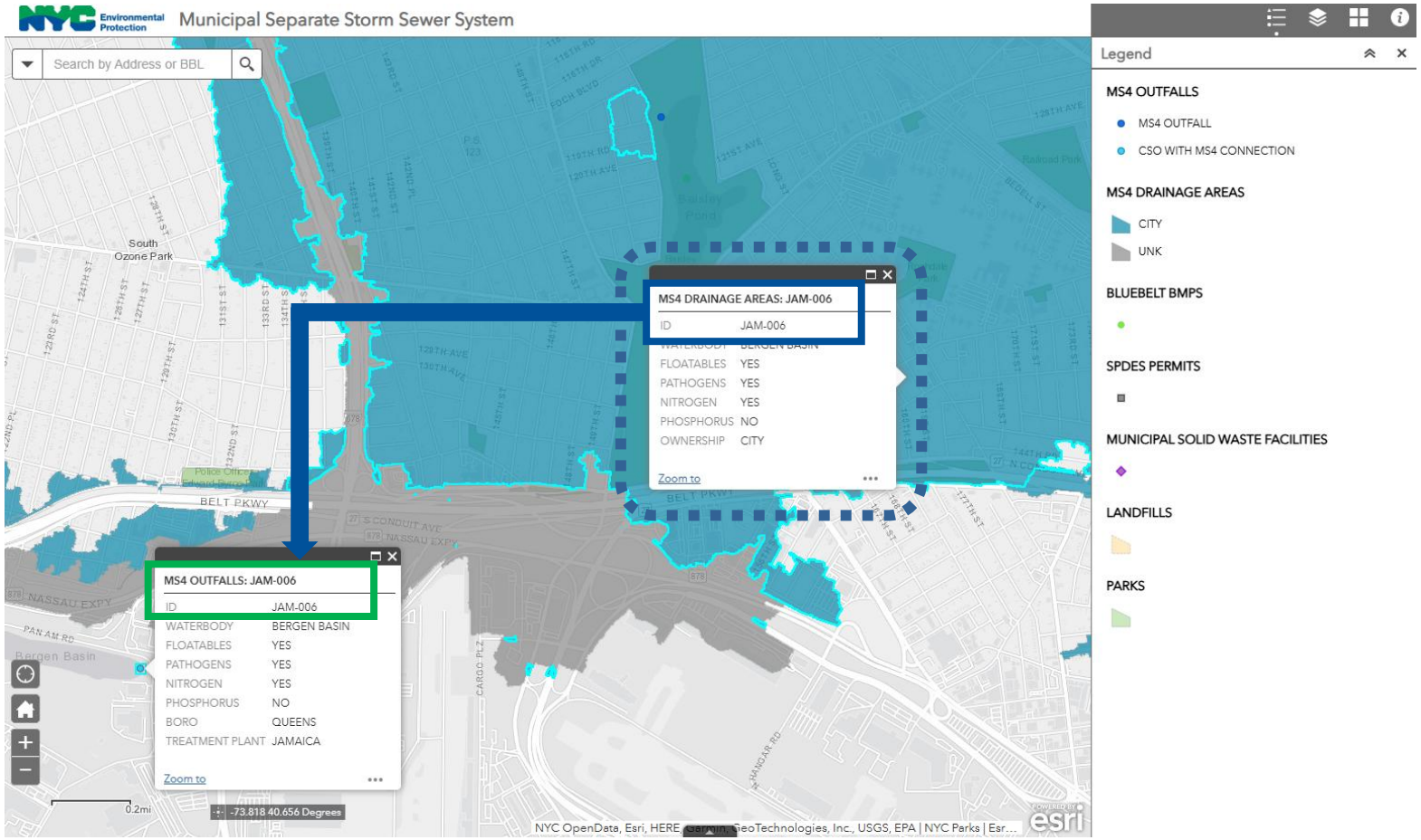
Criteria Requirements

Do any MS4-Only criteria apply?

4a. Locate project on [NYC DEP MS4 Interactive Map]

4b. Click on the associated MS4 Drainage Area shape to identify the corresponding MS4 outfall ID

4c. Locate the identified MS4 outfall location



Notes:

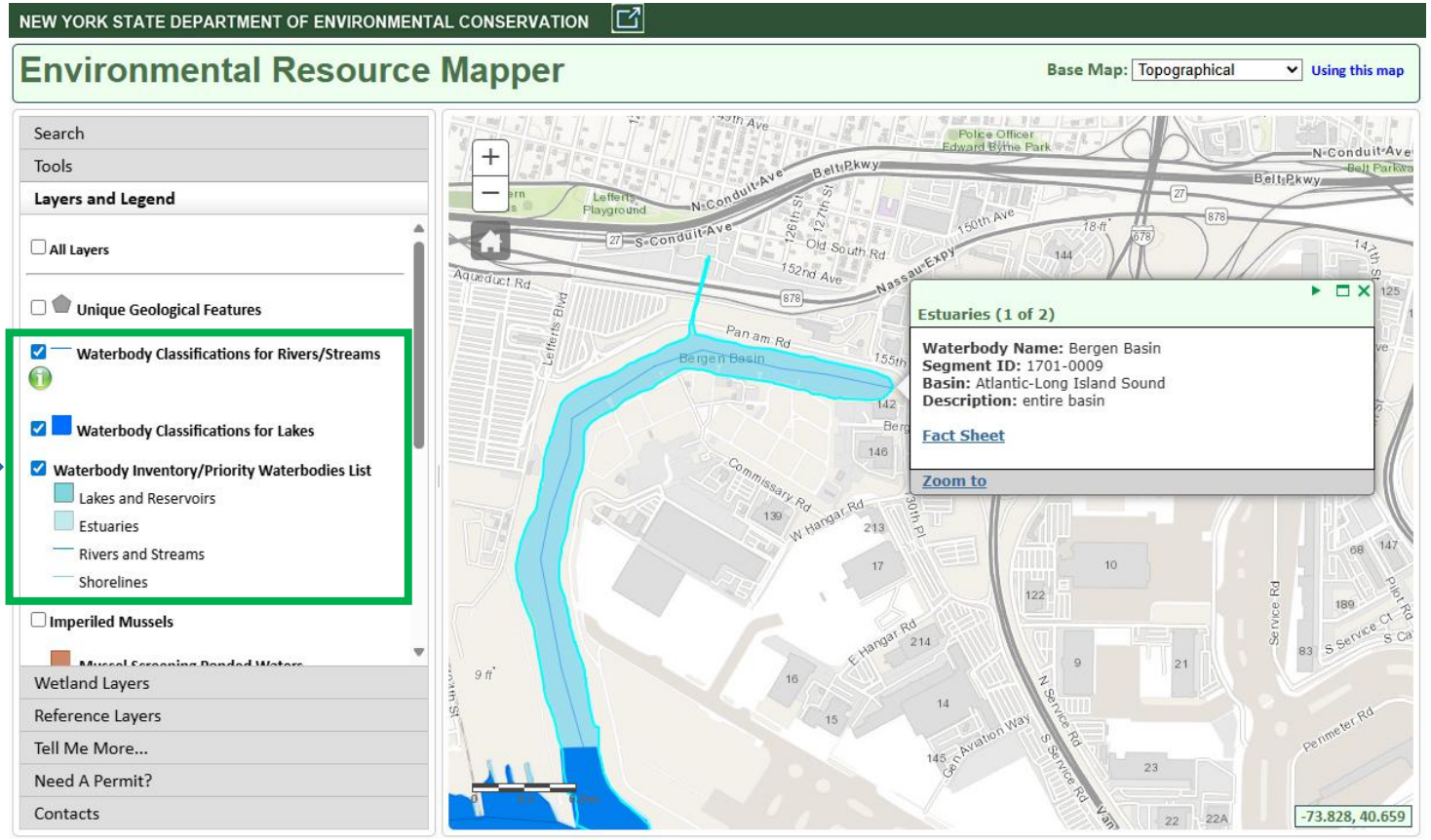
- MS4 Interactive Map provides approximate boundaries for areas discharging to MS4 system and impaired waterbodies.
- The MS4 Map waterbody impairment information must be confirmed with the NYS DEC Environmental Mapper and NYC SWM Table 2.4.
- In some cases, the ownership and discharge area is inaccurate or unknown and must be verified separately.

Criteria Requirements

Do any MS4-Only criteria apply?

4d. Cross reference outfall location with NYS DEC Environmental Resource Mapper and confirm the receiving waterbody

Turn on the layers for:
- Waterbody Classifications for Rivers/Streams
- Waterbody Classifications for Lakes
- Waterbody Inventory/Priority Waterbodies List



Criteria Requirements

Do any MS4-Only criteria apply?

4e. Refer to NYC DEP SWM Table 2.4 to determine pollutants of concern in receiving waterbody

Applicable to Site:

- ✓ Floatables
- ✓ Pathogens
- ✓ Nitrogen

Table 2.4. Impaired Water Segments and Pollutants of Concern in and Around NYC (Source: Final 2018 NYS 303(d list, which is the basis for Appendix I of the 2022 NYC MS4 Permit NY0287890).

Waterbody Name	Water Body Identification Number (WIN)	Pollutant
Alley Creek/Little Neck Bay Trib	(MW2.5) ER/LIS-LNB-19 thru 20	Fecal Coliform
Arthur Kill (Class I) and minor tribs	(MW1.2) SI (portion 1)	Garbage & Refuse
Arthur Kill (Class SD) and minor tribs	(MW1.2) SI (portion 2)	Garbage & Refuse
Atlantic Ocean Coastline	(MW0.0) AO (portion 1)	Fecal Coliform
Bergen Basin	(MW8.5a) JB-247	Fecal Coliform
Bergen Basin	(MW8.5a) JB-247	Nitrogen
Bergen Basin	(MW8.5a) JB-247	Garbage & Refuse
BronxRiver, Lower	(MW2.4) ER-3	Fecal Coliform
BronxRiver, Lower	(MW2.4) ER-3	Garbage & Refuse
BronxRiver, Middle, and tribs	(MW2.4) ER-3	Fecal Coliform
BronxRiver, Middle, and tribs	(MW2.4) ER-3	Garbage & Refuse
Coney Island Creek	(MW1.1) LB/GB-253	Fecal Coliform
Coney Island Creek	(MW1.1) LB/GB-253	Garbage & Refuse
East River, Lower	(MW2.1) ER (portion 1)	Garbage & Refuse
East River, Upper	(MW2.3) ER (portion 2)	Garbage & Refuse
East River, Upper	(MW2.3) ER (portion 3)	Garbage & Refuse

Pathogens may be referenced as “fecal coliform”.

Floatables may be referenced as “garbage & refuse”.

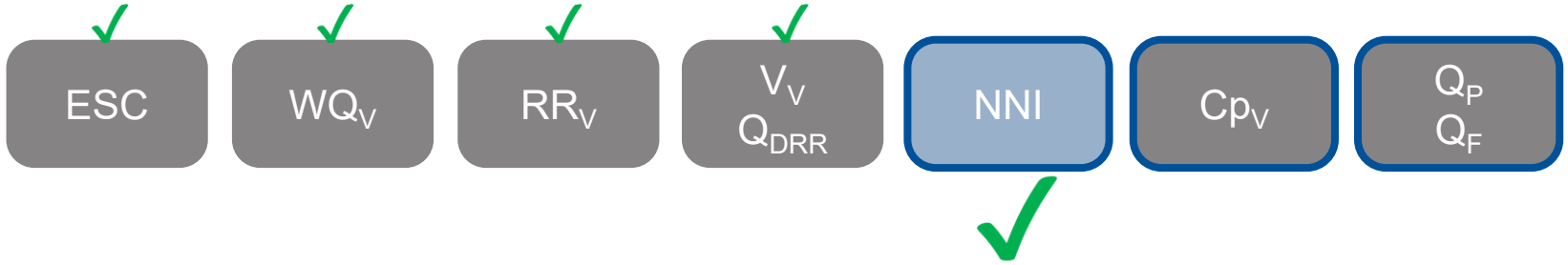
Criteria Requirement

Are there NNI requirements during construction?

Construction NNI Requirements

Considerations:

- In addition to Table 2.4 for POCs to be managed with post-construction BMPs and SMPs, applicants must check Appendix D of the Construction General Permit to determine if the project's receiving waterbody is identified as impaired by pollutants related to construction activity.
- If there are applicable POCs related to construction activity, additional stabilization and/or site inspection & maintenance may be required during construction.
- Refer to the following sections in NYS 303(d) list for more information:
  - Soil Stabilization (Part II.B.1.b.)
  - Qualified Inspector Inspection Requirements (Part IV)

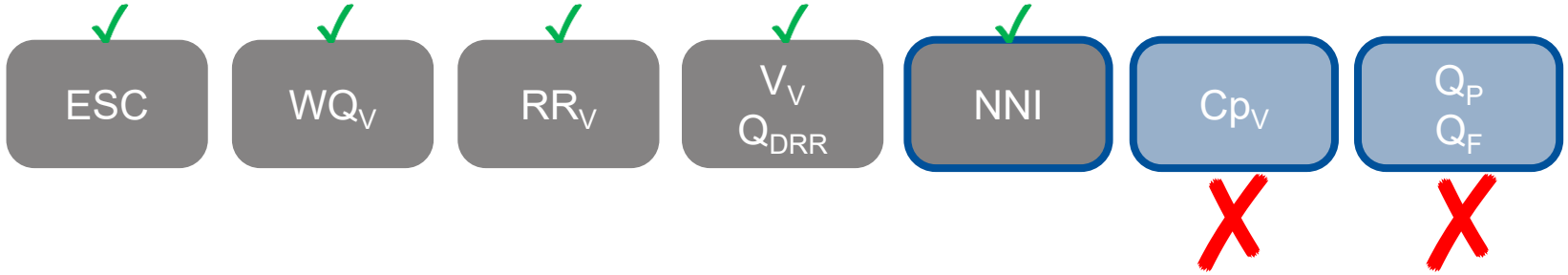


Criteria Requirements

Do any MS4-Only criteria apply?

No-Net-Increase criteria apply when a project meets **all** of the following conditions:

1. Project disturbs 20,000 SF or more of soil, or creates 5,000 sf or more of new impervious area ✓
2. Project increases site imperviousness ✓
3. Project discharges to MS4 system ✓
4. Project discharges to an impaired waterbody ✓



Criteria Requirements

Do any MS4-Only criteria apply?

Channel Protection, Overbank Flood Control, and Extreme Flood Control criteria apply when a project meets **all** of the following conditions:

1. Project disturbs 20,000 sf or more of soil, or creates 5,000 sf or more of new impervious area ✓
2. Project discharges to MS4 system ✓
3. Site discharges to non-tidal waters or to a stream smaller than fifth order ✗

Notes:

Channel protection, overbank flood control, and extreme flood control requirements are not common in NYC projects. However, Designers must review the applicability criteria in the New York State Construction General Permit (2025 CGP Part II.C.2.a.iii) to confirm applicability.

Criteria Applicability

<u>Goal:</u> Establish which stormwater management criteria apply to my project

Key Questions

- Are Erosion & Sediment Controls required?
- Are long-term SMPs required?
- Do any MS4-Only criteria apply?

The following criteria apply:

- ✓ Erosion and Sediment Control (ESC)
- ✓ Water Quality Volume (WQ_V)
- ✓ Runoff Reduction Volume (RR_V)
- ✓ Sewer Operations Volume (V_V) & Maximum Release Rate (Q_{DRR})
- ✓ No Net Increase (NNI)
  - ✓ Floatables
  - ✓ Pathogens
  - ✓ Nitrogen

Geotechnical Planning

Geotechnical Planning

Goal: Develop and Implement a Geotechnical Investigation Plan

Key Questions

- What site constraints limit the geotechnical testing area?
- Where should boring and permeability tests be conducted?
- What are the infiltration rates on site?
- Was groundwater or bedrock discovered?

Geotechnical Planning

Applicability

On-site geotechnical investigations are **required*** when a stormwater management practices (SMP) is proposed to comply with the NYC DEP Stormwater Construction Permit.

Note:

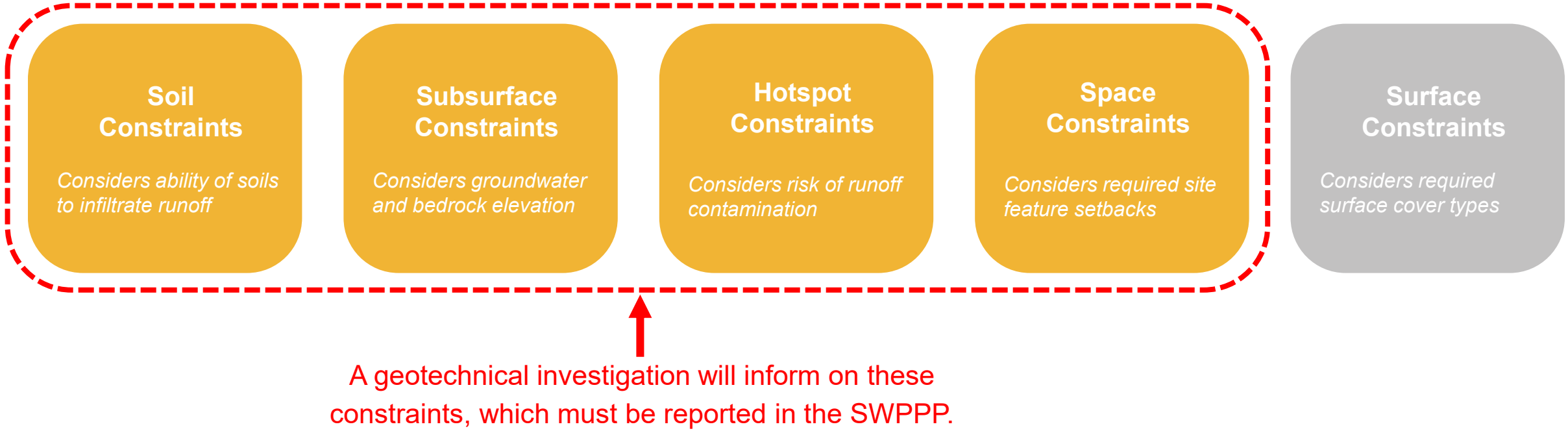
* Geotechnical investigations are not required when a lot line building is proposed that does not increase impervious surface.

Geotechnical Planning

Purpose

The type of proposed SMP should be determined based on a constraints analysis.

The SWPPP **must** document constraints analyzed that impact SMP selection.



Geotechnical Planning

What site constraints limit the geotechnical testing area?

Space Constraints:

- ✓ 10 ft Setback from Building Foundations
- ✓ 5 ft Setback from Property Line

Subsurface Constraints:

- ✓ Areas of historical bedrock
- ✓ Areas of historical high groundwater

Other Potential Constraints:

- ✓ Areas of contamination
- ✓ Essential paved building access pathways

References:

1. *NYC Stormwater Manual Appendix C*

Concept Map: *Geotechnical Testing Constraints*

LEGEND

- Property Limit
- Limit of Disturbance
- Space Constraints
- Subsurface Constraints (N/A)

Geotechnical Planning

Where should boring and permeability tests be conducted?

Select testing locations based on:

- ✓ **Desktop analysis**
  of existing site conditions
- ✓ **Review regulatory guidance**
  that may impact SMP location & design
- ✓ **Create a preliminary constraints map**
  to determine where SMPs cannot be located
- ✓ **Create a preliminary boring plan**
  to ensure the minimum number of tests will be performed at all feasible SMP locations
- ✓ **Review results as they are performed**
  to confirm current investigation is consistent with historic borings

Concept Map: *Boring Plan*

LEGEND

- Property Limit
- Limit of Disturbance
- Space Constraints
- Subsurface Constraints (N/A)
- B-# Boring Log
- P-# Permeability Test

References:

1. *NYS DEC Stormwater Management Design Manual – Appendix D*
2. *BEPA PERM Geotech Investigation Workshop*

Geotechnical Planning

How many boring and permeability tests should be conducted?

Geotechnical Investigation Planning

Considerations:

- Project may choose to conduct geotechnical testing in two rounds—first to confirm hydrologic soil groups and constraints across the site, then to confirm suitable soil conditions for each proposed infiltration practice.
- Alternatively, projects could choose to conduct one round of more comprehensive testing to avoid a second geotechnical mobilization. This more comprehensive testing may also help eliminate additional geotechnical work if practices are found to be infeasible during construction.
- In all cases, DEP recommends having the geotechnical professional communicate closely with the design professional during geotechnical investigation testing in order to effectively alter the testing plan based on site conditions and design requirements.

Geotechnical Planning

Results Analysis

Refer to the Geotechnical Investigation Workshop for additional guidance on reviewing and interpreting results from a geotechnical investigation.

Workshop Highlights:

- Refer to NYS SWMDM Appendix D for the geotechnical testing procedures
- Permeability tests must be conducted at a depth 2-ft below the proposed bottom of SMP
- Permeability tests can be conducted at multiple depths if the proposed bottom of SMP is not known
- Testing shall be repeated, with a minimum of 4 runs, until a stabilized rate is achieved (when 2 successive tests are approximately equal)
- The lowest stabilized rate of the permeability tests shall be used for practice feasibility
- Refer to NYC SWM Section 2.4 for minimum number of soil boring and permeability tests

Geotechnical Planning

What are the infiltration rates on site?

All permeability tests found infiltration rates below 0.5 in/hr.

Concept Map: *Boring Plan*

LEGEND

- Property Limit
- Limit of Disturbance
- Space Constraints
- Subsurface Constraints (N/A)
- B-# Boring Log
- P-# Permeability Test

References:

1. *NYS DEC Stormwater Management Design Manual – Appendix D*
2. *BEPA PERM Geotech Investigation Workshop*

Geotechnical Planning

Was groundwater or bedrock discovered?

No boring tests encountered groundwater or bedrock.

Concept Map: *Boring Plan*

LEGEND

- Property Limit
- Limit of Disturbance
- Space Constraints
- Subsurface Constraints (N/A)
- B-# Boring Log
- P-# Permeability Test

References:

1. *NYS DEC Stormwater Management Design Manual – Appendix D*
2. *BEPA PERM Geotech Investigation Workshop*

Geotechnical Planning

Goal: Develop and Implement a Geotechnical Investigation Plan

Key Questions

- What site constraints limit the geotechnical testing area?
- Where should boring and permeability tests be conducted?
- What are the infiltration rates on site?
- Was groundwater or bedrock discovered?

Geotechnical Investigation results:

- ✓ Infiltration rate < 0.5 in/hr across site (soil constraint)
- ✓ No shallow groundwater
- ✓ No shallow bedrock

SMP Siting

SMP Siting

Goal: Establish Potential SMP Types & Locations

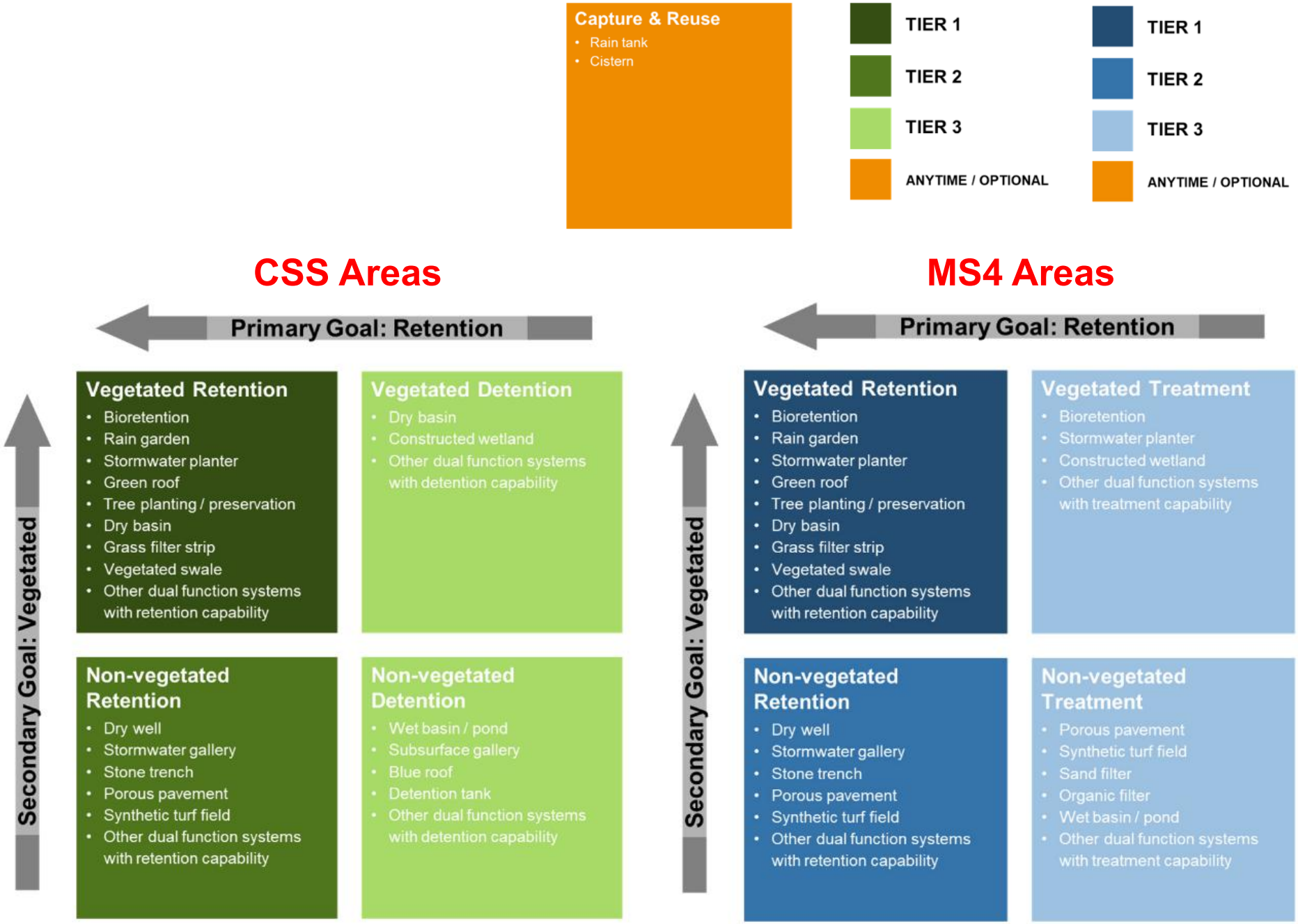
Key Questions

- What soil, subsurface, and hotspot constraints are present?
- What space and subsurface constraints are present?
- Which Tier 1 SMPs are feasible?
- Where can I site Tier 1 SMPs?

SMP Siting

SMP Hierarchy

- The SMP hierarchy creates clear and consistent approach for the selection of SMPs.
- Designers must assess and implement SMPs in higher tiers to the maximum extent practicable before moving to lower tier systems.
- Tiers for SMPs are intended to guide designs towards SMPs most effective at meeting NYC goals.



SMP Siting

Constraints

Projects **must** document constraints that limit the use of Tier 1 or Tier 2 practices when lower tier practices are used:

Soil Constraints

Considers ability of soils to infiltrate runoff

Subsurface Constraints

Considers groundwater and bedrock elevation

Hotspot Constraints

Considers risk of runoff contamination

Surface Constraints

Considers required surface cover types

Space Constraints

Considers required site feature setbacks

Soil | Subsurface | Hotspot | Surface | Space

Legend: ✓ Constraint evaluated does not limit use of SMP function
✗ Constraint evaluated limits use of SMP function

SMP Siting

What soil, subsurface, and hotspot constraints are present?

- **Soil:** Areas where permeability tests indicate soil infiltration rates <0.5 in/hr
- **Subsurface:** Areas where boring tests indicate that the bottom of the SMP would be <3 ft from groundwater or bedrock, or <4 ft for sole source aquifers.
- **Hotspot:** Areas where land use, soil conditions, or other factors pose risk of contaminating infiltration

Constraint Impact on SMP Siting*

Tier 1:

✓ Vegetated Evapotranspiration SMPs
✗ Vegetated Infiltration SMPs

Tier 2:

✗ Non-Vegetated Infiltration SMPs

*Guidance is generalized; designer must comply with NYC SWM Section 4.2 when siting practices.

SMP Siting

What soil, subsurface, and hotspot constraints are present?

Concept Map: *Soil, Subsurface and Hotspot Constraints*

LEGEND

- Property Line
- Limit of Disturbance
- Soil Constraints
- Subsurface Constraints (N/A)
- Hotspot Constraints (N/A)

Soil, Subsurface, and Hotspot Constraint Plan must be included in the SWPPP submission when these constraints impact the use of SMPs.

Notes:

- The constraints plan shown was simplified for clarity.
- SWPPP submissions should include notes with justification of each constraint and references to supporting documentation

Soil | Subsurface | Hotspot | **Surface** | Space

Legend: ✓ Constraint evaluated does not limit use of SMP function
✗ Constraint evaluated limits use of SMP function

SMP Siting

What surface and space constraints are present?

- **Surface:** Areas where regulations require the use of paved surfaces

Constraint Impact on SMP Siting*

Tier 1:

- ✗ Vegetated Evapotranspiration SMPs
- ✗ Vegetated Infiltration SMPs

Tier 2:

- ✓ Non-Vegetated Infiltration SMPs

*Guidance is generalized; designer must comply with NYC SWM Section 4.2 when siting practices.

Soil | Subsurface | Hotspot | Surface | **Space**

Legend: ✓ Constraint evaluated does not limit use of SMP function
✗ Constraint evaluated limits use of SMP function

SMP Siting

What surface and space constraints are present?

- **Space:** Areas where regulations require setbacks from structures, utilities, property lines, existing trees, or other site features

Constraint Impact on SMP Siting*

Tier 1:

- ✓ Vegetated Evapotranspiration SMPs
- ✗ Vegetated Infiltration SMPs

Tier 2:

- ✗ Non-Vegetated Infiltration SMPs

*Guidance is generalized; designer must comply with NYC SWM Section 4.2 when siting practices.

SMP Siting

What surface and space constraints are present?

Surface Constraints:

- ✓ Not Applicable at this site

Space Constraints *(At Grade)*:

- ✓ 10 ft Setback from Building Foundations (N/A)
- ✓ 5 ft Setback from Property Line

Areas outside of the property boundary do not have surface constraints but is not available for SMP siting.

Concept Map: *Constraints at Grade*

LEGEND

- Limit of Property
- Limit of Disturbance
- Surface Constraints (N/A)
- Space Constraints

SMP Siting

What surface and space constraints are present?

Surface Constraints:

- ✓ Not Applicable at this site

Space Constraints *(At Grade)*:

- ✓ 10 ft Setback from Building Foundations
- ✓ 5 ft Setback from Property Line

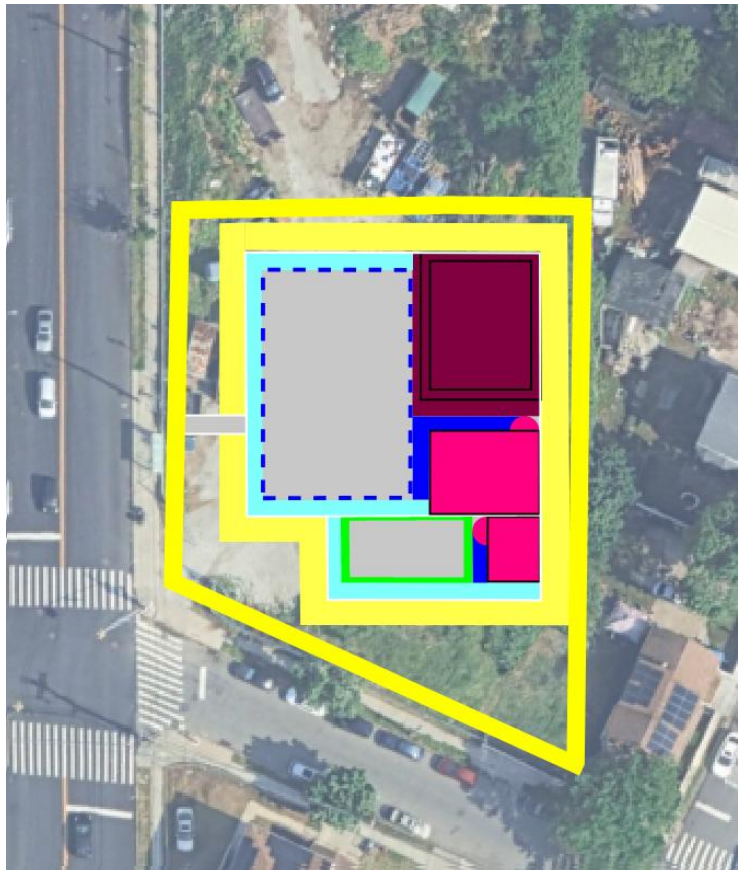
Space Constraints *(Roof Only)*:

- ✓ 6 ft Perimeter Access on Building Frontage
- ✓ 3 ft Radius Clearance from Roof Door
- ✓ 6 ft Clear Paths every 100 ft
- ✓ 3 ft Clearance from Mechanical Equipment

References:

1. *RCNY Chapter 5, FDNY Requirements Section 504.4*
2. *Local Laws 92/94: Solar & Green Roofs*
3. *FDNY Clearances Presentation*

***Concept Map:** Constraints at Grade and on Roof*



LEGEND

- Existing Structures (N/A)
- Proposed Structures Roof Area
- Surface Constraints (N/A)
- Space Constraints at Grade
- Perimeter Access Clearance
- Clear Path
- Roof Access Structure & Door Clearance
- Mechanical Equipment Clearance
- Proposed Recreational Area (*not a constraint*)
- Sustainable Roofing Zone

SMP Siting

What surface and space constraints are present?

Concept Map: *Surface and Space Constraints Plan*

Surface and Space Constraint Plan must be included in the SWPPP submission when these constraints impact the use of SMPs.

Notes:

- The constraints plan shown was simplified for clarity.
- Constraints plans submitted with the SWPPP may be separated or combined as needed for clarity.
- SWPPP submissions should include notes with justification of each constraint and references to supporting documentation

References:

1. *NYC DEP SWPPP Template – Appendix A*

SMP Siting

What Tier 1 SMPs are feasible?

This project has space and soil constraints.

Feasible Tier 1 SMPs are the Evapotranspiration Practices.

SMP HIERARCHY CHECKLIST - MS4 AREAS			Percent of SMP volume applied[a]			Site constraints that limit SMP feasibility[b]				
Tier[c]	Function Type[d]	Practice Type[e]	WQv	RRv	Vv	Soil	Subsurface	Hotspot	Surfaces	Space
Tier 1	Infiltration (Vegetated)	Bioretention	100	100	50	✕	✕	✕	✕	✕
		Rain garden	100	100	50	✕	✕	✕	✕	✕
		Stormwater planter	100	100	50	✕	✕	✕	✕	✕
		Tree planting / preservation	SC	SC	0					
		Dry basin	100	100	50	✕	✕	✕	✕	✕
		Grass filter strip	SC	SC	0	✕	✕	✕	✕	✕
		Vegetated swale	SC	SC	0	✕	✕	✕	✕	✕
	Evapotranspiration[f]	Rain garden	100	100	0		✕		✕	✕
		Stormwater planter	100	100	0				✕	
		Tree planting / preservation	SC	SC	0					
		Green roof	100	100	0					
Tier 2	Infiltration (Non-vegetated)	Dry well	100	100	50	✕	✕	✕		✕
		Stormwater gallery	100	100	50	✕	✕	✕		✕
		Stone trench	100	100	50	✕	✕	✕	✕	✕
		Porous pavement	100	100	50	✕	✕	✕		✕
		Synthetic turf field	100	100	50	✕	✕	✕	✕	✕
Anytime / Optional	Reuse	Rain tank	100	100	SC					
		Cistern	100	100	SC					
Tier 3	Filtration[g]	Bioretention	100	40	0		✕		✕	✕
		Stormwater planter	100	40	0		✕		✕	✕
		Porous pavement	100	0	0		✕			✕
		Synthetic turf field	100	0	0		✕		✕	✕
		Sand filter	100	0	0		✕		✕	
		Organic filter	100	0	0		✕		✕	
	Detention[g,h]	Constructed wetland	100	0	100		✕		✕	✕
		Wet basin / pond	100	0	100		✕		✕	✕
Other	Detention[g,i,j]	Dry basin	0	0	100		✕		✕	✕
		Stormwater gallery	0	0	100		✕			✕
		Blue roof	0	0	100					
		Detention tank	0	0	100					

References:

1. *NYS DEC Stormwater Management Design Manual – Appendix A*

SMP Siting

Where Can I Site Tier 1 SMPs?

Concept Map: *Tier 1 SMP Feasibility*

Evapotranspiration Practices can be sited:

- ✓ On unconstrained roof areas
- ✓ On unconstrained spaces within the planned development area

LEGEND

- Existing Structures
- Proposed Structures Roof Area
- Surface Constraints (N/A)
- Space Constraints
- Feasible Tier 1 SMP Locations (*ET Only*)

SMP Siting

Where Can I Site Tier 1 SMPs?

Prioritizing Vegetated Retention Practices

Considerations:

- 15 RCNY Chapter 19.1 requires projects to maximize the use of vegetated retention practices, defined in NYC SWM as “Tier 1”.
- Projects are required to site Tier 1 practices to the maximum extent practicable first. Once Tier 1 SMPs have been sited, projects must then revisit their constraints plan to evaluate the feasibility of Tier 2 SMPs, then and Tier 3 SMPs, progressively.
- Recreational areas excluded in the Sustainable Roofing Zone may still be feasible for stormwater management requirements; they are not considered a valid constraint.

SMP Siting

Goal: Establish Potential SMP Types & Locations

Key Questions

- What soil, subsurface, and hotspot constraints are present?
- What space and subsurface constraints are present?
- Where can I site SMPs?

This project has space and soil constraints.

Feasible vegetated retention SMPs (Tier 1) include:

- ✓ Green Roofs
- ✓ Stormwater Planters
- ✓ Rain Gardens

Required Site-Wide Criteria

Required Site-Wide Criteria

Goal: Establish the Site-Wide Stormwater Management Requirements

Key Questions

- What are the required site-wide WQ_V and RR_V?
- What are the site-wide NNI requirements?

Required Site-Wide Criteria

Numerical Criteria

Designers must use technical guidance in NYC SWM Chapter 2 to calculate numerical requirements for the applicable criteria:

- ✓ Water Quality Volume (WQ_V)
- ✓ Runoff Reduction Volume (RR_V)
- ✓ Sewer Operations Volume (V_V)
- ✓ Maximum Release Rate (Q_{DRR})

Designers must use technical guidance in NYC SWM Appendix B to calculate numerical requirements for the applicable criteria:

- ✓ No Net Increase (NNI) for Nitrogen

  NNI requirements for Floatables, Pathogens, and Phosphorus do not include numerical calculations

Note:
Calculations in this presentation are rounded for simplicity, with some decimal places omitted. Significant figures are used where appropriate, and final values are rounded to the nearest whole number.

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Calculating Site WQv:

- **Step 1:** Identify Equation
- **Step 2:** Identify Site Contributing Area
- **Step 3:** Calculate Runoff Coefficient
- **Step 4:** Complete Site-Wide Calculation

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

WQ_V Step 1: Identify Equation

Use NYC SWM Eq. 2.1 to calculate WQ_V

EQ 2.1

$$WQ_V = \frac{1.5"}{12} * A * R_V$$

where:

WQ_V: water quality volume (cf)

A: contributing area (sf)

R_V: runoff coefficient relating total rainfall and runoff

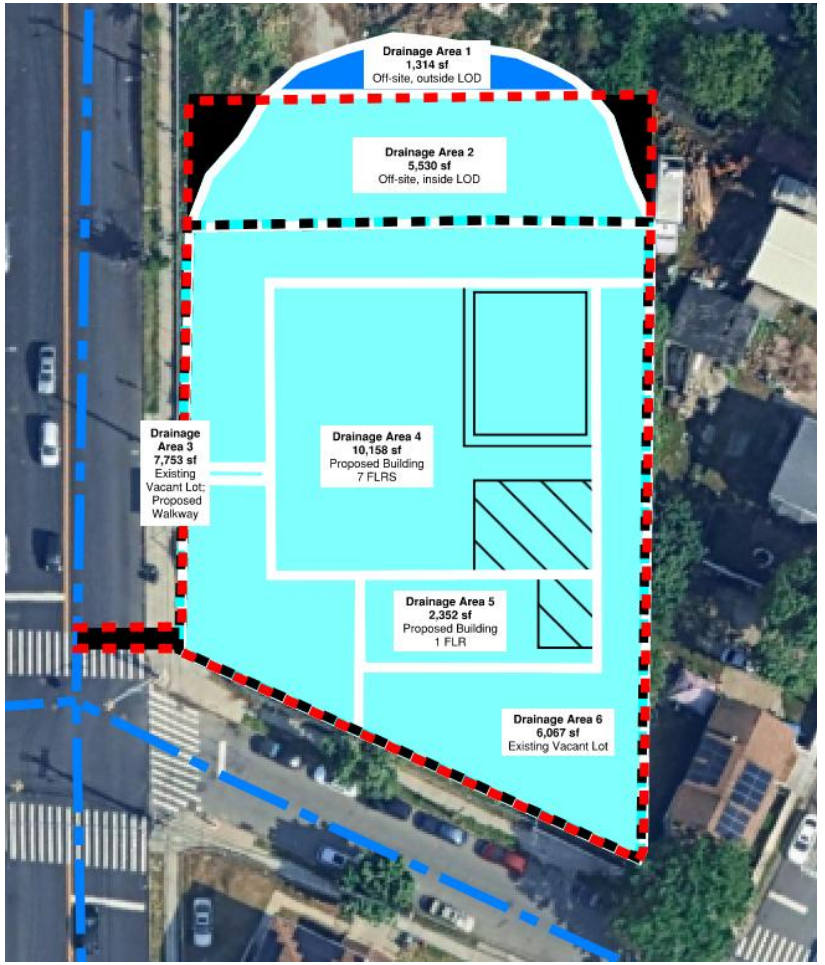
R_V: 0.05 + 0.009(I),

I: percent impervious cover

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Concept Map: *Site Contributing Area (Preliminary)*



WQ_V Step 2: Identify Site Contributing Area

The Contributing Area (A) includes all areas within the Limit of Disturbance that are listed in NYC SWM Table 2.3, as well as areas outside the Limit of Disturbance that drain to those areas.

$$A_{Site} = 33{,}174\ sf$$

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *0 sf*
- Contributing Area in LOD: *31,860 sf*
- Contributing Area outside of LOD: *1,314 sf*
- Non-Contributing Areas in LOD: *384 sf*
- Non-Contributing Areas outside LOD

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Establishing the Contributing Area

Considerations:

- Areas disturbed for construction support that are restored to stabilized, pervious conditions and do not drain to developed areas are typically not included in the site Contributing Area (A), except in cases where DEP determines that these areas pose significant pollution risks
- Areas disturbed by activities listed in NYC SWM Table 2.2 must be included in the site Contributing Area (A) if they drain to portions of the site that have development activities listed in NYC SWM Table 2.3.
- The site Contributing Area (A) includes all tributary areas that drain to portions of the site that have development activities listed in NYC SWM Table 2.3, even those which may be outside the covered development project area.

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

WQ_V Step 3: Calculate Runoff Coefficient

This coefficient relates the total rainfall to runoff on the project site and is based on the percent impervious cover (I) in the proposed condition.

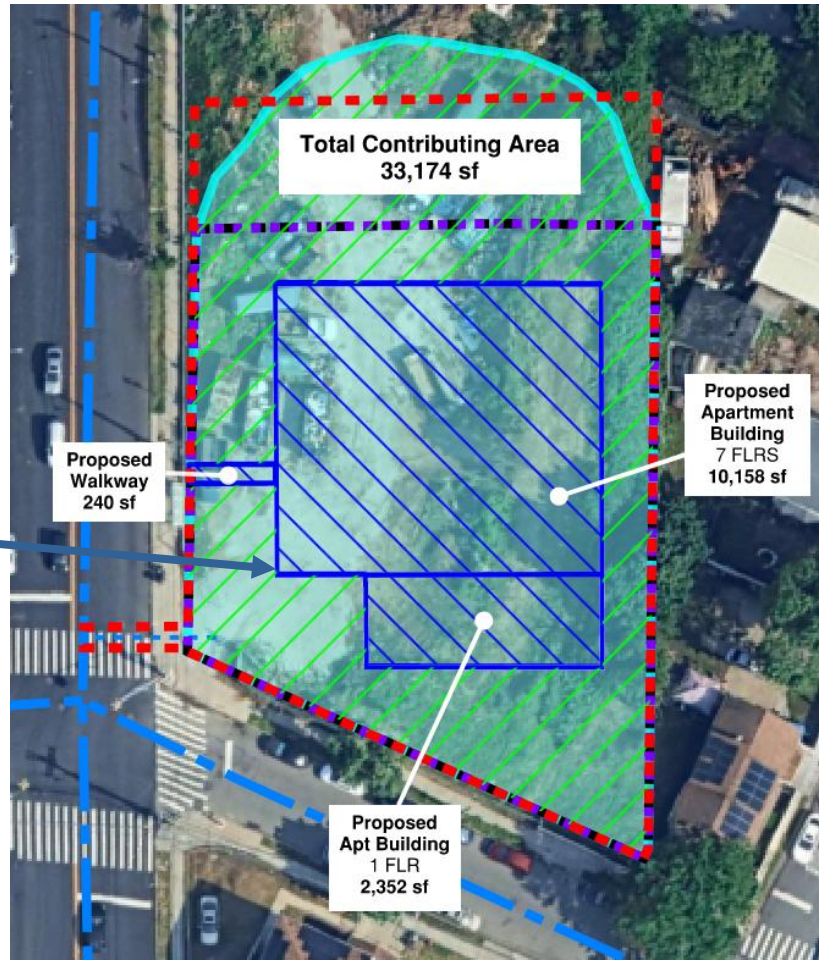
$$R_V = 0.05 + 0.009(I)$$

$$I = \frac{Impervious\ contributing\ area}{Total\ contributing\ area} = \frac{12{,}750\ sf}{33{,}174\ sf} = 38.4\%$$

$$I = 38.4\%$$

$$R_V = 0.05 + 0.009(38.4) = 0.40$$

Concept Map: *Site Contributing Area Cover (Preliminary)*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Developed Area with ESC&SMP Requirements
- Total Contributing Area: *33,174 sf*
- Impervious Contributing Area: *12,750 sf*
- Pervious Contributing Area: *20,424 sf*

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

WQ_V Step 4: Complete Site-Wide Calculation

Use NYC SWM Eq. 2.1 to calculate WQ_V

$$WQ_V = \frac{1.5"}{12} * A * R_V$$

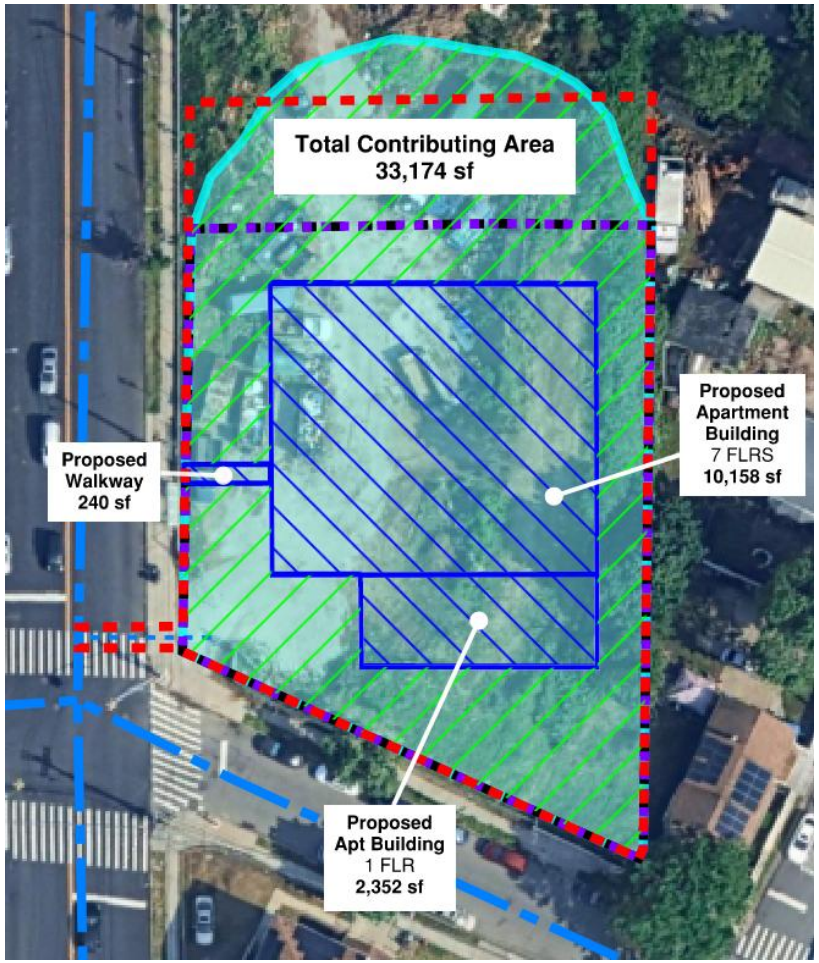
$$A_{Site} = 33{,}174\ sf$$

$$R_{V,Site} = 0.05 + 0.009(38.4) = 0.40$$

$$WQ_{V,Site} = \frac{1.5"}{12} * 33{,}174 * 0.40$$

$$\boldsymbol{WQ_{V,Site} = 1{,}642\ cf}$$

Concept Map: *Site Contributing Area Cover (Preliminary)*



LEGEND

- Limit of Property: *26,330 sf*
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- Developed Area with ESC&SMP Requirements
- Total Contributing Area: *33,174 sf*
- Impervious Contributing Area: *12,750 sf*
- Pervious Contributing Area: *20,424 sf*

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Calculating Required Site WQ_V:

- **Step 1:** Identify Equation
- **Step 2:** Identify Site Contributing Area
- **Step 3:** Calculate Runoff Coefficient
- **Step 4:** Complete Site-Wide Calculation

$$WQ_{V,Site} = 1,642\ cf$$

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Calculating Target RR_V and Minimum RR_V:

- **Step 1:** Establish Target RR_V
- **Step 2:** Identify Minimum RR_V Equation
- **Step 3:** Establish New Impervious Area Proposed
- **Step 4:** Calculate the Specific Reduction Factor
- **Step 5:** Complete Site-Wide Minimum RR_V Calculation

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

RR_V Step 1: Establish Target RR_V

15 RCNY Chapter 19.1 requires the use of vegetated retention practices to the maximum extent practicable. Therefore, projects should always aim to reduce the entire WQ_V using Tier 1 practices.

Target RR_V is met when the site WQ_V is managed using Tier 1 and Tier 2 practices.

$$Target\ RR_V = WQ_{V,Site} = 1,642\ cf$$

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

RR_V Step 2: Identify Minimum RR_V Equation

Use NYC SWM Eq. 2.2 to calculate Minimum RR_V

Minimum RR_V must be met for all projects, without exception.

Meeting Minimum RR_V does not exempt projects from having to demonstrate that they have met Target RR_V to the maximum extent practicable.

EQ 2.2

$$^{*}RR_V = \frac{1.5"}{12} * 0.95 * Aic * S$$

$^{*}\ Min$

where:

Aic: total area of new impervious cover (sf)

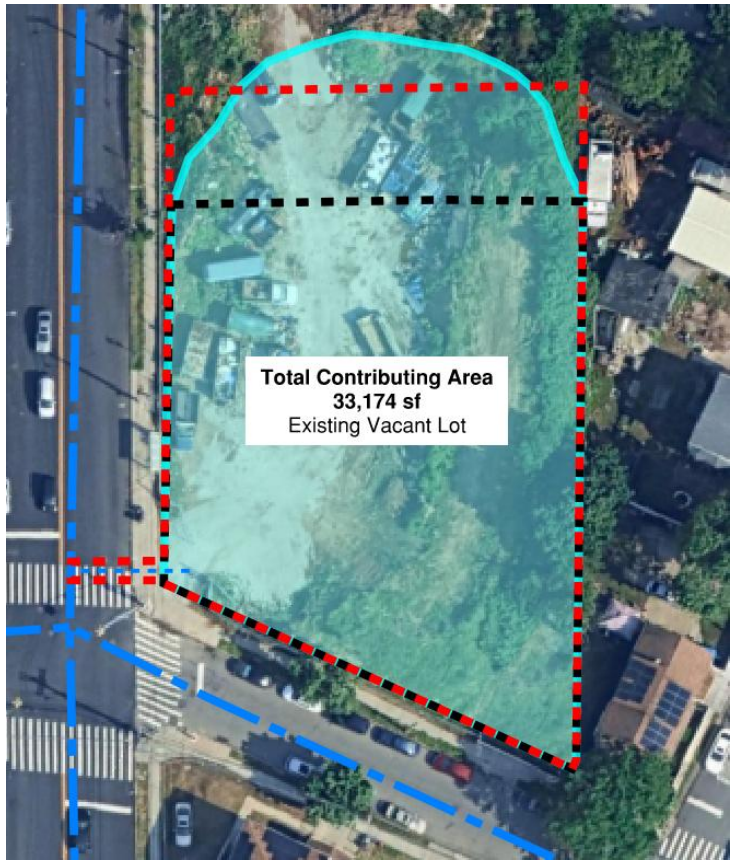
S: specific reduction factor, see Table 2.5

Required Site-Wide Criteria

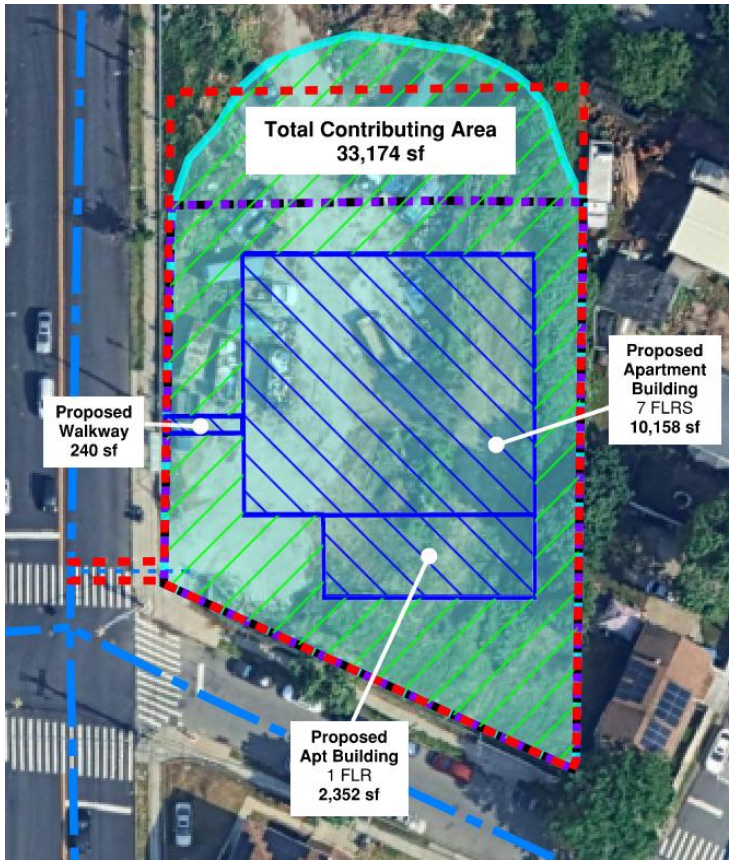
What are the required site-wide WQ_V and RR_V?

RR_V Step 3: Establish New Impervious Area Proposed

Compare pre- and post-development site plans to determine how much new impervious area is proposed in the developed area.



Concept Map: *Existing Site*



Concept Map: *Site Contributing Area Cover (Preliminary)*

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

RR_V Step 3: Establish New Impervious Area Proposed

Compare pre- and post-development site plans to determine how much new impervious area is proposed in the developed area.

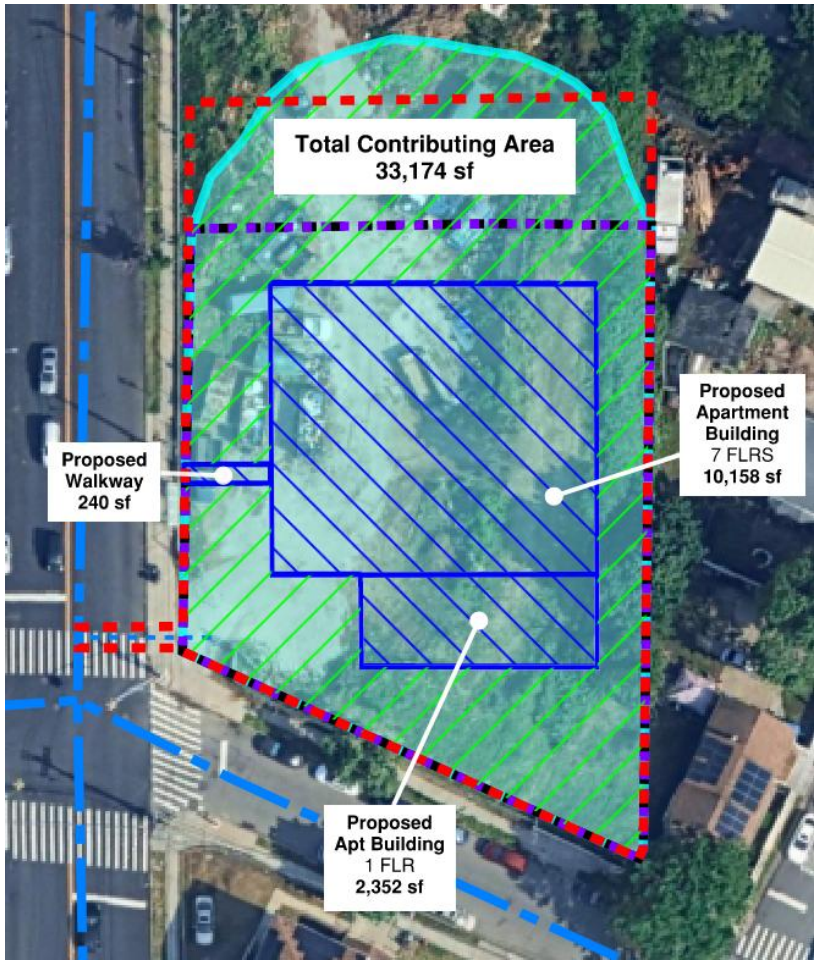
$$Aic_{Proposed} = 12{,}750\ sf$$

$$Aic_{Existing} = 0\ sf$$

$$Aic = 12{,}750 - 0 = 12{,}750\ sf$$

$$\boldsymbol{Aic = 12{,}750\ sf}$$

Concept Map: *Site Contributing Area Cover (Preliminary)*



LEGEND

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- Impervious Contributing Area: *12,750 sf*
- Pervious Contributing Area: *20,424 sf*

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

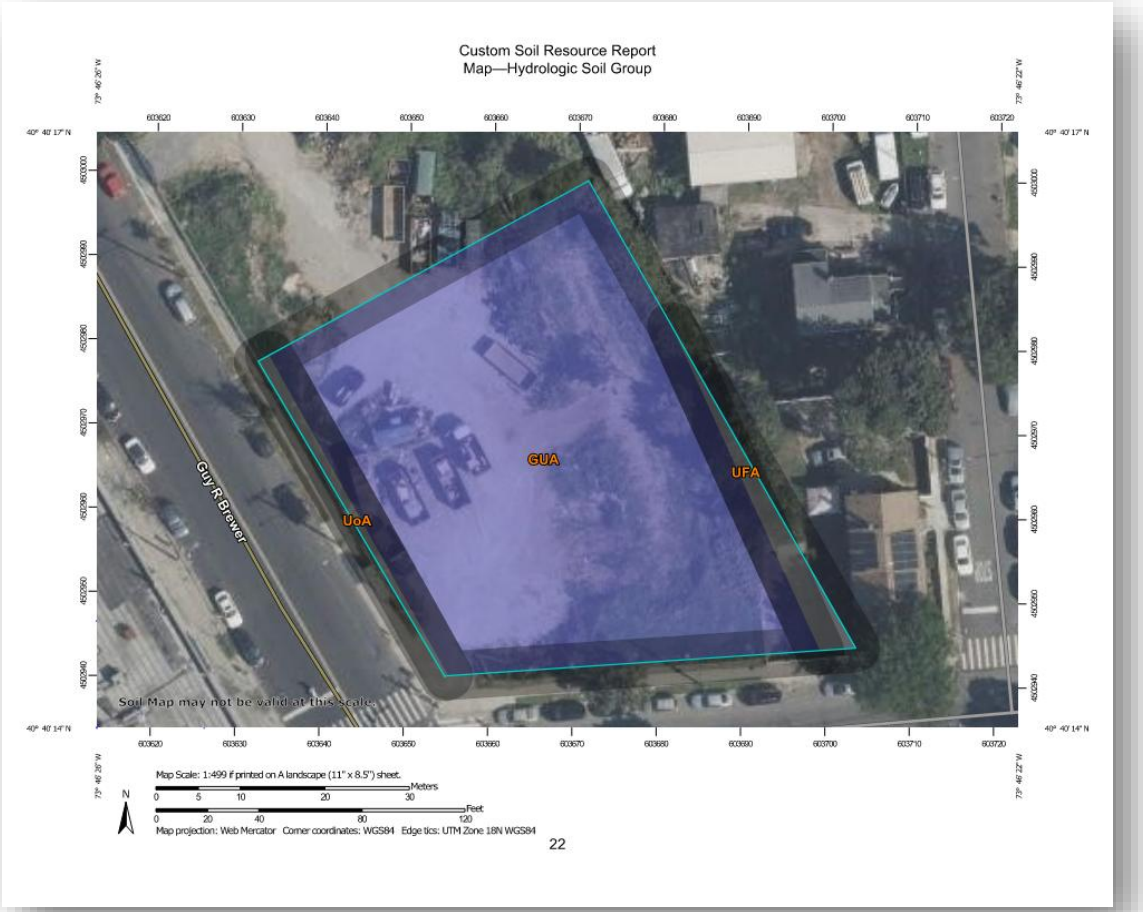
RR_V Step 4: Calculate the Specific Reduction Factor

This value depends on the soils on the project site and can be calculated as follows:

- *Establish Hydrologic Soil Groups (HSG) on the project site.*

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GUA	Greenbelt-Urban land complex, 0 to 3 percent slopes	B	0.6	94.7%
UFA	Urban land-Flatbush complex, 0 to 3 percent slopes		0.0	3.6%
UoA	Urban land, outwash substratum, 0 to 3 percent slopes		0.0	1.8%
Totals for Area of Interest			**0.6**	**100.0%**



Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Establishing Hydrologic Soil Groups

Considerations:

- Projects may use their own geotechnical tests or the USGS Web Soil Survey Map to establish HSG on their site.
- Unranked soils should be classified per the USDA NRCS Part 630 National Engineering Handbook Ch. 7. Otherwise, the soil should assume the properties of HSG-A for the Minimum RR_V requirement.

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

RR_V Step 4: Calculate the Specific Reduction Factor

This value depends on the soils on the project site and can be calculated as follows:

- *Establish Hydrologic Soil Groups (HSG) on the project site.*
- *Refer to NYC SWM Table 2.5 to identify reduction factors for each HSG*

Table 2.5. Specific reduction factors based on hydrologic soil group (HSG).

S	Description
0.55	HSG-A
0.40	HSG-B
0.30	HSG-C
0.20	HSG-D

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

RR_V Step 4: Calculate the Specific Reduction Factor

This value depends on the soils on the project site and can be calculated as follows:

- *Establish Hydrologic Soil Groups (HSG) on the project site.*
- *Refer to NYC SWM Table 2.5 to identify reduction factors for each HSG.*
- *Calculate the Specific Reduction Factor based on findings.*

HSG	Reduction Factor	% of Map Unit (NRCS WSS Report)	Specific Reduction Factors
HSG-A	0.55	0%	0
HSG-B	0.40	100%	0.40
HSG-C	0.30	0%	0
HSG-D	0.20	0%	0
Specific Reduction Factor S			**0.40**

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

RR_V Step 5: Calculate Site-Wide Minimum RR_V Calculation

Use NYC SWM Eq. 2.2 to calculate Minimum RR_V

$$Min\ RR_V = \frac{1.5"}{12} * 0.95 * Aic * S$$

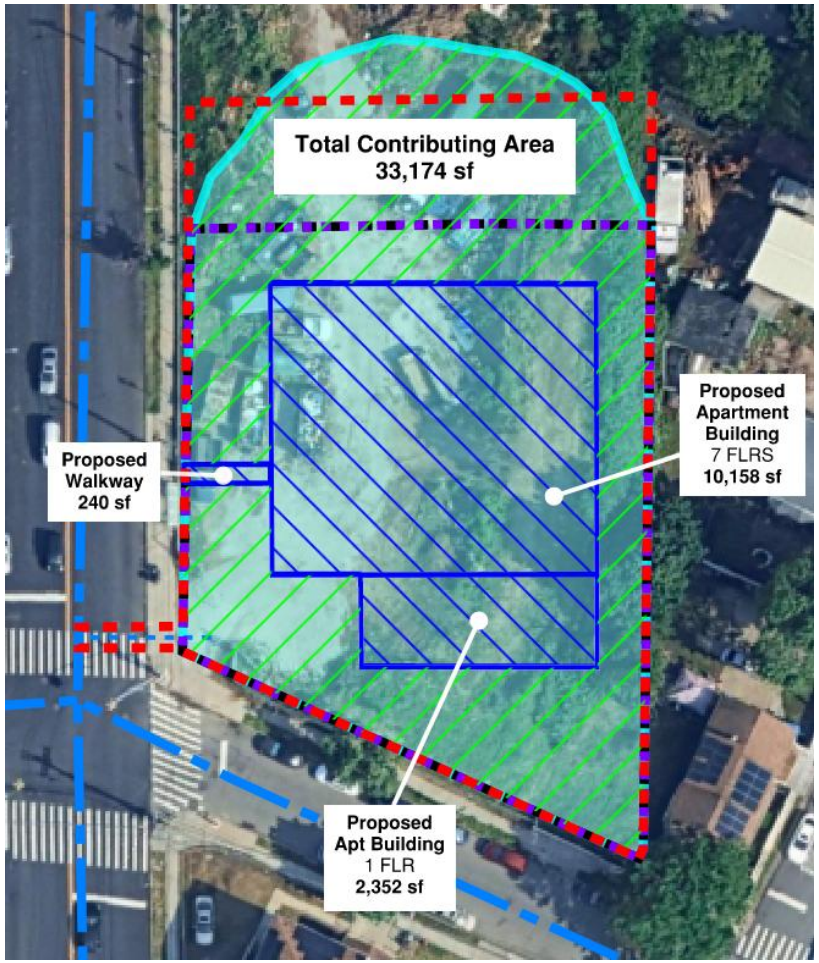
$$Aic = 12{,}750\ sf$$

$$S = 0.40$$

$$Min\ RR_V = \frac{1.5"}{12} * 0.95 * 12{,}750 * 0.40$$

$$\boldsymbol{Min\ RR_V = 606\ cf}$$

Concept Map: *Site Contributing Area Cover (Preliminary)*



LEGEND

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- Pervious Contributing Area: *20,424 sf*

Required Site-Wide Criteria

What are the required site-wide WQ_V and RR_V?

Calculating Required Site WQ_V:

- **Step 1:** Identify Equation
- **Step 2:** Identify Site Contributing Area
- **Step 3:** Calculate Runoff Coefficient
- **Step 4:** Complete Site-Wide Calculation

Calculating Target RR_V and Minimum RR_V:

- **Step 1:** Establish Target RR_V
- **Step 2:** Identify Minimum RR_V Equation
- **Step 3:** Establish New Impervious Area Proposed
- **Step 4:** Calculate the Specific Reduction Factor
- **Step 5:** Complete Site-Wide Minimum RR_V Calculation

$$WQ_{V,Site} = 1,642\ cf$$

$$Target\ RR_V = 1,642\ cf$$

$$Min\ RR_V = 606\ cf$$

Required Site-Wide Criteria

What are the site-wide NNI requirements?

Key Questions

- Which Pollutants of Concern (POCs) are applicable?
- What is the removal requirement for each applicable POC?

Required Site-Wide Criteria

Which Pollutants of Concern (POCs) are applicable?

Pollutants of Concern (POCs) in MS4 Areas

NNI requirements aim to reduce POCs in MS4 areas that discharge to an impaired waterbody. POCs can include:

	Pathogens (Fecal Coliform)	Floatables (Garbage & Refuse)	Phosphorus	Nitrogen
Definition of POCs	*Disease-producing agents such as bacteria, viruses, or other microorganisms*	*Manmade materials that are improperly disposed and have made their way to a waterbody*	*A nutrient that can lead to algae blooms that deplete oxygen in the water, which can kill aquatic life*	*A nutrient that can lead to algae blooms that deplete oxygen in the water, which can kill aquatic life*
Common Sources	Human and animal fecal matter	Plastics, papers, or other manmade products	Lawn/plant fertilizer, illicit discharges of sanitary waste, pet and wildlife waste, and leaves, branches, and grass clippings.	

Pathogens ✓ | Floatables ✓ | Phosphorus ✗ | Nitrogen ✓

Required Site-Wide Criteria

Which Pollutants of Concern (POCs) are applicable?

Refer to NYC DEP SWM Table 2.4 to identify impairments applicable to project site.

Applicable to Site:

- ✓ Pathogens
- ✓ Floatables
- ✓ Nitrogen

Not Applicable to Site:

- ✗ Phosphorus

Notes:

- MS4 Interactive Map provides approximate boundaries for areas discharging to MS4 system and impaired waterbodies.
- It is helpful in determining an MS4 area's receiving waterbody and impairment.

Table 2.4. Impaired Water Segments and Pollutants of Concern in and Around NYC (Source: Final 2018 NYS 303(d list, which is the basis for Appendix I of the 2022 NYC MS4 Permit NY0287890).

Waterbody Name	Water Body Identification Number (WIN)	Pollutant
Alley Creek/Little Neck Bay Trib	(MW2.5) ER/LIS-LNB-19 thru 20	Fecal Coliform
Arthur Kill (Class I) and minor tribs	(MW1.2) SI (portion 1)	Garbage & Refuse
Arthur Kill (Class SD) and minor tribs	(MW1.2) SI (portion 2)	Garbage & Refuse
Atlantic Ocean Coastline	(MW0.0) AO (portion 1)	Fecal Coliform
Bergen Basin	(MW8.5a) JB-247	Fecal Coliform
Bergen Basin	(MW8.5a) JB-247	Nitrogen
Bergen Basin	(MW8.5a) JB-247	Garbage & Refuse
BronxRiver, Lower	(MW2.4) ER-3	Fecal Coliform
BronxRiver, Lower	(MW2.4) ER-3	Garbage & Refuse
BronxRiver, Middle, and tribs	(MW2.4) ER-3	Fecal Coliform
BronxRiver, Middle, and tribs	(MW2.4) ER-3	Garbage & Refuse
Coney Island Creek	(MW1.1) LB/GB-253	Fecal Coliform
Coney Island Creek	(MW1.1) LB/GB-253	Garbage & Refuse
East River, Lower	(MW2.1) ER (portion 1)	Garbage & Refuse
East River, Upper	(MW2.3) ER (portion 2)	Garbage & Refuse
East River, Upper	(MW2.3) ER (portion 3)	Garbage & Refuse

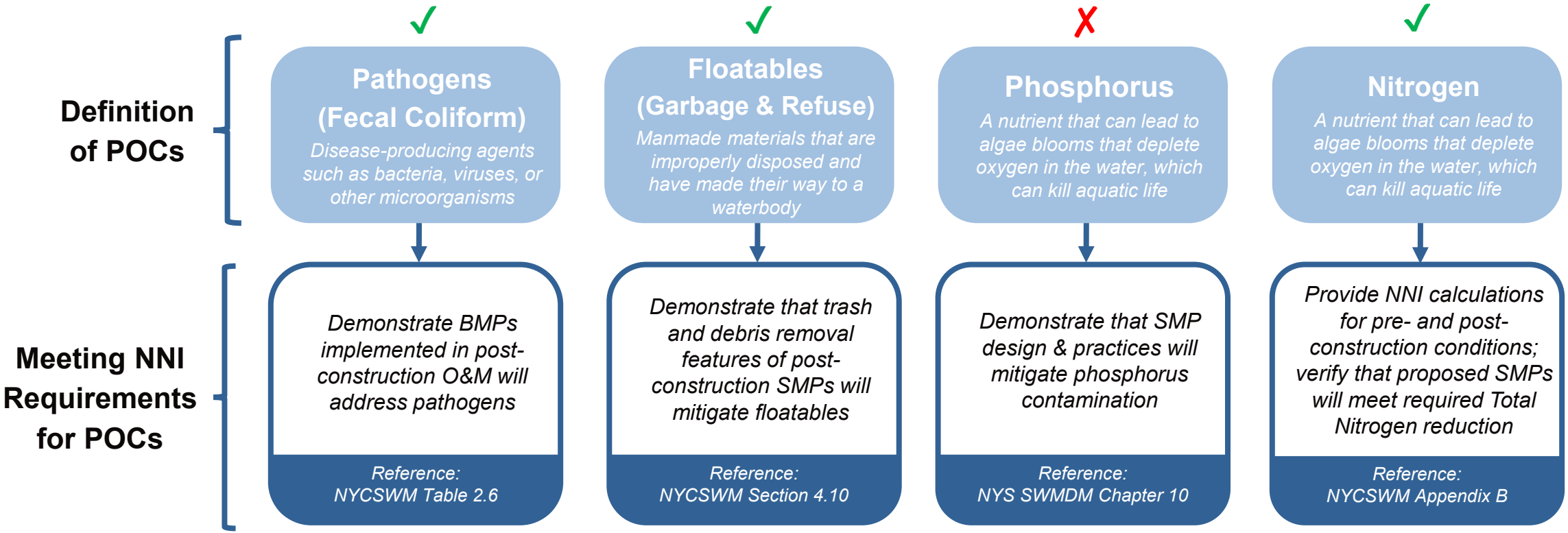
Pathogens may be referenced as "fecal coliform".

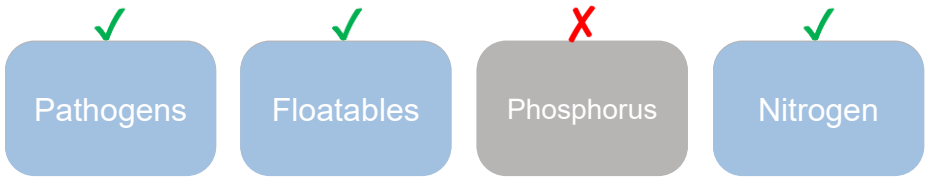
Floatables may be referenced as "garbage & refuse".

Required Site-Wide Criteria

What is the removal requirement for each POC?

NNI requirements to reduce POCs in MS4 areas that discharge to an impaired waterbody are as follows:





Required Site-Wide Criteria

What are the site-wide NNI requirements?

Key Questions

- Which Pollutants of Concern (POCs) are applicable?
- What is the removal requirement for each applicable POC?

This applicable POCs are:

- ✓ Pathogens (Fecal Coliform)
- ✓ Floatables (Garbage & Refuse)
- ✓ Nitrogen

Tier 1 & 2 SMP Design

Tier 1 & 2 SMP Design

Goal: Establishing Practice Requirements

Key Questions

- What are the Tier 1 SMP design requirements?
- What are the Tier 2 SMP design requirements?
- Are all requirements met?

Tier 1 & 2 SMP Design

Practice-Based Requirements

In addition to Site-Wide Requirements, Designers must calculate the practice-based WQ_V for each SMP using the *practice* contributing area.

SMP design consists of establishing:

- ✓ **Required $WQ_{V,SMP}$**
  This is the volumetric requirement that each SMP must meet, based on its contributing area.
- ✓ **V_{SMP}**
  This is the storage volume that the SMP is designed to provide.
- ✓ **Provided WQ_V, RR_V, V_V**
  These are the contributions that the SMP makes to each requirement, based on its V_{SMP} and function.

Tier 1 & 2 SMP Design

What are the Tier 1 SMP design requirements?

SMPs Design Steps:

- **Step 1:** Review Drainage Areas & Constraints
- **Step 2:** Site SMP Footprint
- **Step 3:** Determine SMP Contributing Area
- **Step 4:** Determine Runoff Coefficient of SMP Contributing Area
- **Step 5:** Calculate SMP Required $WQ_{V,SMP}$
- **Step 6:** Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- **Step 7:** Check SMP Contributions to Site-Wide Requirements

Iterate process until all requirements are met

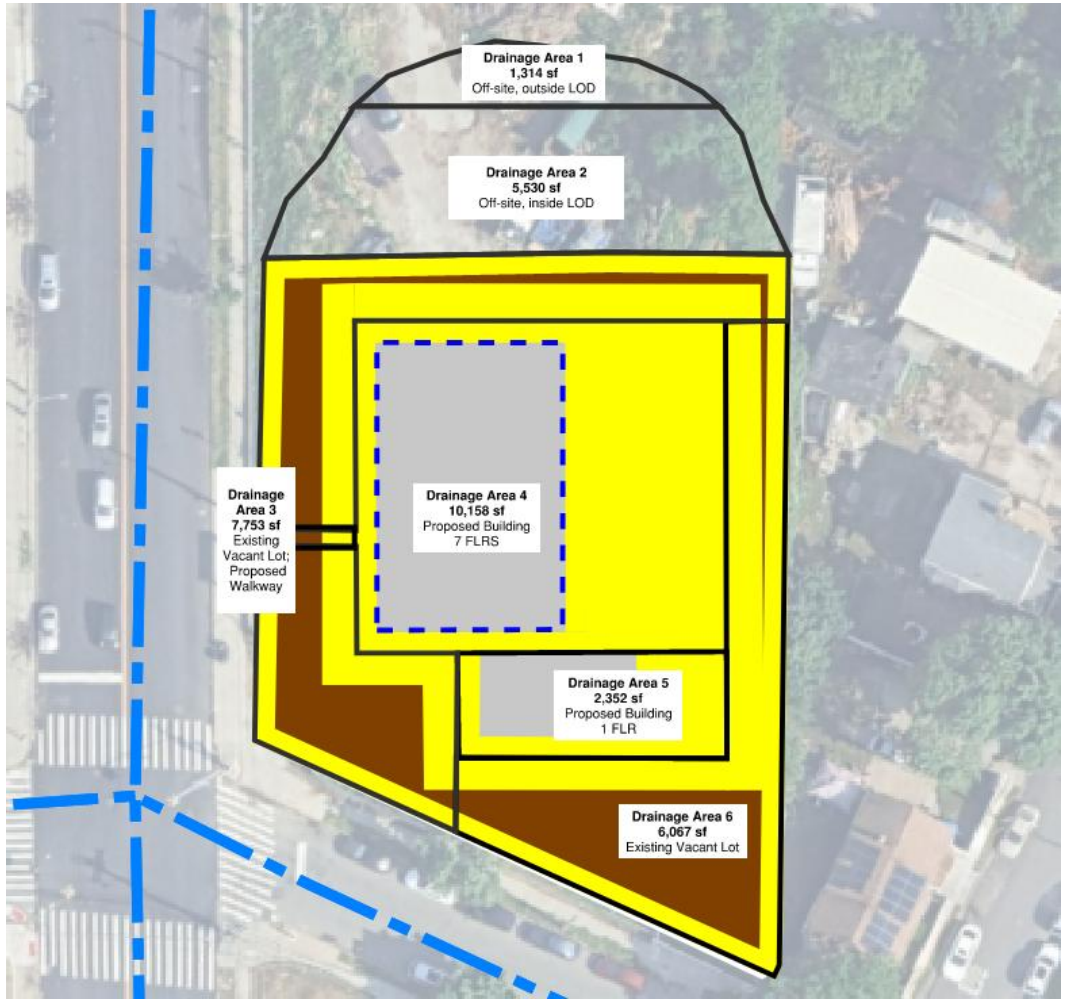
Tier 1 & 2 SMP Design

What are the Tier 1 SMP WQ_V requirements?

SMP Step 1: Review Drainage Areas & Constraints

Constraints may be limited to one portion of the site. It is helpful to evaluate constraints within individual, non-overlapping drainage areas to site SMPs.

Concept Map: *Constraints and Drainage Area Delineation*



Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

SMP Step 2: Site SMP Footprint

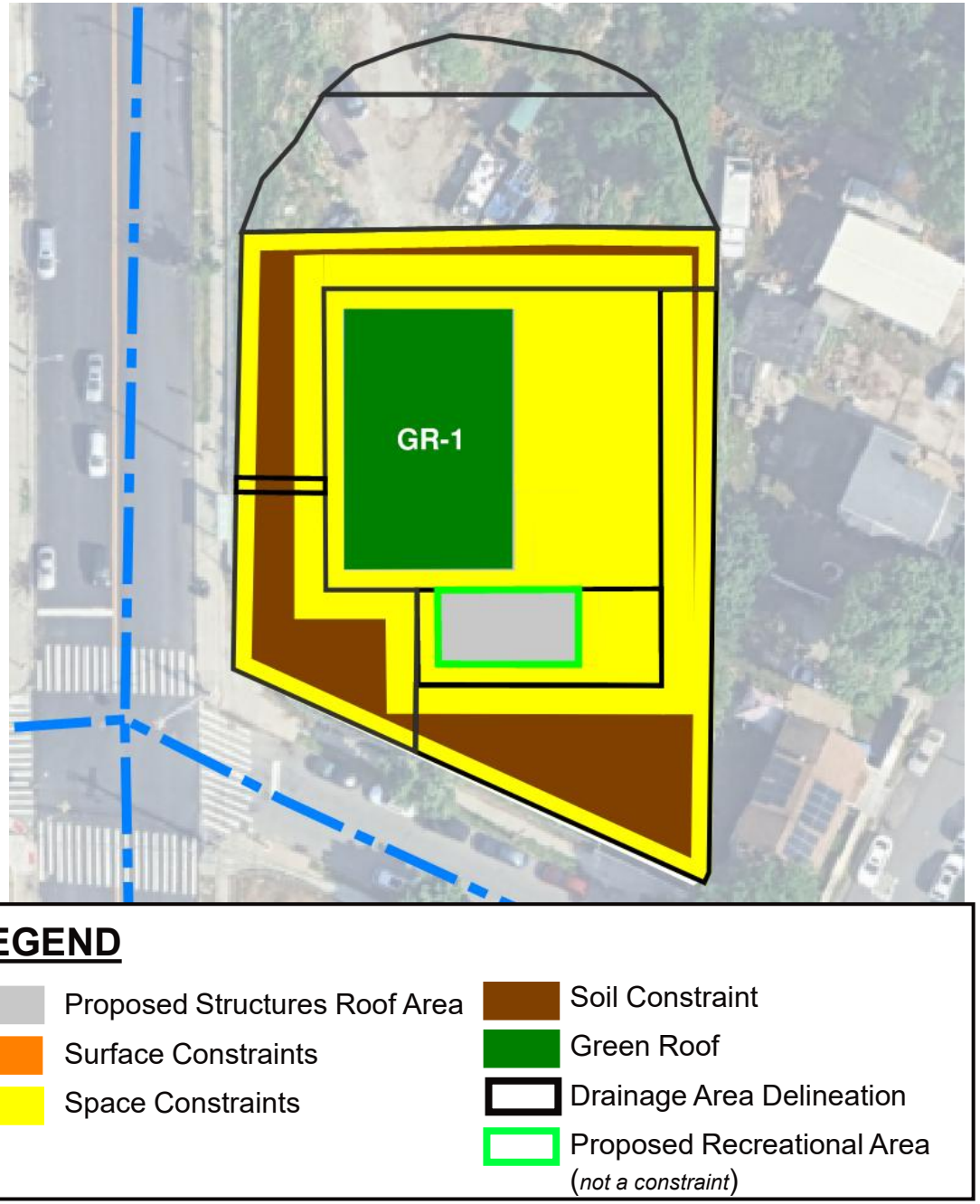
Site Tier 1 practices on unconstrained areas to the maximum extent practicable, based on site constraints.

Notes:

- The sustainable roofing zone definition allows the exclusion of recreational spaces that are integral to the principal use of the building. However, they are not considered a constraint under 15 RCNY Chapter 19.1.
- Meeting the stormwater management requirements outlined in 15 RCNY Chapter 19.1 takes precedence over Local Laws 92/94.

SMP ID	SMP Footprint (sf)
GR-1	4,400

Concept Map: *Proposed Tier 1 SMPs (Preliminary)*



Tier 1 & 2 SMP Design

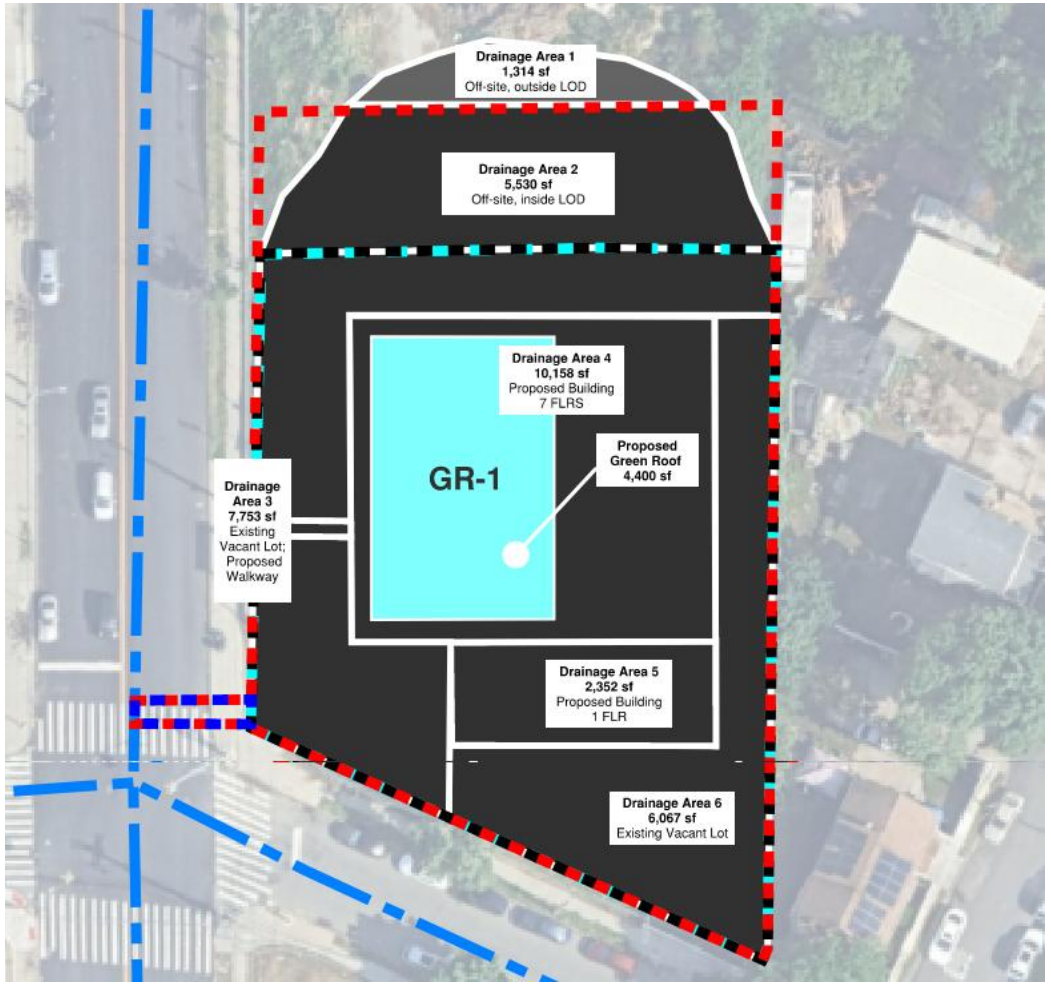
What are the Tier 1 SMP requirements?

SMP Step 3: Determine SMP Contributing Area

Refer to NYC SWM Design Table 4.3 to identify any limits to SMP loading ratio or contributing area for ET SMPs.

SMP ID	SMP Footprint (sf)	SMP Contributing Area, A (sf)
GR-1	4,400	4,400

Concept Map: *Green Roof Contributing Areas (Preliminary)*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- SMP Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD

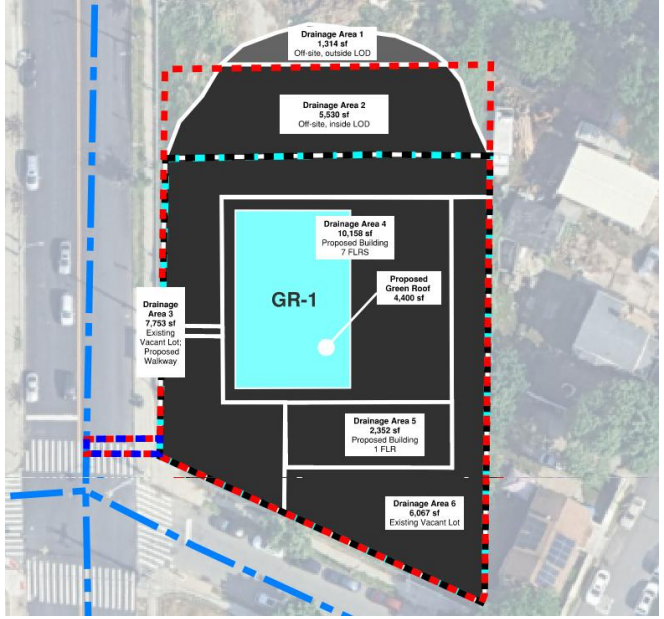
Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

Concept Map: *Green Roof Contributing Areas (Preliminary)*

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD



SMP Step 4: Determine Runoff Coefficient of SMP Contributing Area

This coefficient relates the total rainfall to runoff on the project site and is based on the percent impervious cover (I) in the proposed condition.

$$WQ_{V,SMP} = \frac{1.5"}{12} * A_{SMP} * R_V$$

SMP ID	SMP Footprint (sf)	SMP Contributing Area, A (sf)	Percent Impervious Cover, I (%)	Runoff Coefficient, R_V (-)
GR-1	4,400	4,400	100	0.95

Note: When calculating WQ_V for a vegetated SMP, the SMP footprint should be considered 100% impervious in order for the practice to manage itself.

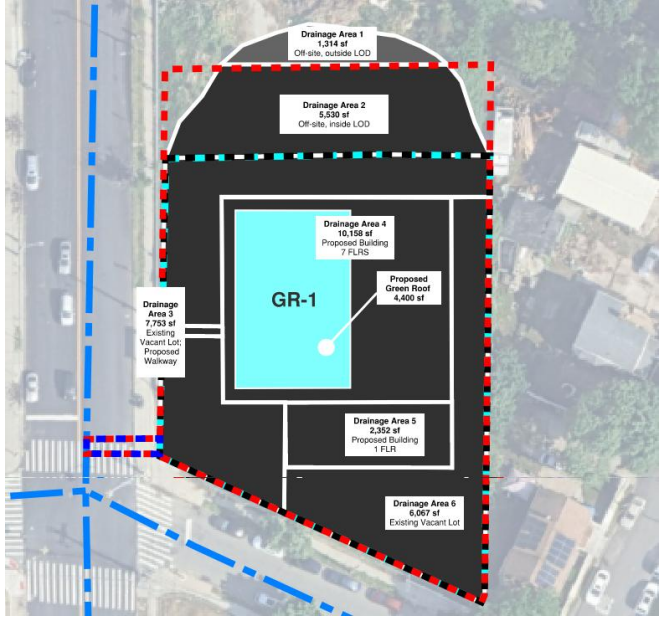
Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

Concept Map: *Green Roof Contributing Areas (Preliminary)*

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD



SMP Step 5: Calculate SMP Required $WQ_{V,SMP}$

Use NYC SWM Eq. 2.1 to calculate WQ_V

- *The Total* $WQ_{V,SMP}$ *is based on the entire contributing area to a practice*

$$WQ_{V,SMP} = \frac{1.5"}{12} * A_{SMP} * R_V$$

SMP ID	SMP Footprint (sf)	SMP Contributing Area, A (sf)	Percent Impervious Cover, I (%)	Runoff Coefficient, R_V (-)	Total $WQ_{V,SMP}$ (cf)
GR-1	4,400	4,400	100	0.95	523

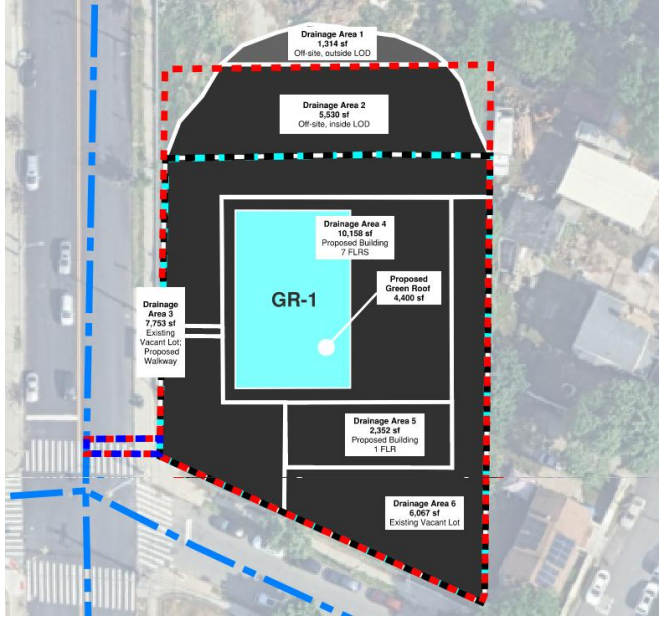
Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

Concept Map: *Green Roof Contributing Areas (Preliminary)*

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD



SMP Step 5: Calculate SMP Required $WQ_{V,SMP}$

Use NYC SWM Eq. 2.1 to calculate WQ_V

- *The Total* $WQ_{V,SMP}$ *is based on the entire contributing area to a practice*
- *When upstream practices are present, the volume they manage must be subtracted from the Total* $WQ_{V,SMP}$ *to establish the practice's Required* $WQ_{V,SMP}$

$$WQ_{V,SMP} = \frac{1.5"}{12} * A_{SMP} * R_V$$

SMP ID	SMP Footprint (sf)	SMP Contributing Area, A (sf)	Percent Impervious Cover, I (%)	Runoff Coefficient, R_V (-)	Total $WQ_{V,SMP}$ (cf)	Volume Managed by Upstream SMPs	Required $WQ_{V,SMP}$ (cf)
GR-1	4,400	4,400	100	0.95	523	-	523

Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

SMP Step 6: Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$

Use NYC SWM Eq. 4.1 to calculate V_{SMP}

EQ 4.1

$$V_{SMP} = V_P + V_S + V_I + V_D$$

where:

V_{SMP} = storage volume of SMP (cf)

V_P = volume of surface ponding (cf)

V_S = volume of voids in the soil media layer (cf)

V_I = volume of voids created by internal structures such as chambers or pipes (cf)

V_D = volume of voids in the drainage media (cf)

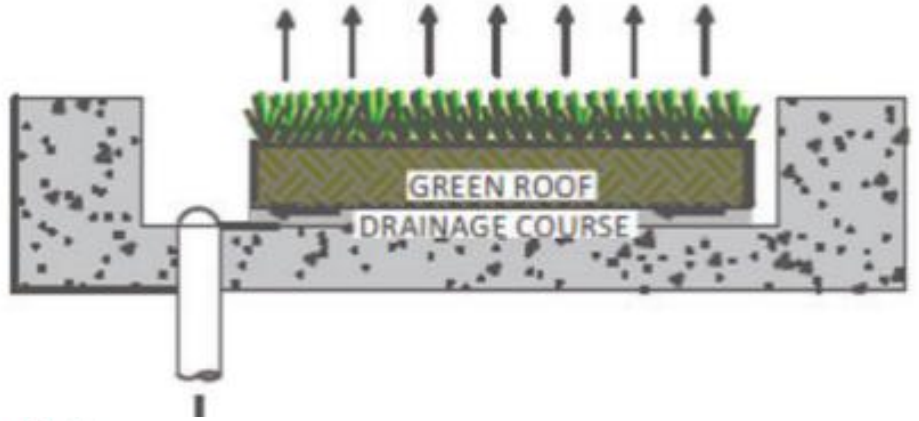
Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

SMP Step 6: Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$

Use NYC SWM Eq. 4.1 to calculate V_{SMP}

- *Determine Applicable Volume Parameters for each SMP type*



EQ 4.1

$$V_{SMP} = V_P + V_S + V_I + V_D$$

where:

V_{SMP} = storage volume of SMP (cf)

V_P = volume of surface ponding (cf)

V_S = volume of voids in the soil media layer (cf)

V_I = volume of voids created by internal structures such as chambers or pipes (cf)

V_D = volume of voids in the drainage media (cf)

$$V_{SMP,GR} = V_{S,GR}$$

- V_P is not applicable → GR cannot pond
- V_S is applicable
- V_I is not applicable → GR do not have internal storage structures
- V_D is not applicable → GR drainage media cannot store water

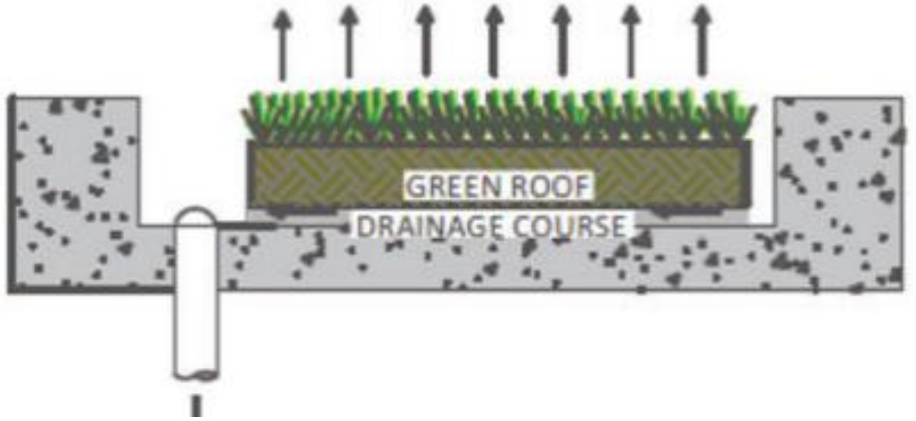
Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

SMP Step 6: Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$

Use NYC SWM Eq. 4.1 to calculate V_{SMP}

- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 to calculate the storage volume provided by each applicable parameter*



EQ 4.4

$$V_S = A_{SMP} * D_S * n_S$$

where:

V_S = volume of voids in the soil media layer (cf)

A_{SMP} = area of the SMP (sf)

D_S = depth of soil media layer (ft)

n_S = available porosity of soil media (cf/cf)

$$\boldsymbol{V_{SMP,GR} = V_{S,GR} = A_{SMP} * D_S * n_S}$$

Tier 1 & 2 SMP Design

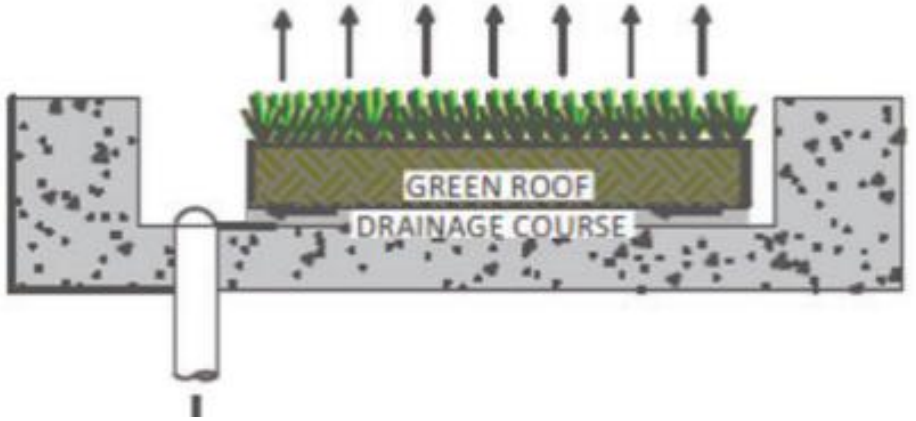
What are the Tier 1 SMP requirements?

SMP Step 6: Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$

Use NYC SWM Eq. 4.1 to calculate V_{SMP}

- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 to calculate the storage volume provided by each applicable parameter*
- *Refer to NYC SWM Design Table 4.3 to identify design requirements for ET SMPs and complete design calculation.*

SMP ID	A_{SMP} (sf)	D_S (in)	n_S (cf/cf)	$V_S = V_{SMP}$ (cf)
GR-1	4,400	7.5	0.2	550



EQ 4.4

$$V_S = A_{SMP} * D_S * n_S$$

where:

V_S = volume of voids in the soil media layer (cf)

A_{SMP} = area of the SMP (sf)

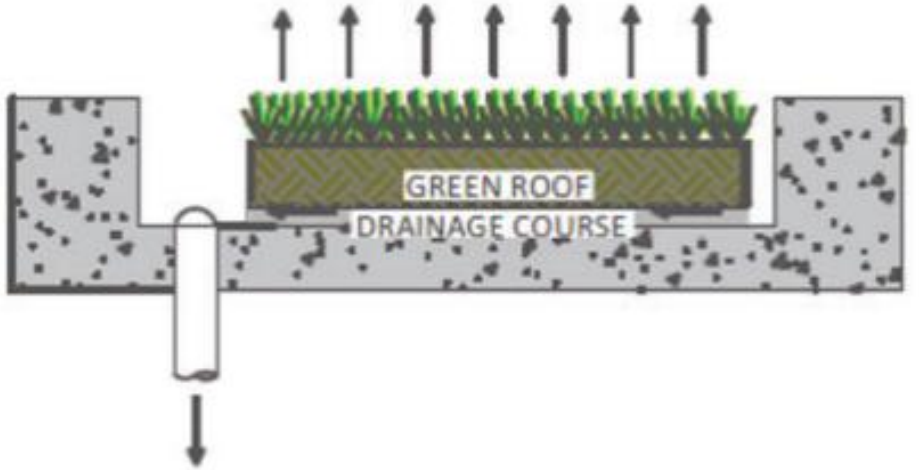
D_S = depth of soil media layer (ft)

n_S = available porosity of soil media (cf/cf)

$$V_{SMP,GR} = V_{S,GR} = A_{SMP} * D_S * n_S$$

Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?



SMP Step 6: Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$

Use NYC SWM Eq. 4.1 to calculate V_{SMP}

- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 to calculate the storage volume provided by each applicable parameter*
- *Refer to NYC SWM Design Table 4.3 to identify design requirements for ET SMPs and complete design calculation.*
- *Confirm that storage volume is sufficient to meet Required $WQ_{V,SMP}$*

$$V_{SMP,GR} = V_{S,GR} = A_{SMP} * D_S * n_S$$

V_S = Volume of voids in the soil media layer [cf]
A_{SMP} = Area of SMP [sf]
D_S = Depth of soil media layer [ft]
n_S = Available porosity of soil media [cf/cf]

SMP ID	A_{SMP} (sf)	D_S (in)	n_S (cf/cf)	$V_S = V_{SMP}$ (cf)		Required $WQ_{V,SMP}$ (cf)
GR-1	4,400	7.5	0.2	550	≥	523

✓

Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

Green Roof Depth

Considerations:

- Green roof depth must be greater than 7.125 inches to manage its full water quality volume.
- Green roofs may be designed with smaller depths, but remaining unmanaged volume will need to be routed to downstream practices.

Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

SMP Step 7: Check SMP Contributions to Site-Wide Requirements

Use NYC SWM Table 4.1 to determine the percent contributions of each SMP.

Table 4.1. Percent of SMP volume that may be applied to SW management criteria by SMP function.

SMP Function	Percent of SMP Volume Applied to Requirement (F_A)		
	WQv	RRv	Vv
Infiltration	100	100	100
Evapotranspiration	100	100	0
Reuse[A]	100	100	50
Filtration	100[B]	40[C]	0
Detention	100[D]	0	100

SMP ID	Required $WQ_{V,SMP}$ (cf)	V_{SMP} (cf)	Provided $WQ_{V,}$ (cf)	Provided RR_V (cf)	Provided V_V (cf)
GR-1	523	550	523	523	0

Note:

Oversizing an SMP will not increase the volume it receives from a 1.5-in rain event and therefore does not increase its contribution to the Provided WQ_V. Therefore, **when V_{SMP} > Required $WQ_{V,SMP}$, Provided $WQ_{V,SMP} = F_A$ x Required $WQ_{V,SMP}$**

Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

Table 4.1. Percent of SMP volume that may be applied to SW management criteria by SMP function.

SMP Function	Percent of SMP Volume Applied to Requirement (F_A) WQv	RRv	Vv
Infiltration	100	100	100
Evapotranspiration	100	100	0
Reuse[A]	100	100	50
Filtration	100[B]	40[C]	0
Detention	100[D]	0	100

SMP Step 7: Check SMP Contributions to Site-Wide Requirements

Use NYC SWM Table 4.1 to determine the percent contributions of each SMP.

SMP ID	Required $WQ_{V,SMP}$ (cf)	V_{SMP} (cf)	Provided WQ_V, (cf)	Provided RR_V (cf)	Provided V_V (cf)
GR-1	523	550	523	523	0

The sum of the volumes provided by each SMP should be greater than the site-wide requirements.

Site-Wide Parameters	WQ_V (cf)	RR_V (cf)	V_V (cf)
Total Volume Provided	523	523	0
Total Volume Required	1,642	606 (*Minimum*)	TBD*
Remaining to be Managed	1,120	84	TBD*

*The sewer operations volume V_V requirements depends on the site cover types in the proposed conditions. Therefore, it must be calculated after Tier 1 and Tier 2 surface SMPs have been sited.

Tier 1 & 2 SMP Design

What are the Tier 1 SMP design requirements?

SMPs Design Steps:

- **Step 1:** Review Drainage Areas & Constraints
- **Step 2:** Site SMP Footprint
- **Step 3:** Determine SMP Contributing Area
- **Step 4:** Determine Runoff Coefficient of SMP Contributing Area
- **Step 5:** Calculate SMP Required $WQ_{V,SMP}$
- **Step 6:** Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- **Step 7:** Check SMP Contributions to Site-Wide Requirements

Iterate process until all requirements are met

✗ **Iteration 1:** One Green Roof proposed

Note:

Green roofs alone will never meet site-wide WQv requirements because:

1. Their contributing area is always equal to their footprint
2. Roof constraints will always prevent a green roof footprint from covering the full roof area

Tier 1 & 2 SMP Design

What are the Tier 1 SMP requirements?

Meeting Minimum RRv

Considerations:

- There are no exceptions to meeting Minimum RRv.
- Recreational areas excluded in the Sustainable Roofing Zone may still be feasible for stormwater management requirements.
- To meet Minimum RRv, project must include enough retention practice either on the rooftop or at grade.

Tier 1 & 2 SMP Design

What are the Tier 2 SMP requirements?

Tier 2 SMPs are not feasible because:

- Soil constraints prevent the project from using infiltration systems

SMP HIERARCHY CHECKLIST - MS4 AREAS

			Percent of SMP volume applied[a]			Site constraints that limit SMP feasibility[b]				
Tier[c]	Function Type[d]	Practice Type[e]	WQv	RRv	Vv	Soil	Subsurface	Hotspot	Surfaces	Space
Tier 1	Infiltration (Vegetated)	Bioretention	100	100	100	X	X	X	X	X
		Rain garden	100	100	100	X	X	X	X	X
		Stormwater planter	100	100	100	X	X	X	X	X
		Tree planting / preservation	SC	SC	0					
		Dry basin	100	100	100	X	X	X	X	X
		Grass filter strip	SC	SC	0	X	X	X	X	X
		Vegetated swale	SC	SC	0	X	X	X	X	X
	Evapotranspiration[f]	Rain garden	100	100	0		X		X	X
		Stormwater planter	100	100	0				X	
		Tree planting / preservation	SC	SC	0					
		Green roof	100	100	0					
Tier 2	Infiltration (Non-vegetated)	Dry well	100	100	50	X	X	X		X
		Stormwater gallery	100	100	50	X	X	X		X
		Stone trench	100	100	50	X	X	X	X	X
		Porous pavement	100	100	50	X	X	X		X
		Synthetic turf field	100	100	50	X	X	X	X	X
Anytime / Optional	Reuse	Rain tank	100	100	SC					
		Cistern	100	100	SC					
Tier 3	Filtration[g]	Bioretention	100	40	0		X		X	X
		Stormwater planter	100	40	0		X		X	X
		Porous pavement	100	0	0		X			X
		Synthetic turf field	100	0	0		X		X	X
		Sand filter	100	0	0		X		X	
		Organic filter	100	0	0		X		X	
	Detention[g,h]	Constructed wetland	100	0	100		X		X	X
		Wet basin / pond	100	0	100		X		X	X
Other	Detention[g,i,j]	Dry basin	0	0	100		X		X	X
		Stormwater gallery	0	0	100		X			X
		Blue roof	0	0	100					
		Detention tank	0	0	100					

References:

1. *NYS DEC Stormwater Management Design Manual – Appendix A*

Tier 1 & 2 SMP Design

What are the Tier 2 SMP requirements?

Tier 2 SMPs are not feasible.

Establish detention and treatment requirements then move to Tier 3 SMP design

Tier 3 SMP Design *(MS4 Only)*

Tier 3 SMP Design *(MS4 Only)*

<u>Goal:</u> Design Tier 3 SMPs to Meet the Applicable Stormwater Management Criteria

Key Questions

- Which criteria dictate Tier 3 Design Requirements?
- What are the Tier 3 Design Requirements?
- Can the Tier 3 Design be optimized?

Tier 3 SMP Design *(MS4 Only)*

Which criteria dictate Tier 3 SMP requirements?

Tier 3 detention and treatment SMPs should consider the remaining Water Quality volume (WQv), Sewer Operations volume (V_V) and Maximum Release Rate (Q_{DRR}) requirements.

$$\boldsymbol{Site\ WQ_V = 1,642\ cf}$$

$$\boldsymbol{Remaining\ WQ_V = 1,642 - 973 = 669\ cf}$$

$$\boldsymbol{V_V = ??}$$

$$\boldsymbol{Q_{DRR} = ??}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

SMP Tier 3 Design Steps *[when driven by Sewer Operations Requirements]*:

- **Step 1:** Determine Contributing Areas
- **Step 2:** Calculate Weighted Runoff Coefficient C_W
- **Step 3:** Calculate Sewer Operations Volume V_V
- **Step 4:** Calculate Maximum Release Rate Q_{DRR}
- **Step 5:** Calculate Developed Flow Q_{DEV} to Confirm Q_{DRR} Applicability
- **Step 6:** Design Tier 3 System to meet V_V & Q_{DRR}
- **Step 7:** Check SMP Contributions to Site-Wide Requirements

Tier 3 SMP Design *(MS4 Only)*

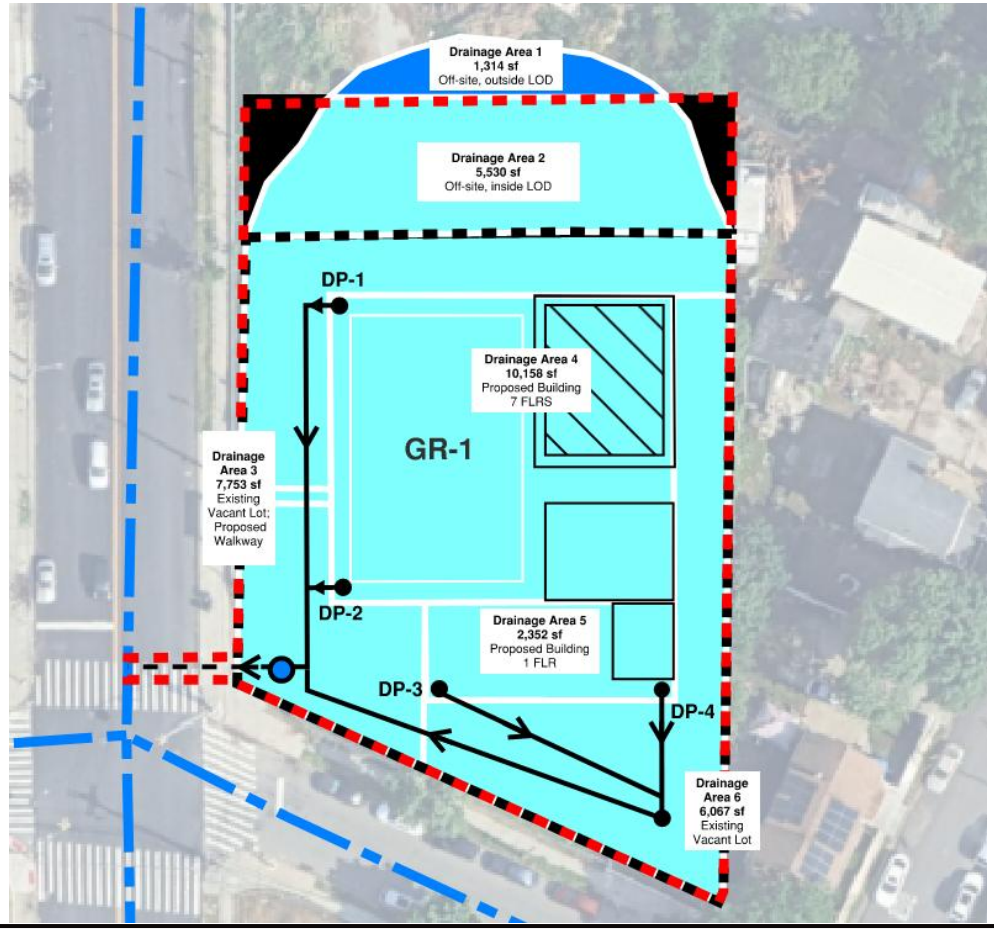
What are the Tier 3 SMP design requirements?

Step 1: Determine Contributing Areas C_W

In this case, all developed areas drain to the detention and treatment system, including overflow from all upstream SMPs

$$A = 33{,}174\ sf$$

Concept Map: *Cover and Contributing Area Drainage Plan*



LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Contributing Area in LOD: *31,860 sf*
- Contributing Areas outside LOD: *1,314 sf*
- Non-Contributing Areas in LOD: *0 sf*
- Detention System Design Point
- DP-# Drainage Point and ID
- Schematic Inlet & Internal Drainage
- Proposed Site Sewer Connection
- NYC MS4

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 2: Calculate Weighted Runoff Coefficient C_W

- *Complete surface cover design*

The sewer operations volume V_V requirements depends on the site cover types in the proposed condition. Therefore, it must be calculated **after** Tier 1 and Tier 2 surface SMPs have been sited.

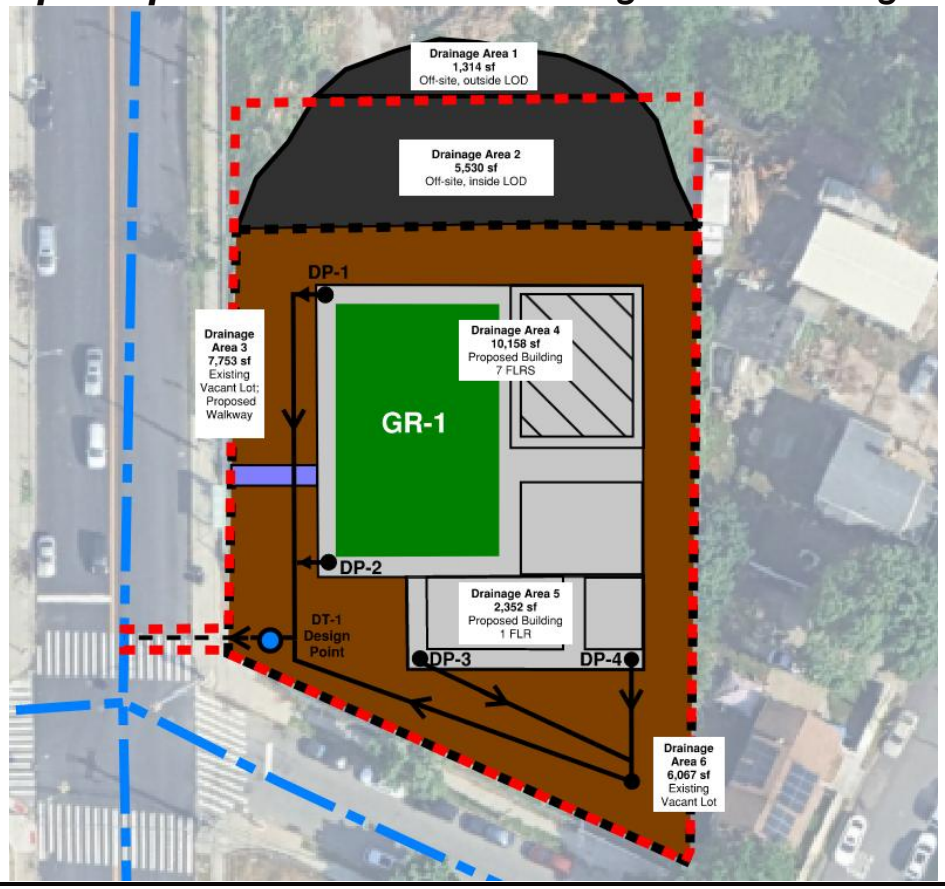
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 2: Calculate Weighted Runoff Coefficient C_W

- *Complete surface cover design*
- *Establish area of all cover types on the proposed site*

Concept Map: *Cover and Contributing Area Drainage Plan*



LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Roof Area: *8,110 sf*
- Paved Area: *240 sf*
- Green Roof Area: *4,400 sf*
- Undeveloped Area: *6,844 sf*
- Landscaped Area: *13,580 sf*
- Detention System Design Point
- DP-# Drainage Point and ID
- Schematic Inlet & Internal Drainage
- Proposed Site Sewer Connection
- NYC MS4

Note:
C values vary by **surface** type, not by pervious or impervious cover which is used for WQv calculations.

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Table 2.8. C values for various surface types.

C	Surface Description
0.95	Roof areas
0.85	Paved areas
0.70	Green roof with min. 4 in. growing media
0.70	Porous asphalt/Porous Concrete[a]
0.70	Synthetic turf fields[a]
0.65	Gravel parking lot
0.30	Undeveloped areas
0.20	Grass, bio-swales, or landscaped areas

[a] Using a C value of 0.7 for the indicated surface types typically requires the use of an outlet pipe, with approval at the discretion of DEP.

$A_{Roof} = 8{,}110\ sf$
$A_{Paved} = 240\ sf$
$A_{GR} = 4{,}400\ sf$
$A_{Undeveloped} = 6{,}844\ sf$
$A_{Landscaped} = 13{,}580\ sf$

Step 2: Calculate Weighted Runoff Coefficient C_W

- *Complete surface cover design*
- *Establish area of all cover types on the proposed site*
- *Refer to NYC SWM Table 2.8 to find C values for each surface type.*

$$C_W = \frac{8{,}110 * 0.95 + 240 * 0.85 + 4{,}400 * 0.70 + 6{,}844 * 0.30 + 13{,}580 * 0.20}{33{,}174}$$

$$C_W = 0.475$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 3: Calculate Sewer Operations Volume V_V

- *Use NYC SWM Eq. 2.3 to calculate V_V*

EQ 2.3

$$V_V = \frac{R_D}{12} * A * C_W$$

where:

V_V: sewer operations volume (cf)

R_D: rainfall depth (in)

A: contributing area (sf)

C_W: weighted runoff coefficient relating peak rate of rainfall and runoff

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 3: Calculate Sewer Operations Volume V_V

- *Use NYC SWM Eq. 2.3 to calculate V_V*
- *Refer to NYC SWM Table 2.7 to establish rainfall depth based on the sewershed type (CSS/MS4) and proposal type for the project (HCP/SCP).*

Table 2.7. Applied rainfall depth by sewershed type and connection proposal type.

R_D	Description
1.85	CSS areas with SCP
1.50	CSS areas with HCP
1.50	MS4 areas with SCP
1.10	MS4 areas with HCP

$$R_D = 1.50$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

EQ 2.3

$$V_V = \frac{R_D}{12} * A * C_W$$

where:
V_V: sewer operations volume (cf)
R_D: rainfall depth (in)
A: contributing area (sf)
C_W: weighted runoff coefficient relating peak rate of rainfall and runoff

Step 3: Calculate Sewer Operations Volume V_V

- *Use NYC SWM Eq. 2.3 to calculate V_V*
- *Refer to NYC SWM Table 2.7 to establish rainfall depth based on the sewershed type (CSS/MS4) and proposal type for the project (HCP/SCP).*
- *Finalize calculation using contributing area from Step 1 and weighted runoff coefficient from Step 2.*

$$R_D = 1.50\ in$$
$$A = 33{,}174\ sf$$
$$C_W = 0.475$$

$$V_V = \frac{1.50}{12} * 33{,}174 * 0.475$$

$$\boldsymbol{V_V = 1{,}970\ cf}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 4: Calculate Maximum Release Rate Q_{DRR}

- *Use NYC SWM Eq. 2.5 to calculate Q_{DRR} for the tax lot*

EQ 2.5

$$Q_{DRR} = \frac{q\left(\frac{cfs}{acre}\right) * A(sf)}{43560(\frac{sf}{acre})} \; or \; 0.046 \; [whichever \; is \; greater]$$

Q_{DRR}: maximum release rate, site (cfs)
q: maximum release rate, per acre (cfs/acre)
A: contributing area (sf)

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 4: Calculate Maximum Release Rate Q_{DRR}

- *Use NYC SWM Eq. 2.5 to calculate Q_{DRR} for the tax lot*
- *Refer to NYC SWM Table 2.9 to establish max release rate per acre based on the sewershed type.*

Table 2.9. Maximum release rate per acre (cfs/acre) by sewershed type.

q (cfs/acre)	Description
1.0	MS4 areas
0.1	CSS areas

$$q = 1.0 \frac{cfs}{acre}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 4: Calculate Maximum Release Rate Q_{DRR}

- *Use NYC SWM Eq. 2.5 to calculate Q_{DRR} for the tax lot*
- *Refer to NYC SWM Table 2.9 to establish max release rate per acre based on the sewershed type.*
- *Complete calculation using contributing area from Step 1.*

EQ 2.5

$$Q_{DRR} = \frac{q\left(\frac{cfs}{acre}\right) * A(sf)}{43560(\frac{sf}{acre})} \; or \; 0.046 \; [whichever \; is \; greater]$$

Q_{DRR}: maximum release rate, site (cfs)
q: maximum release rate, per acre (cfs/acre)
A: contributing area (sf)

$$q = 1.0\frac{cfs}{acre}$$

$$A = 33{,}174\ sf$$

$$Q_{DRR,Calc} = \frac{1.0\frac{cfs}{acre} * 33{,}174\ sf}{43560\frac{sf}{acre}}$$

$$\boldsymbol{Q_{DRR,Calc} = 0.76\ cfs}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 4: Calculate Maximum Release Rate Q_{DRR}

- *Use NYC SWM Eq. 2.5 to calculate Q_{DRR} for the tax lot*
- *Refer to NYC SWM Table 2.9 to establish max release rate per acre based on the sewershed type.*
- *Complete calculation using contributing area from Step 1.*
- *Select the appropriate Q_{DRR} for the tax lot*

EQ 2.5

$$Q_{DRR} = \frac{q\left(\frac{cfs}{acre}\right) * A(sf)}{43560(\frac{sf}{acre})} \; or \; 0.046 \; [whichever \; is \; greater]$$

Q_{DRR}: maximum release rate, site (cfs)
q: maximum release rate, per acre (cfs/acre)
A: contributing area (sf)

$$Q_{DRR,Calc} = 0.76 \; cfs$$

$$0.76 \; cfs > 0.046 \; cfs$$

$$\boldsymbol{Q_{DRR} = 0.76 \; cfs}$$

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

If the developed flow (Q_{DEV}) is greater than the maximum release rate (Q_{DRR}),

Designer must design detention practices in accordance with Chapter 4 of the NYC SWM to ensure that the maximum release rate for the site is not exceeded.

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 5: Calculate Developed Flow Q_{DEV} to Confirm Q_{DRR} Applicability

- *Refer to NYC SWM p. 2-18 to calculate Q_{Dev}*

$$Q_{Dev} = \frac{C_{WS} A_S}{7{,}320}$$

where:
Q_{Dev} = the developed site average storm runoff rate of flow in cfs, based on a rainfall event with a 5 yr. return period, and a 6 minute (min.) time of concentration
C_{WS} = the weighted runoff coefficient for the site
A_S = the site area in ft^2
7,320 = 43,560 ft^2/ac divided by 5.95 inches per hour (in/hr), the average rainfall intensity for the event with a 5 yr. return period and a 6 min. time of concentration

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP design requirements?

Step 5: Calculate Developed Flow Q_{DEV} to Confirm Q_{DRR} Applicability

- *Refer to NYC SWM p. 2-18 to calculate Q_{Dev}*
- *Complete calculation using contributing area from Step 1 and weighted runoff coefficient from Step 2.*
- *Confirm whether Q_{DRR} Applies*

$$Q_{Dev} = \frac{C_{WS} A_S}{7{,}320}$$

$$Q_{Dev} = \frac{0.475 * 33{,}174}{7{,}320}$$

$$\boldsymbol{Q_{Dev} = 2.15\ cfs} \quad > \quad Q_{DRR} = 0.76\ cfs$$

Since $Q_{Dev} > Q_{DRR}$ the Tier 3 system must be designed to meet Q_{DRR}

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Select Tier 3 SMPs to meet remaining site requirements:

- ✓ *In the MS4, a detention system can only be implemented to meet remaining WQv requirements if it includes approved treatment abilities.*
- ✓ *Appropriate SMP(s) must be selected to meet any remaining minimum RRv.*
- ✓ *The Tier 3 practice(s) must be sized to meet the full Vv.*

SMP HIERARCHY CHECKLIST - MS4 AREAS

			Percent of SMP volume applied[a]			Site constraints that limit SMP feasibility[b]				
Tier[c]	Function Type[d]	Practice Type[e]	WQv	RRv	Vv	Soil	Subsurface	Hotspot	Surfaces	Space
Tier 1	Infiltration (Vegetated)	Bioretention	100	100	100	✗	✗	✗	✗	✗
		Rain garden	100	100	100	✗	✗	✗	✗	✗
		Stormwater planter	100	100	100	✗	✗	✗	✗	✗
		Tree planting / preservation	SC	SC	0					
		Dry basin	100	100	100	✗	✗	✗	✗	✗
		Grass filter strip	SC	SC	0	✗	✗	✗	✗	✗
		Vegetated swale	SC	SC	0	✗	✗	✗	✗	✗
	Evapotranspiration[f]	Rain garden	100	100	0		✗		✗	✗
		Stormwater planter	100	100	0				✗	
		Tree planting / preservation	SC	SC	0					
		Green roof	100	100	0					
Tier 2	Infiltration (Non-vegetated)	Dry well	100	100	50	✗	✗	✗		✗
		Stormwater gallery	100	100	50	✗	✗	✗		✗
		Stone trench	100	100	50	✗	✗	✗	✗	✗
		Porous pavement	100	100	50	✗	✗	✗		✗
		Synthetic turf field	100	100	50	✗	✗	✗	✗	✗
Anytime / Optional	Reuse	Rain tank	100	100	SC					
		Cistern	100	100	SC					
Tier 3	Filtration[g]	Bioretention	100	40	0		✗		✗	✗
		Stormwater planter	100	40	0		✗		✗	✗
		Porous pavement	100	0	0		✗			✗
		Synthetic turf field	100	0	0		✗		✗	✗
		Sand filter	100	0	0		✗		✗	
		Organic filter	100	0	0		✗		✗	
	Detention[g,h]	Constructed wetland	100	0	100		✗		✗	✗
		Wet basin / pond	100	0	100		✗		✗	✗
Other	Detention[g,i,j]	Dry basin	0	0	100		✗		✗	✗
		Stormwater gallery	0	0	100		✗			✗
		Blue roof	0	0	100					
		Detention tank	0	0	100					

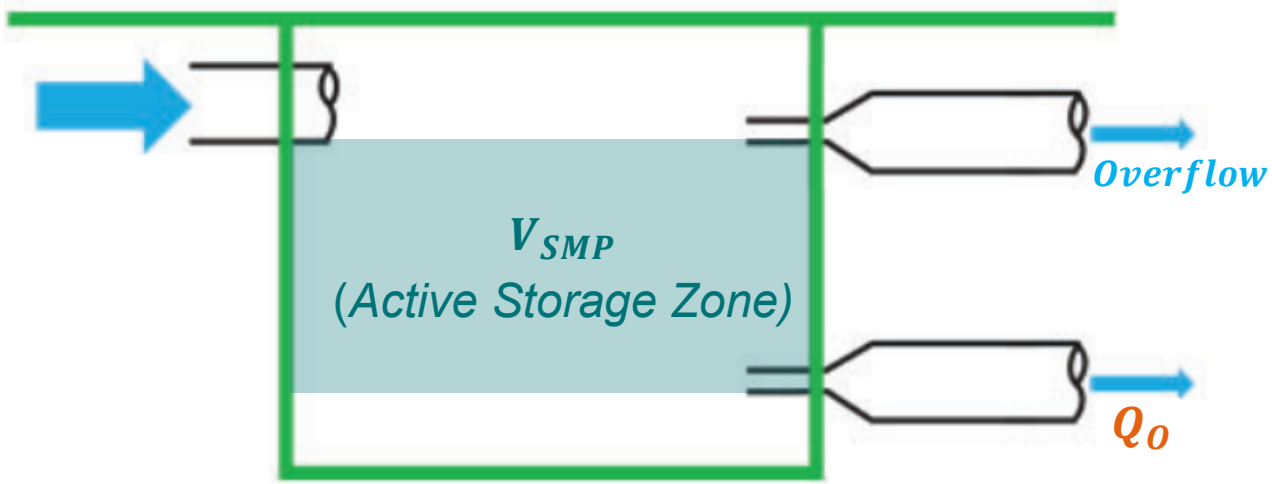
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

When sewer operations requirements apply, Tier 3 SMP design consists of ensuring:

- ✓ **$V_{SMP} > V_V$**
  The SMP active storage volume must exceed the Required Sewer Operations Volume

- ✓ **$Q_o < Q_{DRR}$**
  The release rate from the SMP controlled-flow device (Q_o) must not exceed the Maximum Release Rate (Q_{DRR}) for the contributing area when the 10-year detention volume is being provided (V_V).



Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6: Design Tier 3 System to meet V_V & Q_{DRR}

- **Step 6a:** Design Filtration System
- **Step 6b:** Design Detention System
- **Step 6c:** Design Treatment System

*Sub-steps may vary based on site constraints and SMP selection

Tier 3 SMP Design *(MS4 Only)*

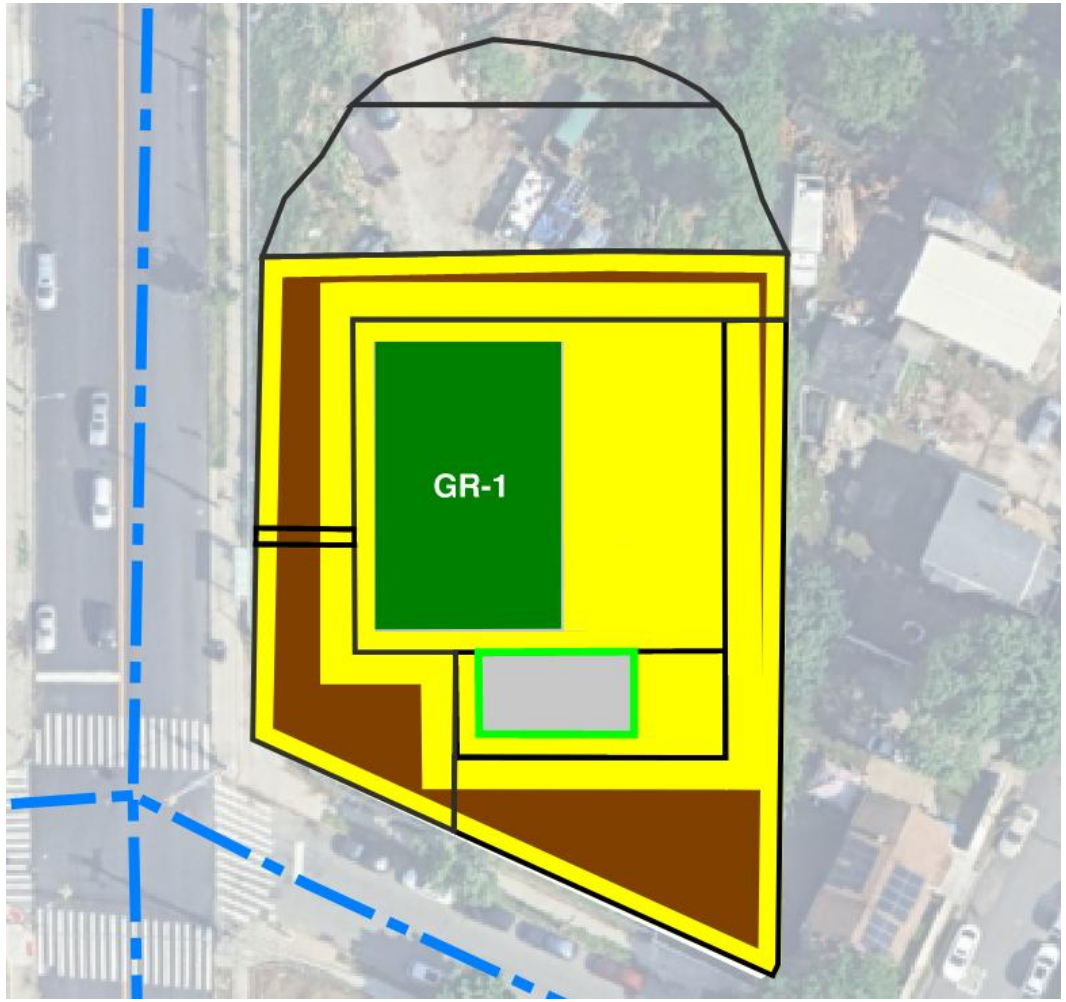
What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Review Drainage Areas & Constraints

Constraints may be limited to one portion of the site. It is helpful to evaluate constraints within individual, non-overlapping drainage areas to site SMPs.

Concept Map: *Constraints and Drainage Area Delineation*



Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

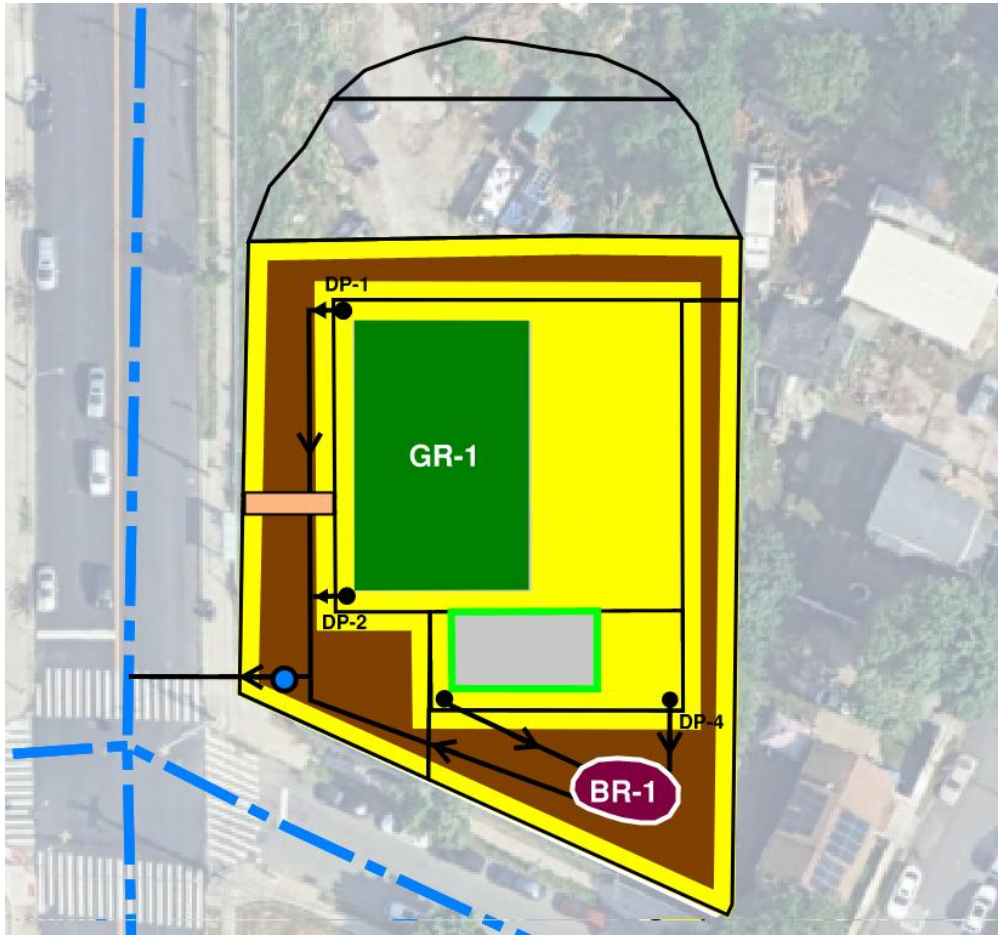
Step 6a: Design Filtration System

- Site SMP Footprint

Site Tier 3 filtration practices on unconstrained areas.

SMP ID	SMP Footprint (sf)
BR-1	500

Concept Map: *Proposed SMPs (Preliminary)*



LEGEND

- Proposed Structures Roof Area
- Space Constraints
- Soil Constraint
- Green Roof
- Bioretention Practice
- Drainage Area Delineation
- Proposed Recreational Area (*not a constraint*)
- DP-# Drainage Point and ID
- Proposed Inlet
- Proposed Internal Drainage
- NYC MS4
- Proposed Site Sewer Connection
- Flow Control Structure

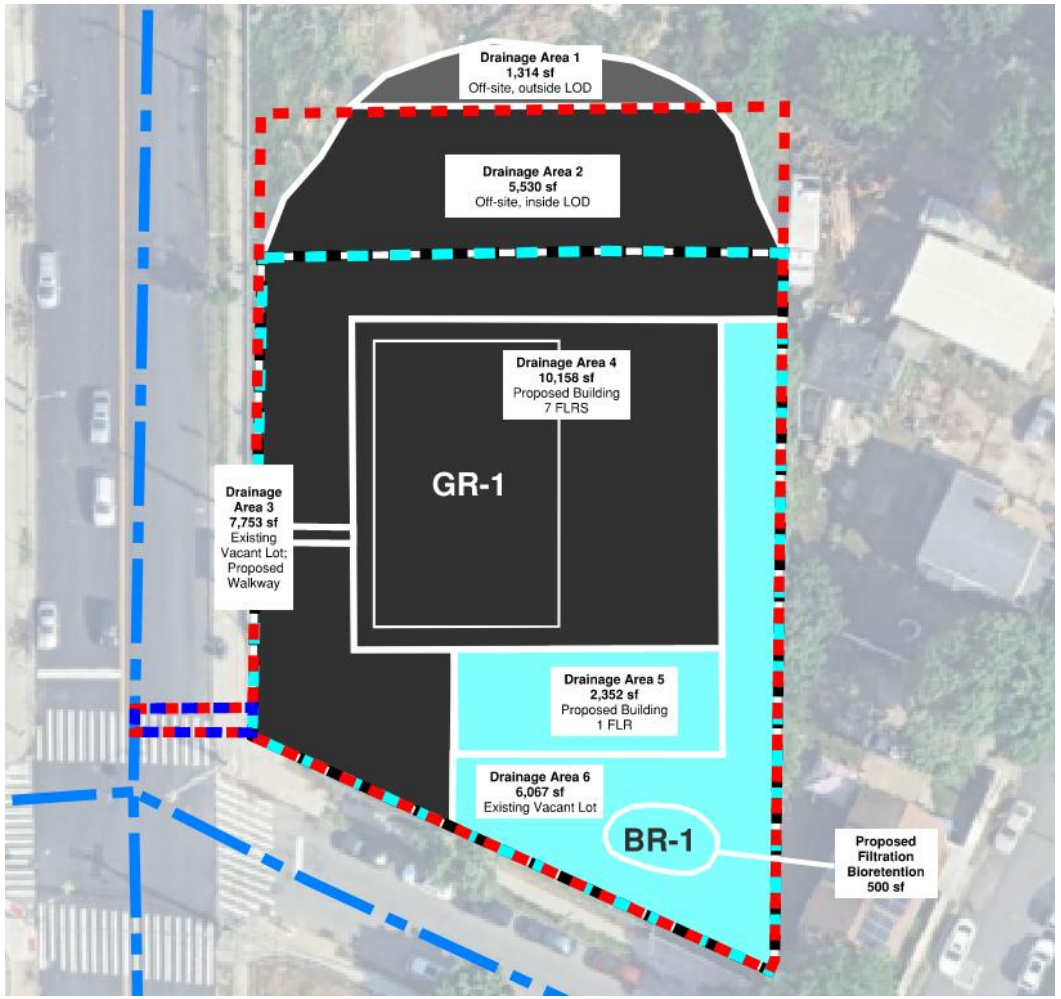
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Determine SMP Contributing Area

Concept Map: *Filtration Bioretention Contributing Area*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- SMP Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Areas Managed Upstream

Notes:

- In cases where SMPs have upstream managed areas, the design must be performed for each practice individually, starting with the upstream-most practice.

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

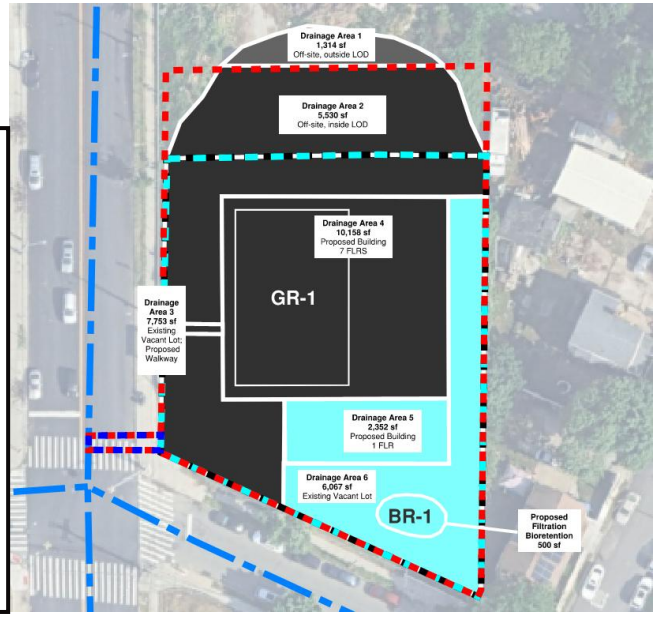
Step 6a: Design Filtration System

- Determine SMP Contributing Area
- *Identify the true contributing area to the practice, based on the sum of its drainage areas.*

Concept Map: *Filtration Bioretention Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Upstream Contributing Areas



SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)
BR-1	500	8,419

Contributing drainage areas to BR-1 are DA-5 & DA-6

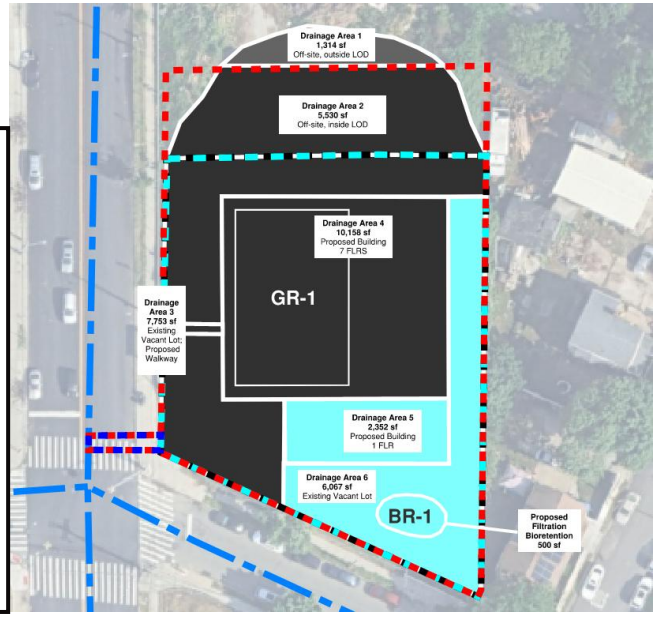
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Concept Map: *Filtration Bioretention Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Upstream Contributing Areas



Step 6a: Design Filtration System

- Determine SMP Contributing Area
- *Identify the true contributing area to the practice, based on the sum of its drainage areas.*
- *Refer to NYC SWM Table 4.4 to identify any limits to SMP contributing area or loading ratio for filtration SMPs.*

SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)	Max. Contributing Area (sf)
BR-1	500	8,419	11,000

For bioretention, the maximum contributing area is the lesser of:

- 5 acres
- A 20:1 practice-to-contributing area ratio (i.e. 20x the practice footprint)

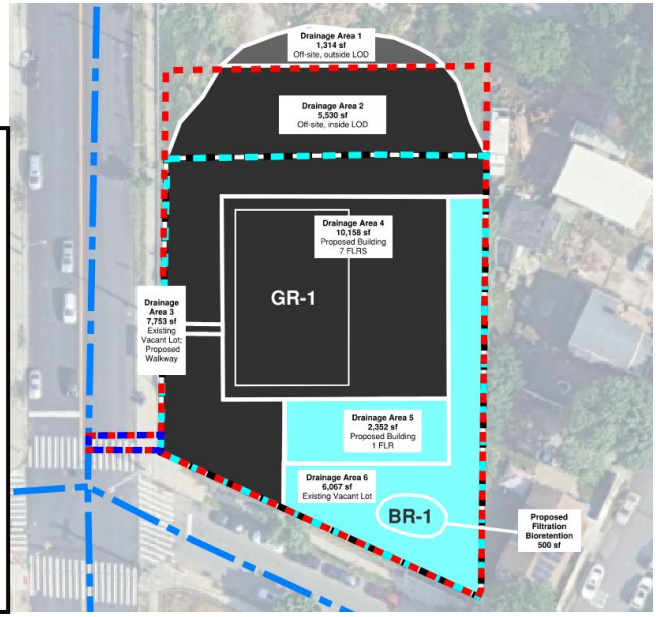
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Concept Map: *Filtration Bioretention Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Upstream Contributing Areas



Step 6a: Design Filtration System

- Determine Runoff Coefficient of SMP Contributing Area

This coefficient relates the total rainfall to runoff on the project site and is based on the percent impervious cover (I) in the proposed condition.

SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)	Max. Contributing Area (sf)	Runoff Coefficient, R_V (-)
BR-1	500	8,419	11,000	

$$R_V = 0.05 + 0.009 * I$$

$$I = \frac{Impervious\ contributing\ area}{Total\ contributing\ area}$$

$$= \frac{2{,}352 + 500\ sf}{33{,}174\ sf} = \frac{2{,}852\ sf}{33{,}174\ sf} = 33.9\%$$

Note: When calculating WQ_V for a vegetated SMP, the SMP footprint should be considered 100% impervious in order for the practice to manage itself.

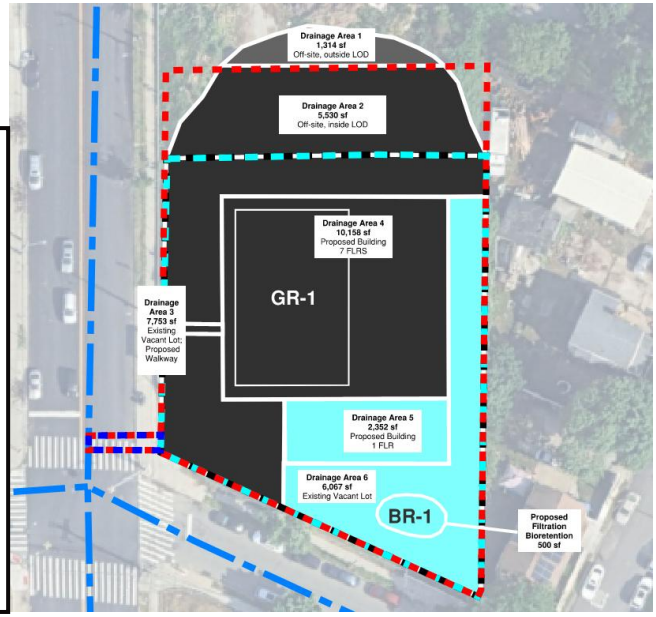
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Concept Map: *Filtration Bioretention Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Upstream Contributing Areas



Step 6a: Design Filtration System

- Determine Runoff Coefficient of SMP Contributing Area

This coefficient relates the total rainfall to runoff on the project site and is based on the percent impervious cover (I) in the proposed condition.

SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)	Max. Contributing Area (sf)	Runoff Coefficient, R_V (-)
BR-1	500	8,419	11,000	0.355

$$R_V = 0.05 + 0.009 * I$$

$$I = 33.9\%$$

$$R_V = 0.05 + 0.009(33.9) = 0.355$$

Note: When calculating WQ_V for a vegetated SMP, the SMP footprint should be considered 100% impervious in order for the practice to manage itself.

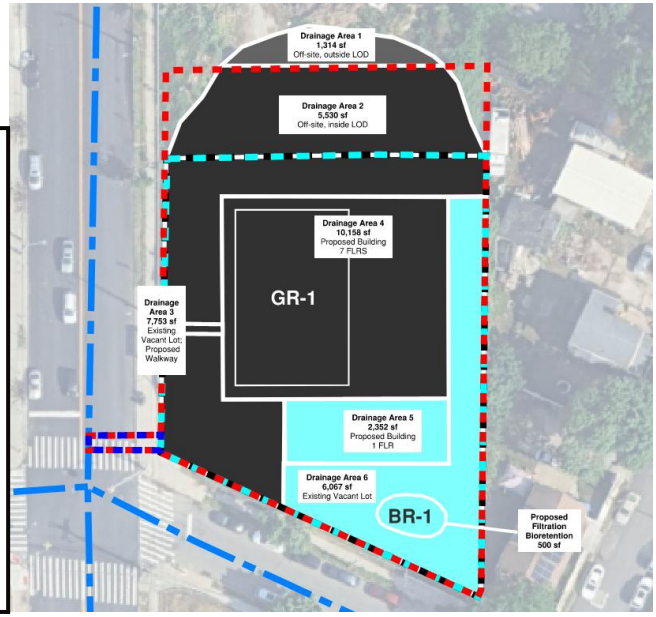
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Concept Map: *Bioretention 1 Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Upstream Contributing Areas



Step 6a: Design Filtration System

- Calculate SMP Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 2.1 to calculate WQ_V*
- *The Total $WQ_{V,SMP}$ is based on the entire contributing area to a practice*
- *When upstream practices are present, the volume they managed must be subtracted from the Total $WQ_{V,SMP}$ to establish the practice's Required $WQ_{V,SMP}$*

$$WQ_{V,SMP} = \frac{1.5"}{12} * A_{SMP} * R_V$$

SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)	Max. Contributing Area (sf)	Runoff Coefficient, R_V (-)	Total $WQ_{V,SMP}$ (cf)
BR-1	500	8,419	11,000	0.355	373

Total $WQ_{V,SMP}$ was calculated based on the SMP Total Contributing Area

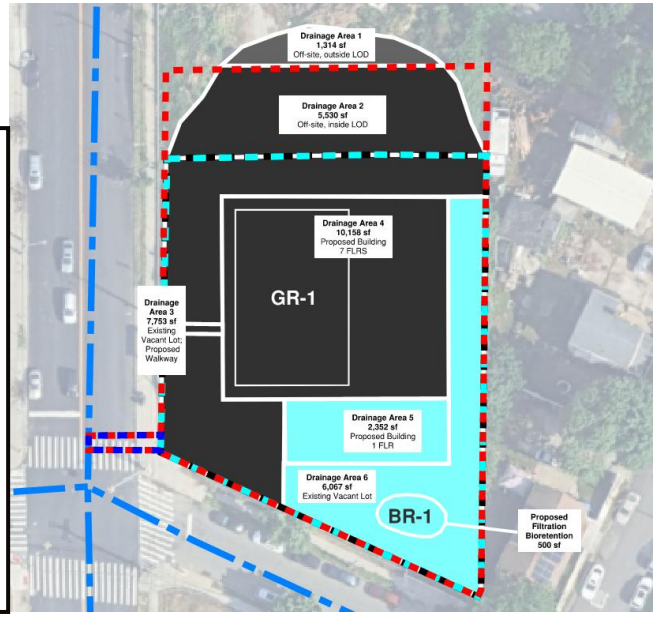
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Concept Map: *Bioretention 1 Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
- ROW Disturbance: *62 sf*
- Practice-Based Contributing Areas
- Non-Contributing Areas
- Non-Contributing Areas outside LOD
- Upstream Contributing Areas



Step 6a: Design Filtration System

- Calculate SMP Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 2.1 to calculate* WQ_V
- *The Total* $WQ_{V,SMP}$ *is based on the entire contributing area to a practice*
- *When upstream practices are present, the volume they managed must be subtracted from the Total* $WQ_{V,SMP}$ *to establish the practice's Required* $WQ_{V,SMP}$

$$WQ_{V,SMP} = \frac{1.5"}{12} * A_{SMP} * R_V$$

SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)	Max. Contributing Area (sf)	Runoff Coefficient, R_V (-)	Total $WQ_{V,SMP}$ (cf)	Volume Managed by Upstream SMPs	Required $WQ_{V,SMP}$ (cf)	Max. $WQ_{V,SMP}$ (cf)
BR-1	500	8,419	11,000	0.355	373	-	373	488

The Required $WQ_{V,SMP}$ *may not exceed the Max.* $WQ_{V,SMP}$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Concept Map: *Bioretention 1 Contributing Area*

LEGEND

- Property Lot: *26,330 sf*
- Limit of Disturbance (LOD): 32,*874 sf*
- On-Site Disturbance: *26,330 sf*
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- Practice-Based Contributing Areas
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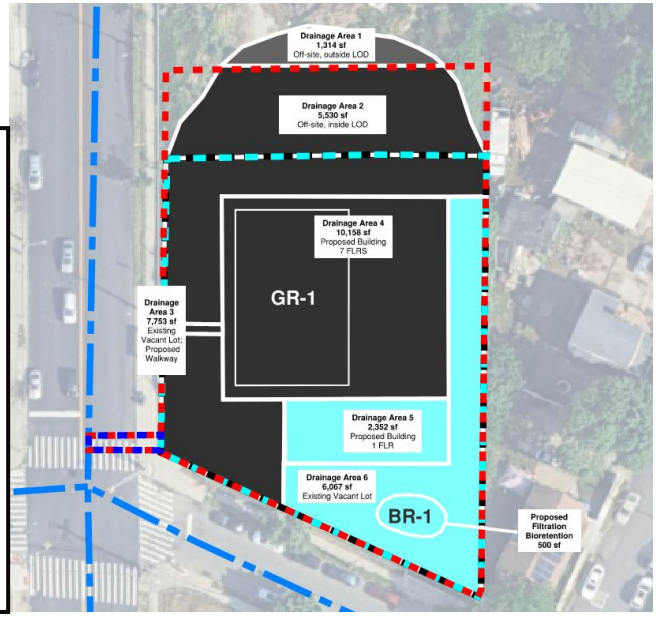
- Upstream Contributing Areas



Step 6a: Design Filtration System

- Calculate SMP Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 2.1 to calculate WQ_V*
- *The Total $WQ_{V,SMP}$ is based on the entire contributing area to a practice*
- *When upstream practices are present, the volume they managed must be subtracted from the Total $WQ_{V,SMP}$ to establish the practice's Required $WQ_{V,SMP}$*

$$WQ_{V,SMP} = \frac{1.5"}{12} * A_{SMP} * R_V$$

SMP ID	SMP Footprint (sf)	SMP Total Contributing Area (sf)	Max. Contributing Area (sf)	Runoff Coefficient, R_V (-)	Total $WQ_{V,SMP}$ (cf)	Volume Managed by Upstream SMPs	Required $WQ_{V,SMP}$ (cf)		Max. $WQ_{V,SMP}$ (cf)	
BR-1	500	8,419	11,000	0.355	373	0	373	≤	488	✓

The Required $WQ_{V,SMP}$ may not exceed the Max. $WQ_{V,SMP}$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 4.1 to calculate V_{SMP}*

EQ 4.1

$$V_{SMP} = V_P + V_S + V_I + V_D$$

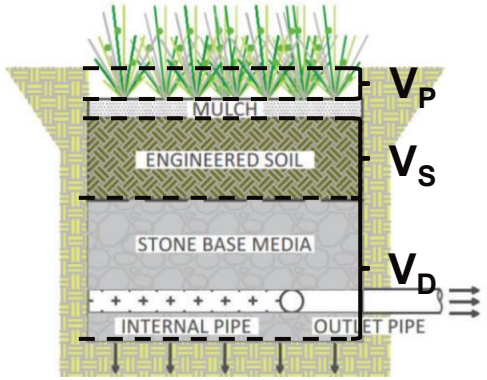
where:
V_{SMP} = storage volume of SMP (cf)
V_P = volume of surface ponding (cf)
V_S = volume of voids in the soil media layer (cf)
V_I = volume of voids created by internal structures such as chambers or pipes (cf)
V_D = volume of voids in the drainage media (cf)

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 4.1 to calculate V_{SMP}*
- *Determine Applicable Volume Parameters for each SMP type*



EQ 4.1

$$V_{SMP} = V_P + V_S + V_I + V_D$$

where:
V_{SMP} = storage volume of SMP (cf)
V_P = volume of surface ponding (cf)
V_S = volume of voids in the soil media layer (cf)
V_I = volume of voids created by internal structures such as chambers or pipes (cf)
V_D = volume of voids in the drainage media (cf)

$$\boldsymbol{V_{SMP,BR} = V_{P,BR} + V_{S,BR} + V_{D,BR}}$$

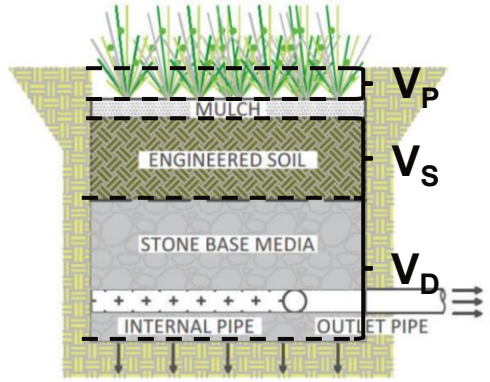
- V_P is applicable
- V_S is applicable
- V_I is not applicable → BR do not have internal storage structures
- V_D is applicable

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 4.1 to calculate V_{SMP}*
- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 & Appendix D (as needed) to calculate the storage volume provided by each applicable parameter*



$$V_{SMP,BR} = V_{P,BR} + V_{S,BR} + V_{D,BR}$$

Reference: Appendix D (assuming 3:1 grading slope)

$$V_P = \frac{1}{3}\left(A_{P1} + \sqrt{A_{P1} * A_{P2}} + A_{P2}\right) * D_P$$

where:
V_P = Volume of surface ponding (cf)
A_{P1} = Area at the base of surface ponding zone (sf)
A_{P2} = Area at the top of surface ponding zone (sf)
D_P = Depth of surface ponding (ft)

V_P for filtration SMPs must be 75% of Required $WQ_{V,SMP}$ to prevent bypass (see NYC SWM Table 4.4).

EQ 4.4

$$V_S = A_{SMP} * D_S * n_S$$

where:
V_S = volume of voids in the soil media layer (cf)
A_{SMP} = area of the SMP (sf)
D_S = depth of soil media layer (ft)
n_S = available porosity of soil media (cf/cf)

EQ 4.7

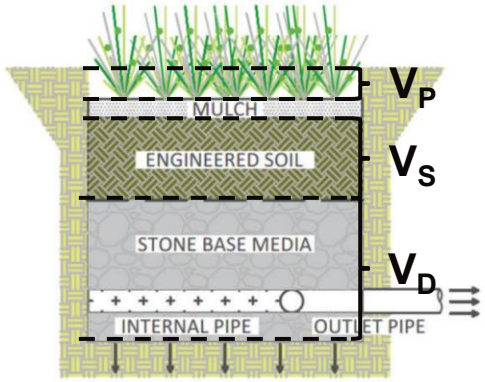
$$V_D = (A_{SMP} * D_D - V_{I,d}) * n_D$$

where:
V_D = volume of voids in the drainage media (cf)
A_{SMP} = area of the SMP (sf)
D_D = depth of the drainage media (ft)
$V_{I,d}$ = volume of voids created by internal structures within the drainage media (cf)
n_D = porosity of drainage media (cf/cf)

$$V_{SMP,BR} = \underbrace{\left(\frac{1}{3}\left(A_{P1} + \sqrt{A_{P1} * A_{P2}} + A_{P2}\right) * D_P\right)}_{V_{P,BR}} + \underbrace{(A_{SMP} * D_S * n_S)}_{V_{S,BR}} + \underbrace{(A_{SMP} * D_D * n_D)}_{V_{D,BR}}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?



Step 6a: Design Filtration System

- Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 4.1 to calculate V_{SMP}*
- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 & Appendix D (as needed) to calculate the storage volume provided by each applicable parameter*

$$\boldsymbol{V_{SMP,BR} = V_{P,BR} + V_{S,BR} + V_{D,BR}}$$

Reference: Appendix D (assuming 3:1 grading slope)

$$V_P = \frac{1}{3}\left(A_{P1} + \sqrt{A_{P1} * A_{P2}} + A_{P2}\right) * D_P$$

$$A_{P1} = A_{P2} = 500\ sf$$

$$D_P = 0.75\ ft$$

$$\boldsymbol{V_{P,BR} = 258\ sf}$$

EQ 4.4

$$V_S = A_{SMP} * D_S * n_S$$

$$A_{SMP} = 500\ sf$$

$$D_S = 2.5\ ft$$

$$n_S = 0.2$$

$$\boldsymbol{V_{S,BR} = 250\ sf}$$

EQ 4.7

$$V_D = (A_{SMP} * D_D - V_{I,d}) * n_D$$

$$A_{SMP} = 500\ sf$$

$$D_D = 1\ ft$$

$$n_D = 0.4$$

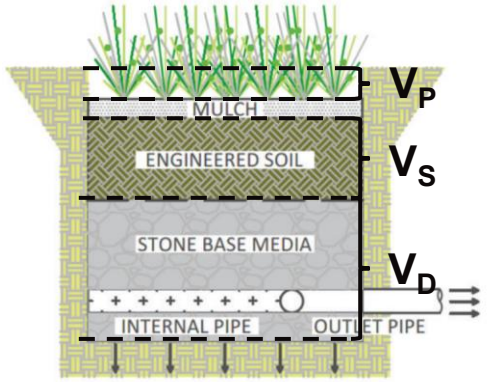
$$\boldsymbol{V_{D,BR} = 200\ sf}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 4.1 to calculate V_{SMP}*
- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 to calculate the storage volume provided by each applicable parameter*
- *Refer to NYC SWM Table 4.4 to identify design requirements for Filtration SMPs and complete design calculation.*



$$V_{SMP,BR} = V_{P,BR} + V_{S,BR} + V_{D,BR}$$

A_{SMP} = Area of SMP [sf]
V_P = Volume of surface ponding [cf]
D_P = Depth of surface ponding [ft]
V_S = Volume of voids in the soil media layer [cf]
D_S = Depth of soil media layer [ft]
n_S = Available porosity of soil media [cf/cf]
V_D = Volume of voids in the drainage media layer [ft]
D_D = Depth of drainage media layer [ft]
n_D = Available porosity of drainage media [cf/cf]

V_P is calculated assuming a 3:1 grading slope; refer to NYC SWM Appendix D for volume calculation methods.

SMP ID	A_{SMP} (sf)	D_P (ft)	V_P (cf)	D_S (ft)	n_S (cf/cf)	V_S (cf)	n_D (cf/cf)	D_D (ft)	V_D (cf)	V_{SMP} (cf)
BR-1	500	0.75	258	2.5	0.2	250	0.4	1	200	708

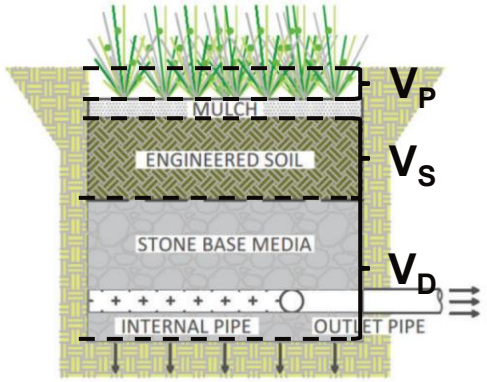
V_P must be at least 75% of Required $WQ_{V,SMP}$ for filtration SMPs

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Design SMP V_{SMP} to Meet Required $WQ_{V,SMP}$
- *Use NYC SWM Eq. 4.1 to calculate V_{SMP}*
- *Determine Applicable Volume Parameters for each SMP type*
- *Refer to the appropriate equations in NYC SWM Section 4.3 to calculate the storage volume provided by each applicable parameter*
- *Refer to NYC SWM Table 4.4 to identify design requirements for Filtration SMPs and complete design calculation.*



$$V_{SMP,BR} = V_{P,BR} + V_{S,BR} + V_{D,BR}$$

A_{SMP} = Area of SMP [sf]
V_P = Volume of surface ponding [cf]
D_P = Depth of surface ponding [ft]
V_S = Volume of voids in the soil media layer [cf]
D_S = Depth of soil media layer [ft]
n_S = Available porosity of soil media [cf/cf]
V_D = Volume of voids in the drainage media layer [ft]
D_D = Depth of drainage media layer [ft]
n_D = Available porosity of drainage media [cf/cf]

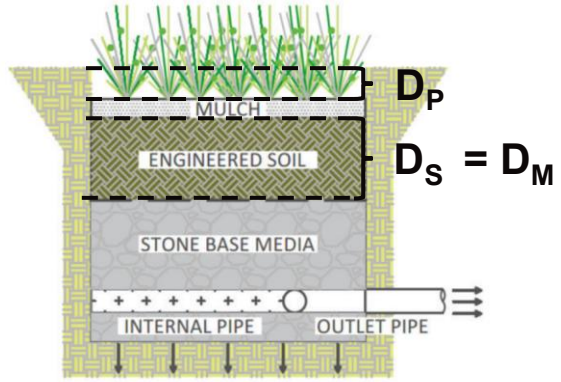
SMP ID	A_{SMP} (sf)	D_P (ft)	V_P (cf)	D_S (ft)	n_S (cf/cf)	V_S (cf)	n_D (cf/cf)	D_D (ft)	V_D (cf)	V_{SMP} (cf)		Required SMP WQ_V (cf)	
BR-1	500	0.75	258	2.5	0.2	250	0.4	1	200	708	≥	373	✓

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Calculate Filtration SMP Surface Ponding Drawdown Time
- *Use NYC SWM Eq. 4.10 to calculate dt_P*
- *Determine applicable parameters*
- *Refer to the appropriate design requirements table in NYC SWM Section 4 to identify the maximum drawdown time*



EQ 4.10

$$dt_P = \frac{V_P}{\left(\frac{K_S}{12}\right) * \left(1 + \frac{0.5D_P}{D_M}\right) * \left(\frac{A_{P1} + A_{P2}}{2}\right)}$$

where:
dt_P = drawdown time of surface ponding (hr)
V_P = volume of surface ponding (cf)
K_S = saturated hydraulic conductivity of media below the surface ponding area (in/hr)
D_P = maximum depth of ponding (ft)
D_M = depth of media below surface ponding area (ft)
A_{P1} = area at the base of surface ponding zone (sf)
A_{P2} = area at the top of surface ponding zone (sf)

Hydraulic conductivity shall be set based on media type, as follows:

- Engineered soil: 0.5 in/hr
- Sand filter media: 1.75 in/hr
- Peat/sand filter media: 1.0 in/hr

$D_M = D_S$

SMP ID	V_P (cf)	K_S (in/hr)	D_P (ft)	D_M (ft)	A_{P1}, A_{P2} (sf)	dt_P (hr)		Max dt_P (hr)
BR-1	258	0.50	0.75	2.5	500	10.8	≤	24

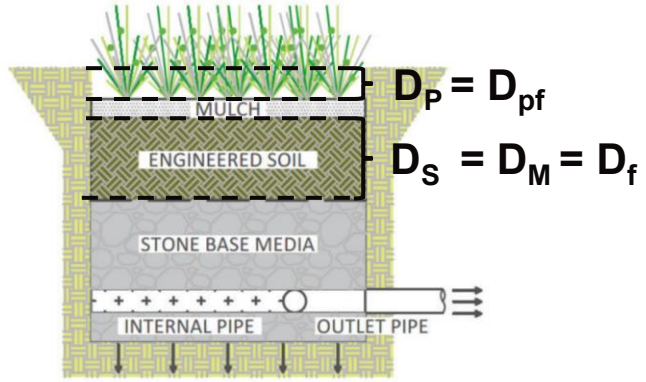
✓

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6a: Design Filtration System

- Calculate Filtration SMP Total Drawdown Time
- *Use NYC SWM Eq. 4.12 to calculate dt_{SMP}*
- *Determine applicable parameters*
- *Refer to the appropriate design requirements table in NYC SWM Section 4 to identify the maximum drawdown time*



EQ 4.12

$$dt_{SMP} = \frac{V_{SMP}}{\left(\frac{K_S}{12}\right) * \left(1 + \frac{0.5 D_{pf}}{D_f}\right) * A_f}$$

where:

dt_{SMP} = drawdown time of filtration SMP (hr)

V_{SMP} = volume of filtration SMP (cf)

K_S = saturated hydraulic conductivity of filtration media (in/hr)

D_{pf} = maximum depth of ponding above filtration media (ft)

D_f = depth of filter media (ft)

A_f = area of filter bed (sf)

$D_{pf} = D_P$ $D_f = D_M = D_S$

SMP ID	V_{SMP} (cf)	K_S (in/hr)	D_{pf} (ft)	D_f (ft)	A_f (sf)	dt_{SMP} (hr)		Max dt_{SMP} (hr)
BR-1	708	0.50	0.75	2.5	500	29.6	≤	48

✓

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Table 4.1. Percent of SMP volume that may be applied to SW management criteria by SMP function.

SMP Function	Percent of SMP Volume Applied to Requirement (F_A) WQv	RRv	Vv
Infiltration	100	100	100
Evapotranspiration	100	100	0
Reuse[A]	100	100	50
Filtration	100[B]	40[C]	0
Detention	100[D]	0	100

[A] Designers must demonstrate continuous and reliable capacity throughout the year (see Section 4.11)
[B] Applies to MS4 areas only
[C] Applies to practices with engineered soils only
[D] Applies to CSS areas and select detention practices with treatment abilities in MS4 areas

Step 7: Check SMP Contributions to Site-Wide Requirements

Use NYC SWM Table 4.1 to determine the percent contributions of each SMP.

SMP ID	Required $WQ_{V,SMP}$ (cf)	V_{SMP} (cf)	Provided WQ_V, (cf)	Provided RR_V (cf)	Provided V_V (cf)
GR-1	523	550	523	523	0
BR-1	373	708	373	283	0

Note: The site-wide WQv value needs to be updated since this does not currently account for the SMP footprint of the Filtration Bioretention practice as 100% impervious.

Site-Wide Parameters	WQ_V (cf)	RR_V (cf)	V_V (cf)
Total Volume Provided	896	806	0
Total Volume Required	1,642	606 (*Minimum*)	1,970
Remaining Volume to be Managed	746	-	1,970

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 7: Check SMP Contributions to Site-Wide Requirements

Reiterate required site-wide WQv calculations, including vegetated SMP footprints into calculations of percent impervious cover (I) as needed.

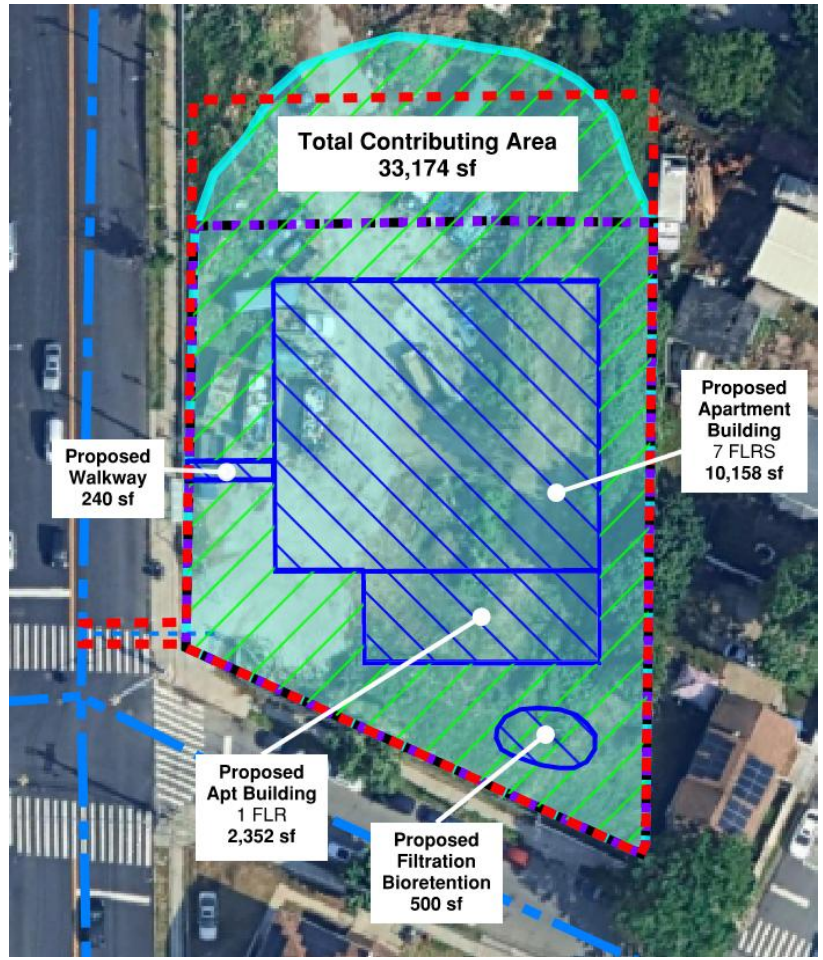
$$R_V = 0.05 + 0.009(I)$$

$$I = \frac{Impervious\ contributing\ area}{Total\ contributing\ area} = \frac{12{,}750 + 500\ sf}{33{,}174\ sf} = \frac{13{,}250\ sf}{33{,}174\ sf}$$

$$I = 39.9\%$$

$$R_V = 0.05 + 0.009(39.9) = 0.41$$

Concept Map: *Site Contributing Area Cover for WQv*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Developed Area with ESC&SMP Requirements
- Total Contributing Area: *33,174 sf*
- Impervious Contributing Area: *13,250 sf*
- Pervious Contributing Area: *19,924 sf*

Recall: When calculating WQ_V for a vegetated SMP, the SMP footprint should be considered 100% impervious in order for the practice to manage itself.

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 7: Check SMP Contributions to Site-Wide Requirements

Reiterate required site-wide WQv calculations, including vegetated SMP footprints into calculations of percent impervious cover (I) as needed.

$$WQ_V = \frac{1.5"}{12} * A * R_V$$

$$A_{Site} = 33{,}174\ sf$$

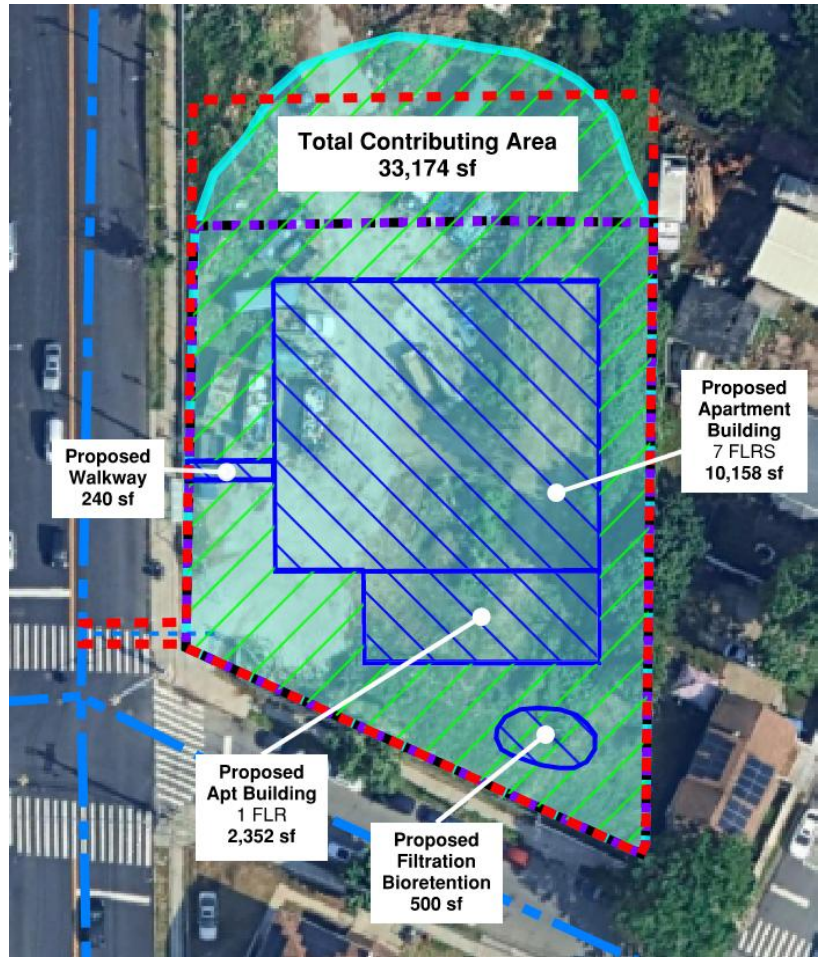
$$R_{V,Site} = 0.41$$

$$WQ_{V,Site} = \frac{1.5"}{12} * 33{,}174 * 0.41$$

$$\boldsymbol{WQ_{V,Site} = 1{,}698\ cf}$$

Recall: When calculating WQ_V for a vegetated SMP, the SMP footprint should be considered 100% impervious in order for the practice to manage itself.

Concept Map: *Site Contributing Area Cover for WQv*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Developed Area with ESC&SMP Requirements
- Total Contributing Area: *33,174 sf*
- Impervious Contributing Area: *13,250 sf*
- Pervious Contributing Area: *19,924 sf*

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Table 4.1. Percent of SMP volume that may be applied to SW management criteria by SMP function.

SMP Function	Percent of SMP Volume Applied to Requirement (F_A) WQv	RRv	Vv
Infiltration	100	100	100
Evapotranspiration	100	100	0
Reuse[A]	100	100	50
Filtration	100[B]	40[C]	0
Detention	100[D]	0	100

[A] Designers must demonstrate continuous and reliable capacity throughout the year (see Section 4.11)
[B] Applies to MS4 areas only
[C] Applies to practices with engineered soils only
[D] Applies to CSS areas and select detention practices with treatment abilities in MS4 areas

Step 7: Check SMP Contributions to Site-Wide Requirements

Use NYC SWM Table 4.1 to determine the percent contributions of each SMP.

SMP ID	Required $WQ_{V,SMP}$ (cf)	V_{SMP} (cf)	Provided WQ_V, (cf)	Provided RR_V (cf)	Provided V_V (cf)
GR-1	523	550	523	523	0
BR-1	373	708	373	283	0

Updated site-wide WQv, accounting for proposed vegetated SMP footprints

Site-Wide Parameters	WQ_V (cf)	RR_V (cf)	V_V (cf)
Total Volume Provided	896	806	0
Total Volume Required	1,698	606 (*Minimum*)	1,970
Remaining Volume to be Managed	802	-	1,970

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Select additional Tier 3 SMPs to meet remaining site requirements:

- ✓ *Limited space remaining, so surface SMPs are no longer feasible.*
- ✓ *Detention tank must be sized to meet the full Vv, which will also manage remaining WQv and must include treatment abilities in MS4 areas.*

SMP HIERARCHY CHECKLIST - MS4 AREAS

			Percent of SMP volume applied[a]			Site constraints that limit SMP feasibility[b]				
Tier[c]	Function Type[d]	Practice Type[e]	WQv	RRv	Vv	Soil	Subsurface	Hotspot	Surfaces	Space
Tier 1	Infiltration (Vegetated)	Bioretention	100	100	100	✗	✗	✗	✗	✗
		Rain garden	100	100	100	✗	✗	✗	✗	✗
		Stormwater planter	100	100	100	✗	✗	✗	✗	✗
		Tree planting / preservation	SC	SC	0					
		Dry basin	100	100	100	✗	✗	✗	✗	✗
		Grass filter strip	SC	SC	0	✗	✗	✗	✗	✗
		Vegetated swale	SC	SC	0	✗	✗	✗	✗	✗
	Evapotranspiration[f]	Rain garden	100	100	0		✗		✗	✗
		Stormwater planter	100	100	0				✗	
		Tree planting / preservation	SC	SC	0					
		Green roof	100	100	0					
Tier 2	Infiltration (Non-vegetated)	Dry well	100	100	50	✗	✗	✗		✗
		Stormwater gallery	100	100	50	✗	✗	✗		✗
		Stone trench	100	100	50	✗	✗	✗	✗	✗
		Porous pavement	100	100	50	✗	✗	✗		✗
		Synthetic turf field	100	100	50	✗	✗	✗	✗	✗
Anytime / Optional	Reuse	Rain tank	100	100	SC					
		Cistern	100	100	SC					
Tier 3	Filtration[g]	Bioretention	100	40	0		✗		✗	✗
		Stormwater planter	100	40	0		✗		✗	✗
		Porous pavement	100	0	0		✗			✗
		Synthetic turf field	100	0	0		✗		✗	✗
		Sand filter	100	0	0		✗		✗	
		Organic filter	100	0	0		✗		✗	
	Detention[g,h]	Constructed wetland	100	0	100		✗		✗	✗
		Wet basin / pond	100	0	100		✗		✗	✗
Other	Detention[g,i,j]	Dry basin	0	0	100		✗		✗	✗
		Stormwater gallery	0	0	100		✗			✗
		Blue roof	0	0	100					
		Detention tank	0	0	100					

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and diameter for the detention SMP*

Design Decisions for Case Study:

- ✓ Detention tank has a re-entrant orifice tube outlet
- ✓ Detention tank must be paired with appropriate treatment
- ✓ Smallest allowable orifice diameter set in NYC Stormwater Manual is 1 inch
- ✓ The invert of the existing MS4 is a constraint for the depth of the proposed site connection
- ✓ The orifice diameter must be sized so the release rate does not exceed the Q_{DRR} **while also** not exceeding the maximum drawdown time for a detention tank

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*

EQ 4.15

$$Q_O = C_D * A_o * \sqrt{2gH}$$

where:
QO = maximum release rate of orifice (cfs)
CD = coefficient of discharge; 0.61 (flush), 0.52 (re-entrant)
AO = area of orifice (ft2)
g = acceleration due to gravity, 32.2 (ft/s2)
H = maximum hydraulic head above the centerline of the orifice (ft)

$$Q_O = Q_{DRR} = 0.76\ cfs$$

$$C_D = 0.52$$

$$H = 4.00\ ft$$

$$0.76\ cfs = 0.52 * A_O * \sqrt{2 * 32.2 \frac{ft}{s^2} * 4.00\ ft}$$

$$\boldsymbol{A_O = 0.091\ sf}$$

To minimize SMP footprint, designer should choose the maximum depth that is still feasible with site limitations and use a re-entrant orifice.

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*

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$$C_D = 0.52$$

$$H = 4.00\ ft$$

$$0.76\ cfs = 0.52 * A_O * \sqrt{2 * 32.2 \frac{ft}{s^2} * 4.00\ ft}$$

$$\boldsymbol{A_O = 0.091\ sf}$$

$$A_O = \frac{\pi}{4} * {D_0}^2$$

$$0.091\ sf = \frac{\pi}{4} * {D_0}^2$$

$$\boldsymbol{D_O = 0.34\ ft = 4.09\ in \geq D_{O,min} = 1\ in}$$ ✓

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*

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where:
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CD = coefficient of discharge; 0.61 (flush), 0.52 (re-entrant)
AO = area of orifice (ft2)
g = acceleration due to gravity, 32.2 (ft/s2)
H = maximum hydraulic head above the centerline of the orifice (ft)

$$D_O = 0.34\ ft = 4.09\ in \quad \geq \quad D_{O,min} = 1\ in$$

Set the orifice diameter to the nearest 0.25-inch interval rounding down

$$\boldsymbol{D_O = 4.00\ in}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*

EQ 4.16

$$S_{DR} = 1{,}930(Q_{DRR})^2/(d_O)^4 + d_O/24$$

where:

S_{DR} = the maximum storage depth in ft. for a Re-entrant orifice tube outlet

Q_{DRR} = the detention facility maximum release rate in cfs

d_O = the nominal dia. of the orifice tube outlet in in.

$$S_{DR} = \frac{1{,}930 * {Q_{DRR}}^2}{{d_O}^4} + \frac{d_O}{24}$$

$$S_{DR} = \frac{1{,}930 * (0.76\ cfs)^2}{(4.00\ in)^4} + \frac{4.00\ in}{24}$$

$$\boldsymbol{S_{DR} = 4.54\ ft}$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*

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where:

S_{DR} = the maximum storage depth in ft. for a Re-entrant orifice tube outlet

Q_{DRR} = the detention facility maximum release rate in cfs

d_O = the nominal dia. of the orifice tube outlet in in.

$$S_{DR} = \frac{1{,}930 * {Q_{DRR}}^2}{{d_O}^4} + \frac{d_O}{24}$$

$$S_{DR} = \frac{1{,}930 * (0.76\ cfs)^2}{(4.00\ in)^4} + \frac{4.00\ in}{24}$$

$$\boldsymbol{S_{DR} = 4.54\ ft} \quad \geq \quad H = 4.00\ ft \quad \checkmark$$

Note:
If the active storage depth is too high or low, iterate this step by changing the orifice size or choosing a different orifice configuration.

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*
- *Establish the required SMP footprint to meet volumetric requirements*

$$S_{DR} = 4.54\ ft$$

$$V_V = S_{DR} * A_{SMP}$$

$$\boldsymbol{A_{SMP} = \frac{1,934\ cf}{4.54\ ft} = 426\ sf}$$

Note:
This calculated minimum SMP footprint area is a starting point for system design based on the maximum storage depth. Design iterations can be performed with different detention tank configurations, depths, and footprints to provide the required management.

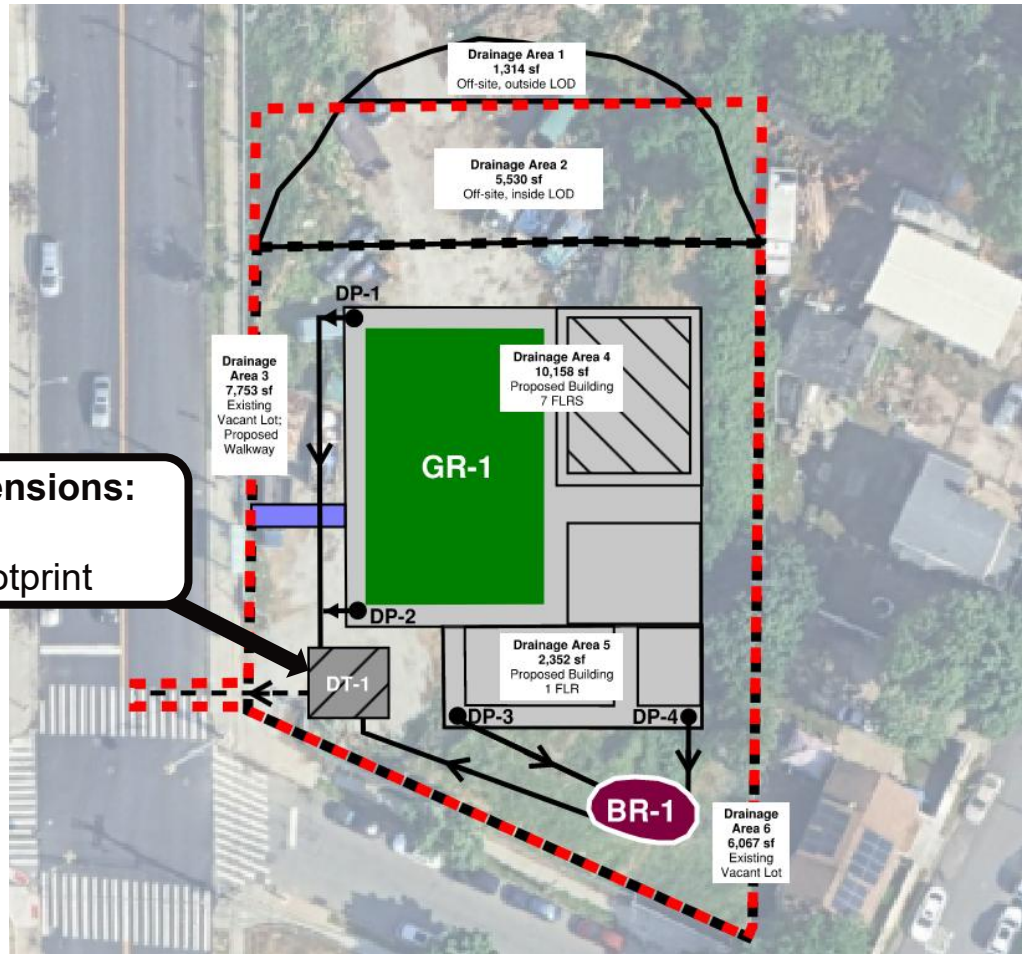
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*
- *Establish the required SMP footprint to meet volumetric requirements*
- *Design detention tank active storage zone dimensions to provide the necessary storage volume to meet volumetric requirements*

***Concept Map**: Detention Tank Footprint (Preliminary)*



DT-1 Proposed Dimensions:
- 4.0 ft Depth
- 24 ft W x 21 ft L Footprint

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Proposed Site Sewer Connection
- NYC MS4
- Detention Tank: *504 sf*
- DP-# Drainage Point and ID
- Schematic Inlet & Internal Drainage

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
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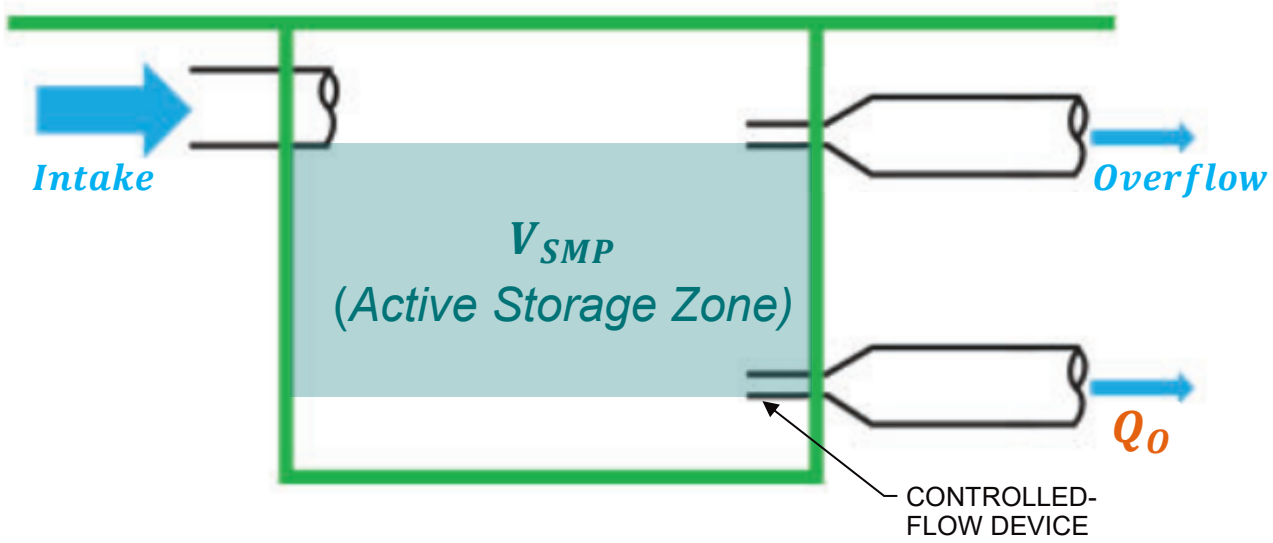

EQ 4.5

$$V_I = V_M * N_M$$

where:

V_I = volume of voids created by internal structure (cf)

V_M = interior volume of one modular structure (cf)

N_M = number of modular structures (unit less)

$$V_{SMP} = V_P + V_S + V_I + V_D$$

$$V_{SMP,DT} = V_{I,DT} = V_M * N_M$$

$$V_{SMP,DT} = V_{I,DT} = (4.00\ ft * 24\ ft * 21\ ft) * 1$$

$$V_{SMP,DT} = 2,016\ cf$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*
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Evapotranspiration	100	100	0
Reuse[A]	100	100	50
Filtration	100[B]	40[C]	0
Detention	100[D]	0	100

[A] Designers must demonstrate continuous and reliable capacity throughout the year (see Section 4.11)
[B] Applies to MS4 areas only
[C] Applies to practices with engineered soils only
[D] Applies to CSS areas and select detention practices with treatment abilities in MS4 areas

$$V_{V,Provided} = V_{SMP,DT} * 100\% = 2{,}016\ cf$$

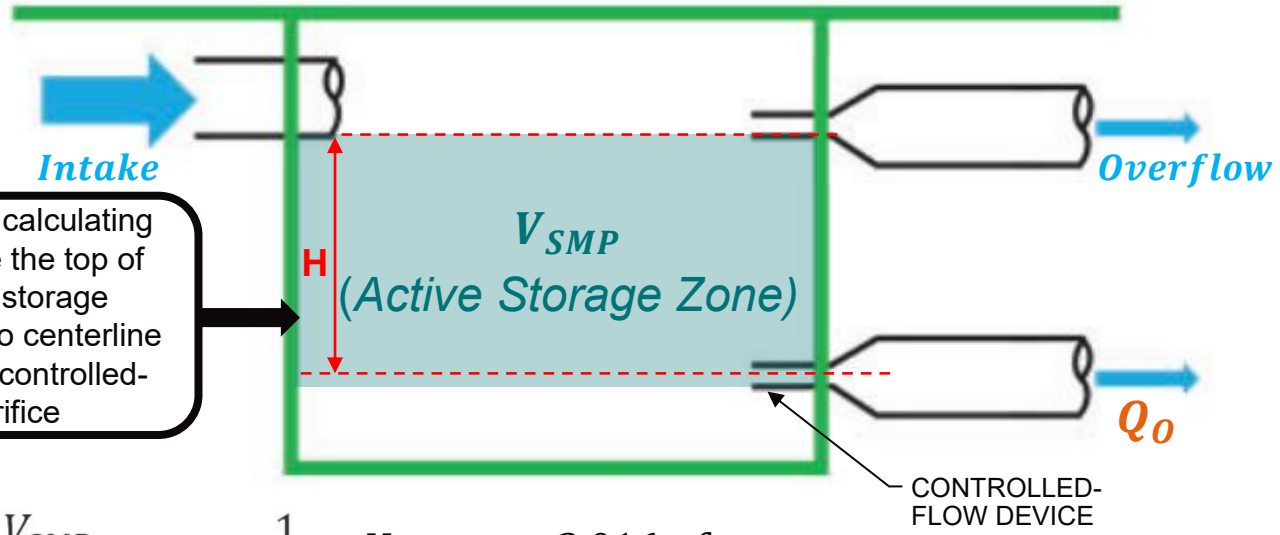
$$\boldsymbol{V_{V,Provided} = 2{,}016\ cf \quad \geq \quad V_{V,Req} = 1{,}970\ cf} \quad ✓$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*
- *Establish the required SMP footprint to meet volumetric requirements*
- *Design detention tank active storage zone dimensions to provide the necessary storage volume to meet volumetric requirements*
- *Use NYC SWM Table 4.5 and Eq. 4.14 to confirm the selected orifice size meets drawdown time requirements*



EQ 4.14

$$dt_{SMP} = \frac{V_{SMP}}{0.5 C_D A_o \sqrt{2gH}} * \frac{1}{3600}$$

where:
dt_{SMP} = drawdown time of detention SMP (hr)
V_{SMP} = volume of detention SMP (cf)
C_D = coefficient of discharge; 0.61 (flush), 0.52 (re-entrant), or 0.73 (long re-entrant)
A_o = area of the orifice (ft2)
g = acceleration due to gravity, 32.2 (ft/s2)
H = maximum hydraulic head above the centerline of the orifice (ft)

$$V_{SMP,DT} = 2{,}016\ cf$$

$$C_D = 0.52$$

$$D_O = 4.00\ in$$

$$A_O = \frac{\pi}{4} * {D_0}^2 = \frac{\pi}{4} * \left(4.00\ in * \frac{1\ ft}{12\ in}\right)^2 = 0.087\ ft^2$$

$$H = 3.83\ ft$$

$$dt_{SMP} = \frac{2{,}016\ cf}{0.5 * 0.52 * 0.087\ ft^2 * \sqrt{2 * 32.2 \frac{ft}{s^2} * 3.83\ ft}} * \frac{1}{3600}$$

$$dt_{SMP} = 1.57\ hr$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*
- *Establish the required SMP footprint to meet volumetric requirements*
- *Design detention tank active storage zone dimensions to provide the necessary storage volume to meet volumetric requirements*
- *Use NYC SWM Table 4.5 and Eq. 4.14 to confirm the selected orifice size meets drawdown time requirements*

Table 4.5. Basic design requirements for detention SMPs.

Design Parameter	Dry Basin	Constructed Wetland[a]	Wet Basin/ Pond[a]	Stormwater Gallery	Blue Roof	Detention Tank
MAX. (MIN.) loading ratio, practice-to-contributing area	1:40	(1:100)	(1:100)	-	-	-
MAX. (MIN.) contributing area	5 acre	(25 acre)	(25 acre)	5 acre	-	-
MIN. infiltration rate of underlying soils	-	-	-	-	-	-
Vertical separation from groundwater / bedrock[b]	3' MIN	3' MIN	3' MIN	3' MIN	-	3' MIN
Has a permanent pool?	No	Yes	Yes	No	No	No
Slope of surface media	1:3 MAX	1:3 MAX	1:3 MAX	-	-	-
Slope of bottom of practice	3% MAX	3% MAX	3% MAX	No Slope	-	-
MAX. Drawdown time	Temp. Storage Area = 48hr	Temp. Storage Area = 48hr	Temp. Storage Area = 48hr	Temp. Storage Area = 48hr	Temp. Storage Area =24hr	Temp. Storage Area = 72hr

EQ 4.14

$$dt_{SMP} = \frac{V_{SMP}}{0.5 C_D A_o \sqrt{2gH}} * \frac{1}{3600}$$

where:
dt_{SMP} = drawdown time of filtration SMP (hr)
V_{SMP} = volume of filtration SMP (cf)
C_D = coefficient of discharge; 0.61 (flush), 0.52 (re-entrant), or 0.73 (long re-entrant)
A_o = area of the orifice (ft2)
g = acceleration due to gravity, 32.2 (ft/s2)
H = maximum hydraulic head above the centerline of the orifice (ft)

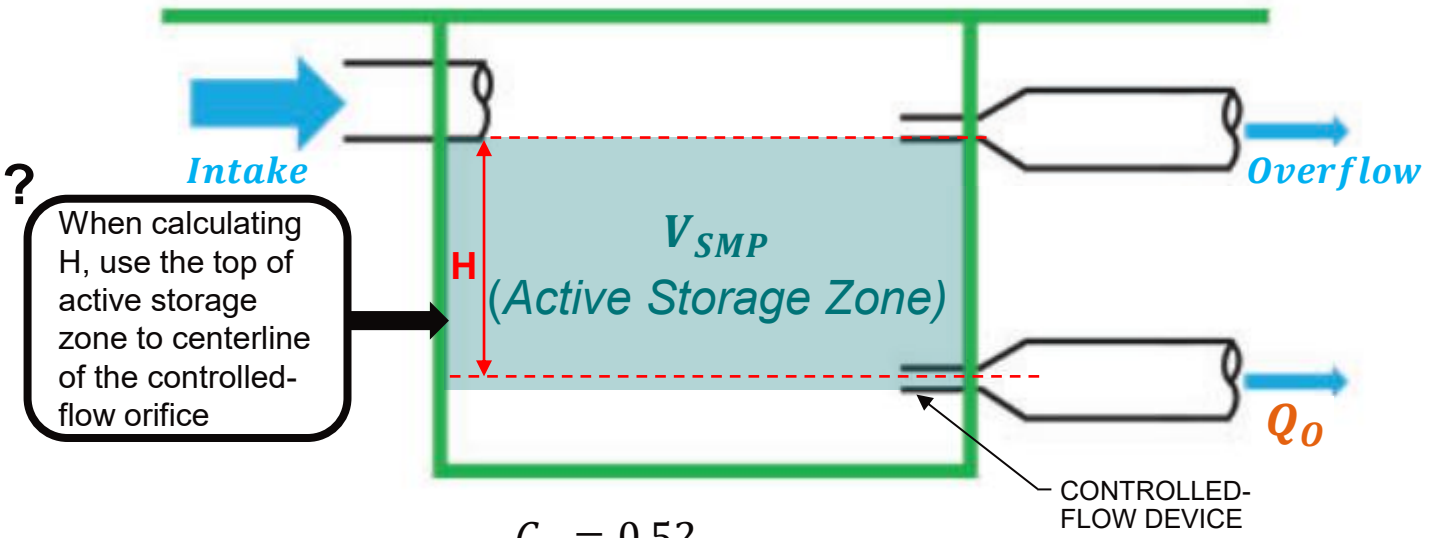
$$dt_{SMP} = 1.57\ hr \quad \leq \quad dt_{Max} = 72\ hr \quad \checkmark$$

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6b: Design Detention System

- *Refer to NYC SWM Section 4.10 for guidance on designing SMP components*
- *Select the orifice type and use NYC SWM Eq. 4.15 to calculate an appropriate orifice diameter for the detention SMP*
- *Use NYC SWM Eq. 4.16 to calculate the maximum detention storage depth for a re-entrant orifice tube outlet, based on the maximum release rate and orifice diameter*
- *Establish the required SMP footprint to meet volumetric requirements*
- *Design detention tank active storage zone dimensions to provide the necessary storage volume to meet volumetric requirements*
- *Use NYC SWM Table 4.5 and Eq. 4.14 to confirm the selected orifice size meets drawdown time requirements*
- *Use NYC SWM Eq. 4.15 to re-confirm that the maximum release rate is not exceeded with the SMP design*



EQ 4.15

$$Q_O = C_D * A_o * \sqrt{2gH}$$

where:
QO = maximum release rate of orifice (cfs)
CD = coefficient of discharge; 0.61 (flush), 0.52 (re-entrant)
AO = area of orifice (ft2)
g = acceleration due to gravity, 32.2 (ft/s2)
H = maximum hydraulic head above the centerline of the orifice (ft)

$$C_D = 0.52$$

$$A_O = \frac{\pi}{4} * {D_0}^2 = \frac{\pi}{4} * \left(4.00\ in * \frac{1\ ft}{12\ in}\right)^2 = 0.087\ ft^2$$

$$H = 3.83\ ft$$

$$Q_O = 0.52 * 0.087\ ft^2 * \sqrt{2 * 32.2 \frac{ft}{s^2} * 3.83\ ft}$$

$$Q_O = 0.71\ cfs \leq \boldsymbol{Q_{DRR} = 0.76\ cfs}$$ ✓

Tier 3 SMP Design *(MS4 Only)*

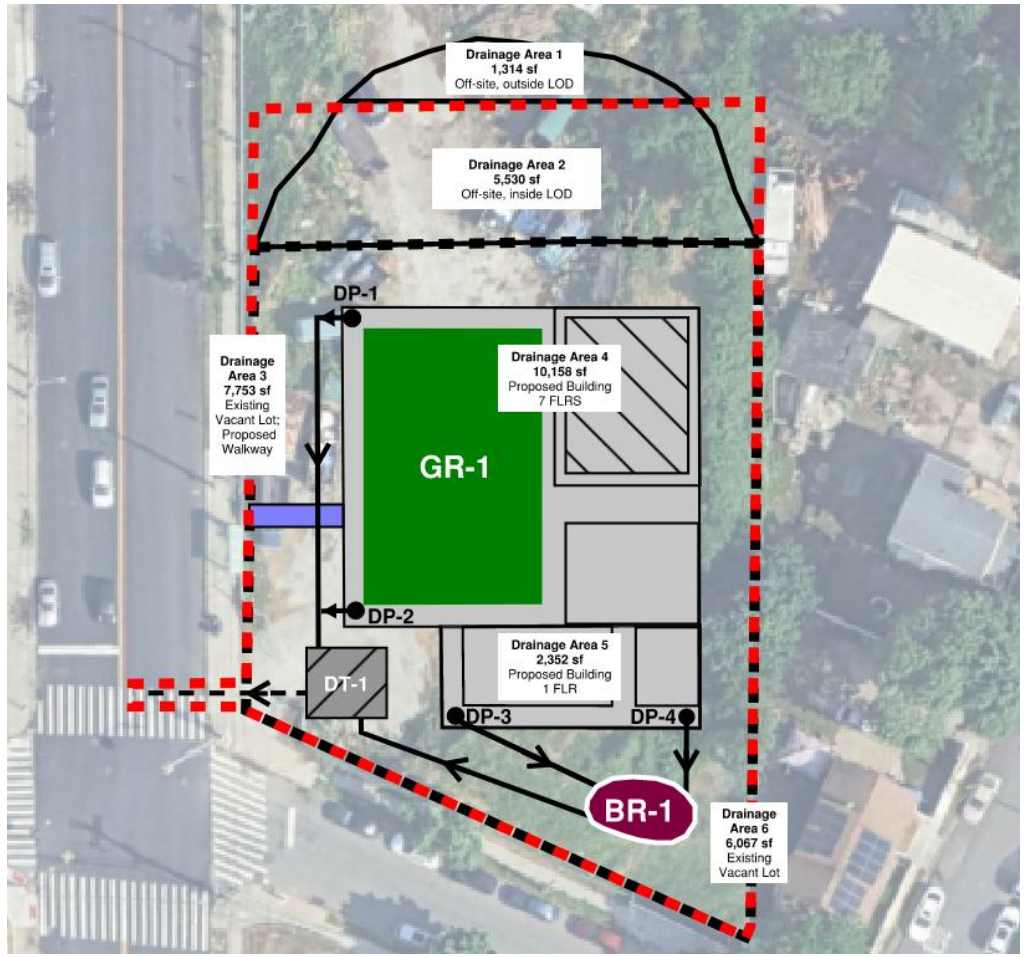
What are the Tier 3 SMP requirements?

DT-1 Proposed Dimensions:

- 4.0 ft Depth
- 24 ft W x 21 ft L Footprint

Provided by SMP		Required	
$V_{SMP,DT} = 2,016\ cf$	≥	$V_V = 1,970\ cf$	✓
$Q_O = 0.71\ cfs^*$	≤	$Q_{DRR} = 0.76\ cfs$	✓
$dt_{SMP} = 1.57\ hr$	≤	$dt_{Max} = 72\ hr$	✓

***Concept Map**: Detention Tank Footprint (Preliminary)*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Proposed Site Sewer Connection
- NYC MS4
- Detention Tank: *504 sf*
- DP-# Drainage Point and ID
- Schematic Inlet & Internal Drainage

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Verifying Sufficient Provided Stormwater Volume

Considerations:

- In circumstances where the chosen designed orifice flow rate (Q_O) is less than the maximum site release rate (Q_{DRR}), DEP may require verification that sufficient stormwater volume is provided in accordance with the flow rate equation in the detention series calculation (NYC SWM Appendix G):

$$t_V = 0.27\left(\frac{C_W A_t}{Q_O}\right)^{0.5} - 15 \qquad V_V = \left(\frac{0.19 C_W A_t}{t_V + 15} - 40 Q_O\right) t_V$$

- The provided SMP volume (V_{SMP}) must exceed this required stormwater volume (V_V)

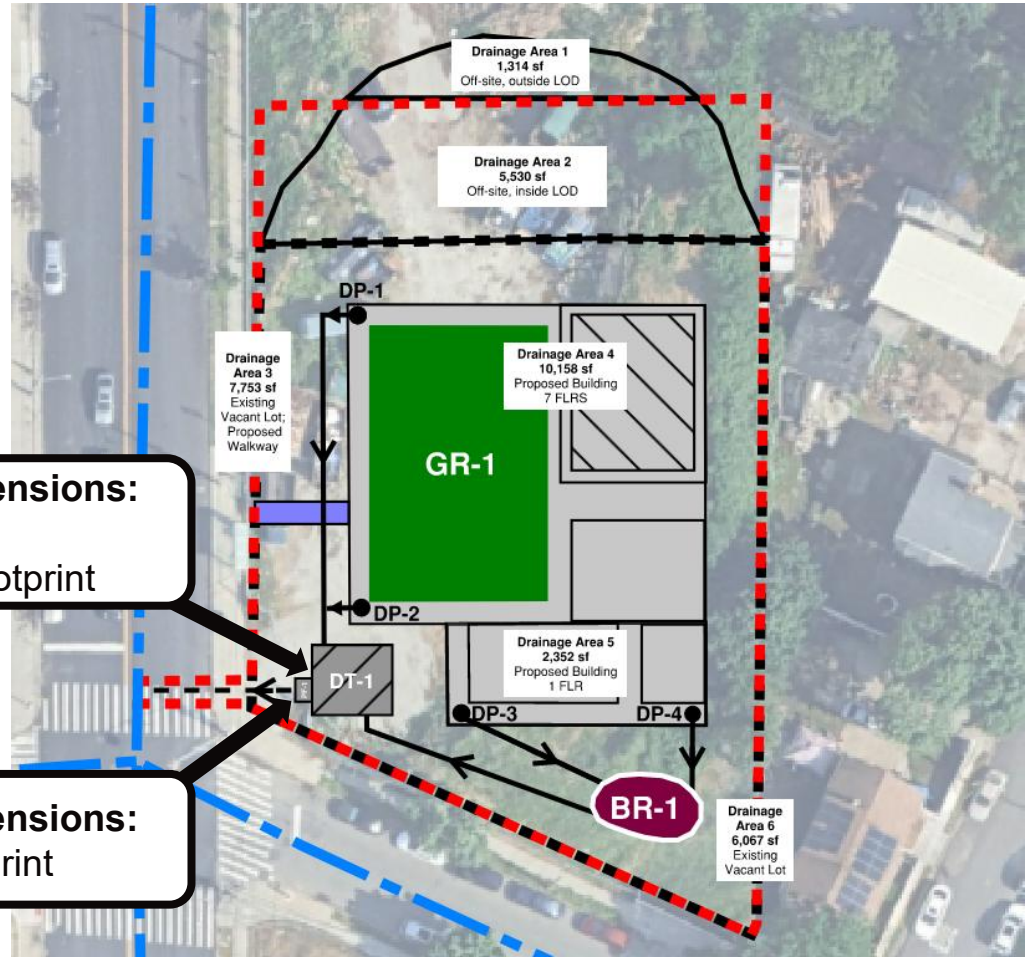
Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6c: Design Treatment System

- *Refer to NYC SWM Sections 4.7 & 4.9 for guidance on selecting an appropriate treatment practice/device paired with the detention tank*

***Concept Map**: Detention Tank Footprint (Preliminary)*



DT-1 Proposed Dimensions:
- 4.0 ft Depth
- 24 ft W x 21 ft L Footprint

PF-1 Proposed Dimensions:
- 5 ft W x 7 ft L Footprint

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Proposed Site Sewer Connection
- NYC MS4
- Detention Tank: *504 sf*
- Proprietary Filter Unit: *35 sf*
- DP-# Drainage Point and ID
- Schematic Inlet & Internal Drainage

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6c: Design Treatment System

- *Refer to NYC SWM Sections 4.7 & 4.9 for guidance on selecting an appropriate treatment practice/device paired with the detention tank*
- *Refer to the NYS DEC Construction Stormwater Toolbox for verified proprietary practices*

Proprietary treatment systems must be:

- Approved via processes in the NYS SWMDM
- Verified with third-party testing

Verified Proprietary Practices for New Development

Practice	Manufacturer
EcoPure Biofiltration System	Advanced Drainage Systems, Inc. (ADS)
EcoPure Biofiltration System 3-Cell	Advanced Drainage Systems, Inc. (ADS)
FocalPoint High-Rate Biofiltration System	ACF Environmental - Convergent Alliance
Bayfilter	Bay Saver
MWS - Linear Modular Wetland	Bio Clean Environmental Services, Inc.
Filterra Bioretention	Contech
Jellyfish Filter	Contech
StormFilter with PhosphoSorb Media	Contech
ZPG Media Filter	Contech
Up-Flo Filter with CP2 Media	Hydro International
FloGard Perk Filter	Oldcastle Infrastructure
The BioPod Biofilter	Oldcastle Infrastructure
Stormtree Biofiltration Practice	StormTree, Inc.

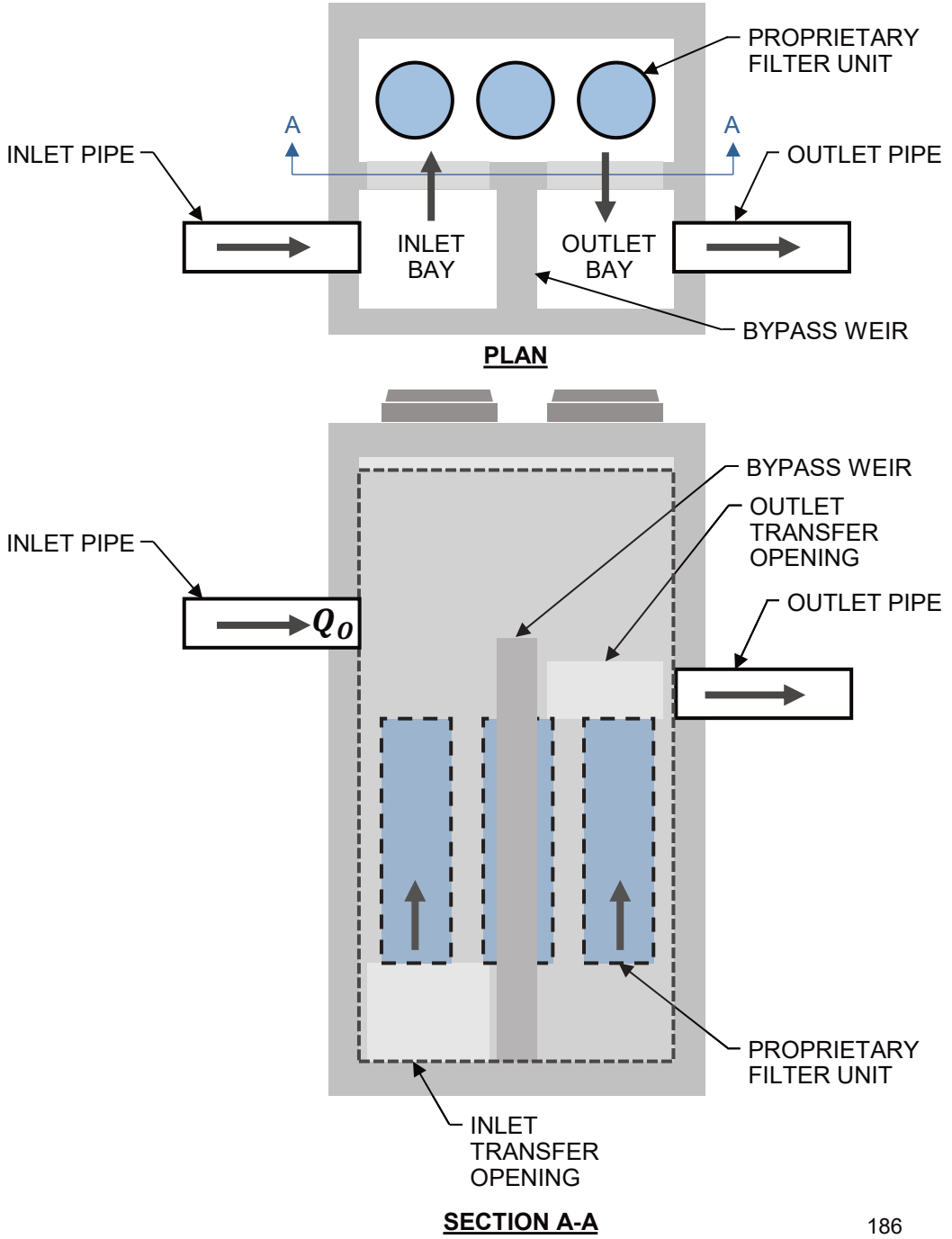
Reference: NYS DEC Construction Stormwater Toolbox

Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6c: Design Treatment System

- *Refer to NYC SWM Sections 4.7 & 4.9 for guidance on selecting an appropriate treatment practice/device paired with the detention tank*
- *Refer to the NYS DEC Construction Stormwater Toolbox for verified proprietary practices*
- *Design the treatment filter to treat the water quality event without bypass*

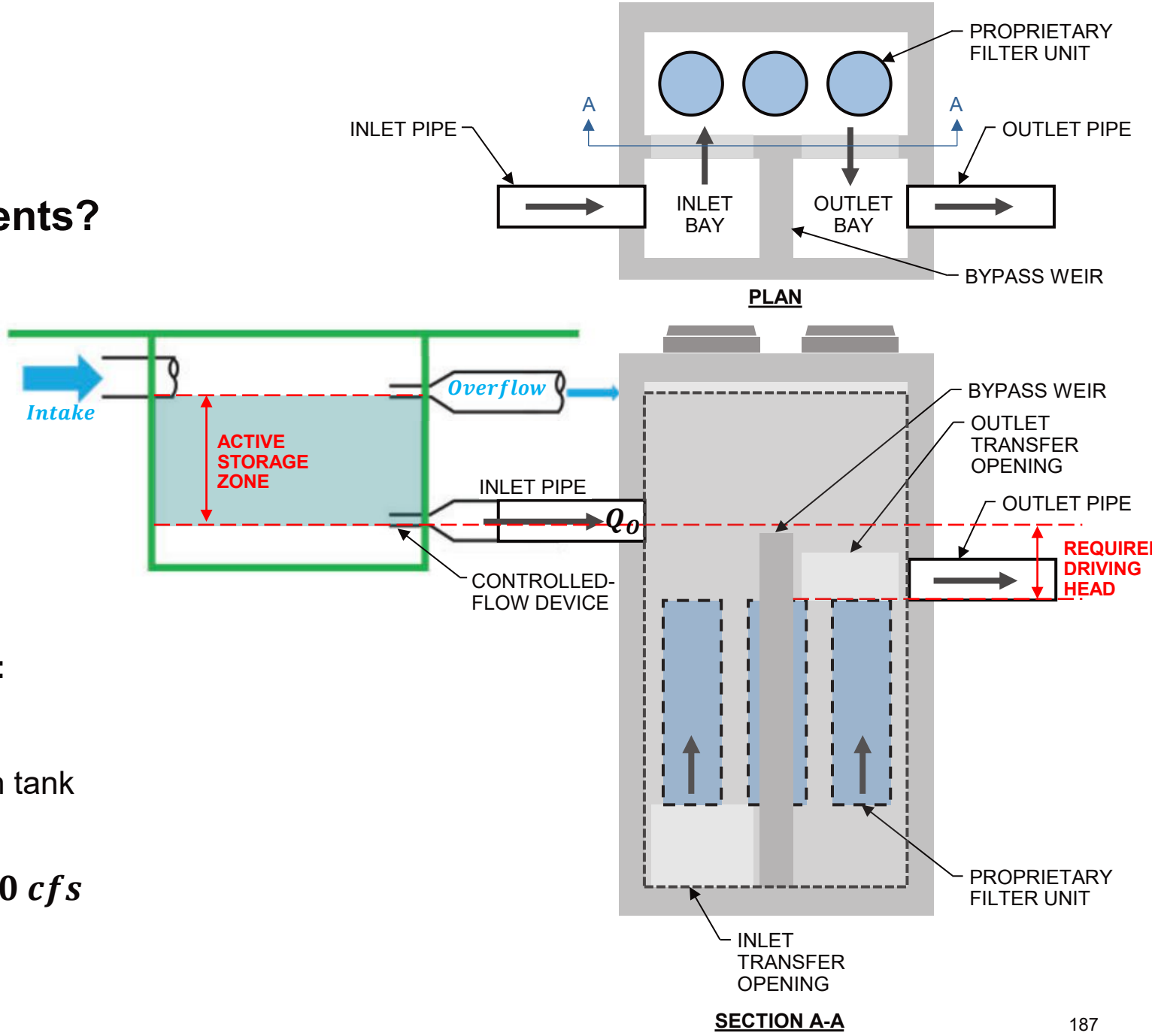


Tier 3 SMP Design *(MS4 Only)*

What are the Tier 3 SMP requirements?

Step 6c: Design Treatment System

- *Refer to NYC SWM Sections 4.7 & 4.9 for guidance on selecting an appropriate treatment practice/device paired with the detention tank*
- *Refer to the NYS DEC Construction Stormwater Toolbox for verified proprietary practices*
- *Design the treatment filter to treat the water quality event without bypass*



Proprietary Filter Design Considerations:

- Filter treatment flow rate
- Required driving head
- Active storage zone in upstream detention tank

$$Q_O = 0.71\ cfs \quad \leq \quad Q_{filter} = 0.80\ cfs$$

SMP Design

What are the Tier 3 SMP requirements?

Step 7: Check SMP Contributions to Site-Wide Requirements

Use NYC SWM Table 4.1 to determine the percent contributions of each SMP.

Table 4.1. Percent of SMP volume that may be applied to SW management criteria by SMP function.

SMP Function	Percent of SMP Volume Applied to Requirement (F_A) WQv	RRv	Vv
Infiltration	100	100	100
Evapotranspiration	100	100	0
Reuse[A]	100	100	50
Filtration	100[B]	40[C]	0
Detention	100[D]	0	100

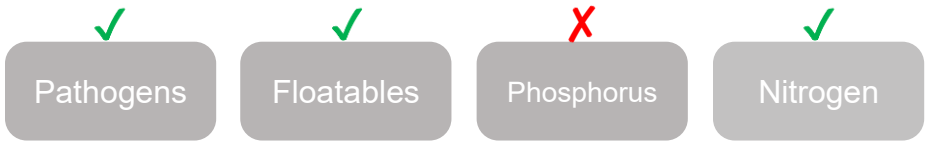
[A] Designers must demonstrate continuous and reliable capacity throughout the year (see Section 4.11)
[B] Applies to MS4 areas only
[C] Applies to practices with engineered soils only
[D] Applies to CSS areas and select detention practices with treatment abilities in MS4 areas

SMP ID	Required $WQ_{V,SMP}$ (cf)	V_{SMP} (cf)	Provided WQ_V, (cf)	Provided RR_V (cf)	Provided V_V (cf)
GR-1	523	550	523	523	0
BR-1	373	708	373	283	0
DT-1	1,698	2,016	802	0	1,970

In MS4 areas, provided WQ_V for detention practices can only be applied if implemented with treatment abilities

Site-Wide Parameters	WQ_V (cf)	RR_V (cf)	V_V (cf)
Total Volume Provided	1,698	806	1,970
Total Volume Required	1,698	606 (*Minimum*)	1,970
Remaining Volume to be Managed	0	-	0

NNI SMP & BMP Design

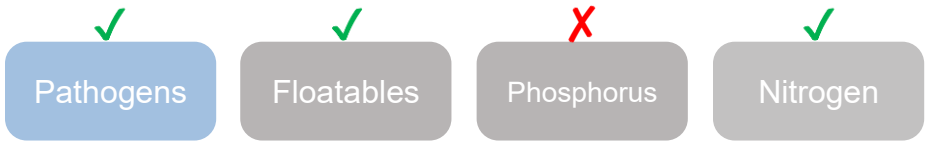


No-Net-Increase BMP & SMP Design

What are the NNI requirements?

Key Questions

- What is the removal requirement for Pathogens?
- What is the removal requirement for Floatables?
- What is the removal requirement for Nitrogen?

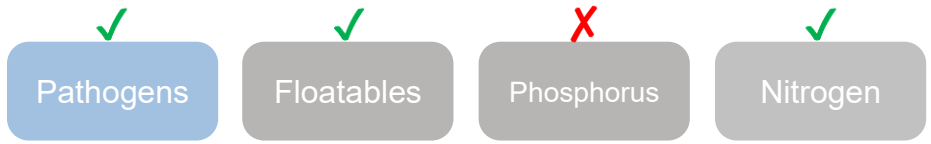


No-Net-Increase Criteria

What is the removal requirement for <u>Pathogens</u>?

Identifying BMPs for Required Pathogen Removal:

- **Step 1:** Identify site-specific sources of pathogens
- **Step 2:** Select appropriate BMPs for pathogen removal
- **Step 3:** Document implementation plan for each BMP



No-Net-Increase Criteria

What is the removal requirement for Pathogens?

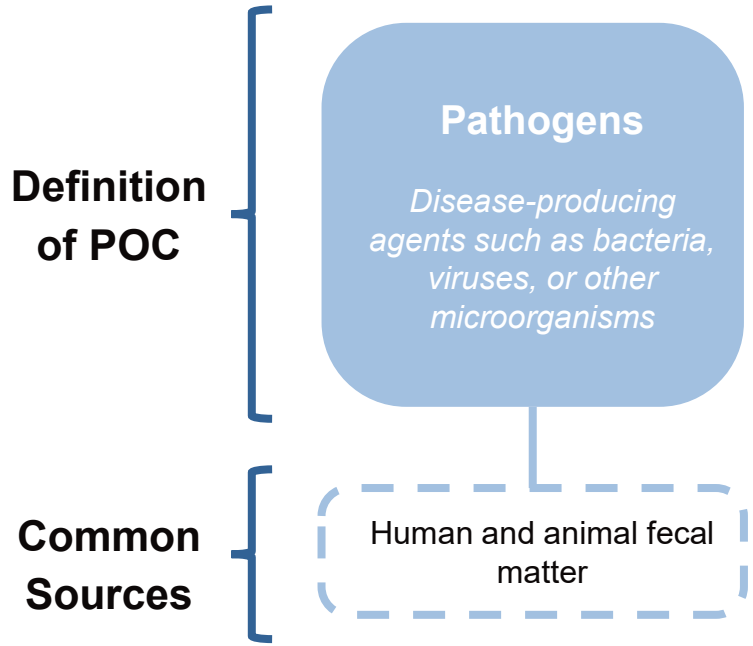
Pathogens Step 1: Identify site-specific sources of pathogens

Refer to NYC SWM Page 2-15 to reference common sources of pathogens and identify other site-specific sources if applicable.

Case Study Scope: *A vacant lot is being developed into an apartment building.*

Consider Potential Sources of Pathogens in Final Use (Post-Construction):

- Humans (tenants)
- Animals (pets)
- Urban wildlife (pests, rats, etc.)



Reference: NYC SWM

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Pathogens?

Pathogens Step 2: Select appropriate BMPs for pathogen removal

Refer to NYC SWM Table 2.6 for selecting BMPs for pathogen removal by land use applicable to the project.

Effective pathogen reduction BMPs can include:

- Minimizing stormwater runoff from impervious areas
- Monitoring illegal dumping into catch basins
- Increasing collections and waste disposal

Notes:

- The examples provided in Table 2.6 is not exhaustive nor prescriptive, and applicants may propose additional BMPs to mitigate site-specific pathogens.
- In some instances, “pathogens” may also be referenced as “fecal coliform”.

Table 2.6. BMPs for pathogen removal by land use.

BMP	Source of Pathogen	Applicable Land Use
Install sign, distribute public education and outreach materials, and implement trainings to support pathogen reduction programs.	All	All
Inspect and clean areas where animal waste may be present (e.g., dumpsters, grease storage, waterfowl congregation areas, and dog parks).	Pets and Wildlife	All
Discourage free-range pets. Adopt rules within a development to pick up pet wastes. Offer bags and waste receptacles to make it easy for pet owners to pick up and dispose of waste products. Distribute educational materials and signage to support program.	Pets	Residential, Open Space & Outdoor Recreation, Commercial & Office Buildings (pet store, veterinarian)
Identify areas with high bird populations and evaluate deterrents, habitat modifications, and other measures.	Wildlife	Open Space & Outdoor Recreation, Residential (common areas in a development), Vacant Lots
Reduce food sources accessible to urban wildlife (e.g., manage restaurant dumpsters/grease traps and residential garbage).	Wildlife	Residential, Commercial & Office Buildings (restaurants, groceries), Public Facilities & Institutions, Industrial
Use latched or heavy-lidded trash containers to deter wildlife.	Wildlife	Open Space & Outdoor Recreation, Residential, Commercial & Office Buildings (restaurants, groceries), Public Facilities & Institutions, Industrial
Increase collections and waste disposal for provide haulers.	Wildlife	Commercial & Office Buildings (restaurants, groceries)
Reduce attractive odors that may draw wildlife.	Wildlife	Residential, Commercial & Office Buildings (restaurants, groceries)
Introduce strategies to reduce food, shelter, and habitats for overpopulated urban wildlife.	Wildlife	All
Inhibit access to open water by managing vegetation growth, limit food sources-seeds, and discourage feeding wildlife, especially on impervious surfaces, near open water, or near practices that discharge directly to open waters. Provide educational materials to support program.	Wildlife	Open Space & Outdoor Recreation, Residential (common areas in a development)
Inspect and clean catch basins regularly and distribute educational materials to support program.	Wildlife	Residential, Commercial & Office Buildings, Parking
Monitor for illegal dumping into catch basins.	Human and Pet	All
Monitor illicit connections by tenants to storm sewer. Look for dry weather flows in storm sewer system.	Human	All
Minimize stormwater runoff that is directly connected to the system from impervious areas.	All	All
Clean main sewer line that connects to building, pump septic tank, or leaching pit. Pressure test or inspect sewer main or septic tank for leakage once every five years.	Human	Residential, Commercial & Office Buildings, Industrial, Public Facilities & Institutions
Locate portable toilets away from storm drains or open water.	Human	All (especially during construction and temporary public events)

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Pathogens?

Pathogens Step 2: Select appropriate BMPs for pathogen removal

Refer to NYC SWM Table 2.6 for selecting BMPs for pathogen removal by land use applicable to the project.

Case Study Scope: A vacant lot is being developed into an apartment building.

Applicable Land Use:

- ✓ All
- ✓ Residential

Select BMPs that match the land uses for the project and are relevant to the site conditions.

Table 2.6. BMPs for pathogen removal by land use.

BMP	Source of Pathogen	Applicable Land Use
Install sign, distribute public education and outreach materials, and implement trainings to support pathogen reduction programs.	All	All
Inspect and clean areas where animal waste may be present (e.g., dumpsters, grease storage, waterfowl congregation areas, and dog parks).	Pets and Wildlife	All
Discourage free-range pets. Adopt rules within a development to pick up pet wastes. Offer bags and waste receptacles to make it easy for pet owners to pick up and dispose of waste products. Distribute educational materials and signage to support program.	Pets	Residential, Open Space & Outdoor Recreation, Commercial & Office Buildings (pet store, veterinarian)
Identify areas with high bird populations and evaluate deterrents, habitat modifications, and other measures.	Wildlife	Open Space & Outdoor Recreation, Residential (common areas in a development), Vacant Lots
Reduce food sources accessible to urban wildlife (e.g., manage restaurant dumpsters/grease traps and residential garbage).	Wildlife	Residential, Commercial & Office Buildings (restaurants, groceries), Public Facilities & Institutions, Industrial
Use latched or heavy-lidded trash containers to deter wildlife.	Wildlife	Open Space & Outdoor Recreation, Residential, Commercial & Office Buildings (restaurants, groceries), Public Facilities & Institutions, Industrial
Increase collections and waste disposal for provide haulers.	Wildlife	Commercial & Office Buildings (restaurants, groceries)
Reduce attractive odors that may draw wildlife.	Wildlife	Residential, Commercial & Office Buildings (restaurants, groceries)
Introduce strategies to reduce food, shelter, and habitats for overpopulated urban wildlife.	Wildlife	All
Inhibit access to open water by managing vegetation growth, limit food sources-seeds, and discourage feeding wildlife, especially on impervious surfaces, near open water, or near practices that discharge directly to open waters. Provide educational materials to support program.	Wildlife	Open Space & Outdoor Recreation, Residential (common areas in a development)
Inspect and clean catch basins regularly and distribute educational materials to support program.	Wildlife	Residential, Commercial & Office Buildings, Parking
Monitor for illegal dumping into catch basins.	Human and Pet	All
Monitor illicit connections by tenants to storm sewer. Look for dry weather flows in storm sewer system.	Human	All
Minimize stormwater runoff that is directly connected to the system from impervious areas.	All	All
Clean main sewer line that connects to building, pump septic tank, or leaching pit. Pressure test or inspect sewer main or septic tank for leakage once every five years.	Human	Residential, Commercial & Office Buildings, Industrial, Public Facilities & Institutions
Locate portable toilets away from storm drains or open water.	Human	All (especially during construction and temporary public events)

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Pathogens?

Pathogens Step 3: Document implementation plan for each BMP

Complete Table 6.8 of the NYCDEP SWPPP Template outlining the implementation plan for each BMP.

Section 6.3.2.1 BMPs for Pathogen Removal

TABLE 6.8 – SELECTED BMPS FOR PATHOGEN REMOVAL

BMP[1]	SOURCE OF PATHOGEN MANAGED BY BMP	ADDITIONAL DETAILS[2]
Increase tenant awareness about pathogen reduction.	All Sources	Install sign, distribute public education and outreach materials, and implement trainings to support pathogen reduction programs.
Adopt rules within a development to pick up pet wastes and discourage free-range pets.	Pets	Issue fines for violation of rules. Offer bags and waste receptacles to make it easy for pet owners to pick up and dispose of waste products.
Introduce strategies to reduce food, shelter, and habitats for overpopulated urban wildlife.	Wildlife	Maintain regular trash collection for apartment building. Issue warnings and/or fines for improper trash disposal. Vacuum and disinfect apartment hallways and elevators.
Monitor for illegal dumping into catch basins.	Human	Inspect local catch basins on a regular basis to check for illegal dumping.

[1]Refer to NYC SWM Table 2.6 for a list of acceptable BMPs for pathogen removal.
[2]Use this column to provide information on the land use, location, and implementation plan for each BMP.

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Pathogens?

Pathogens Step 3: Document implementation plan for each BMP

Refer to NYC SWM Chapter 5 and include appropriate BMPs and inspection checklists in the O&M Manual to reduce pathogens.

BMP Number	BMP Type	Source of Pathogen
1	Latched or Heavy-Lidded Trash Containers	Wildlife
2	Waste Disposal for Pets	Pets
3	Monitor for Illegal Dumping into Catch Basins	Human

EXAMPLE FOR ILLUSTRATION PURPOSES ONLY

- Color to be used in Sections 5.1 and 6

Latched or Heavy-Lidded Trash Containers

The odors from trash containers can attract wildlife (squirrels, raccoons, rats, mice, seagulls) who view trash as a potential food source. Trash containers can also become a potential shelter for wildlife if easily accessible or unsealed.

Wildlife is a concern from a stormwater perspective due to the feces they leave behind which can contaminate stormwater runoff with pathogens.

To deter wildlife from the site, latched or heavy-lidded trash containers should be utilized. The latched heavy-lidded trash containers should be inspected regular to ensure trash is not overflowing from the container, the latch is functioning properly, and the container is in good condition.

https://www.uline.com/

Figure 1: Latched Trash Containers

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for <u>Pathogens</u>?

Identifying BMPs for Required Pathogen Removal:

- **Step 1:** Identify site-specific sources of pathogens
- **Step 2:** Select appropriate BMPs for pathogen removal
- **Step 3:** Document implementation plan for each BMP

Required Documentation:

✓ Implementation Plan for BMPs

Section 6.3.2.1 BMPs for Pathogen Removal

TABLE 6.8 – SELECTED BMPS FOR PATHOGEN REMOVAL

BMP[1]	SOURCE OF PATHOGEN MANAGED BY BMP	ADDITIONAL DETAILS[2]
Increase tenant awareness about pathogen reduction.	All Sources	Install sign, distribute public education and outreach materials, and implement trainings to support pathogen reduction programs.
Adopt rules within a development to pick up pet wastes and discourage free-range pets.	Pets	Issue fines for violation of rules. Offer bags and waste receptacles to make it easy for pet owners to pick up and dispose of waste products.
Introduce strategies to reduce food, shelter, and habitats for overpopulated urban wildlife.	Wildlife	Maintain regular trash collection for apartment building. Issue warnings and/or fines for improper trash disposal. Vacuum and disinfect apartment hallways and elevators.
Monitor for illegal dumping into catch basins.	Human	Inspect local catch basins on a regular basis to check for illegal dumping.

[1]Refer to NYC SWM Table 2.6 for a list of acceptable BMPs for pathogen removal.
[2]Use this column to provide information on the land use, location, and implementation plan for each BMP.

✓ List of BMPs and inspection checklists in O&M Manual

BMP Number	BMP Type	Source of Pathogen
1	Latched or Heavy-Lidded Trash Containers	Wildlife
2	Waste Disposal for Pets	Pets
3	Monitor for Illegal Dumping into Catch Basins	Human

No-Net-Increase Criteria

What is the removal requirement for <u>Floatables</u>?

Identifying SMP Components for Required Floatable Removal:

- **Step 1:** Identify SMP-specific surface and subsurface components for floatable removal
- **Step 2:** Document appropriate SMP maintenance in the O&M Manual
- **Step 3:** Include floatables removal narrative description in SWPPP

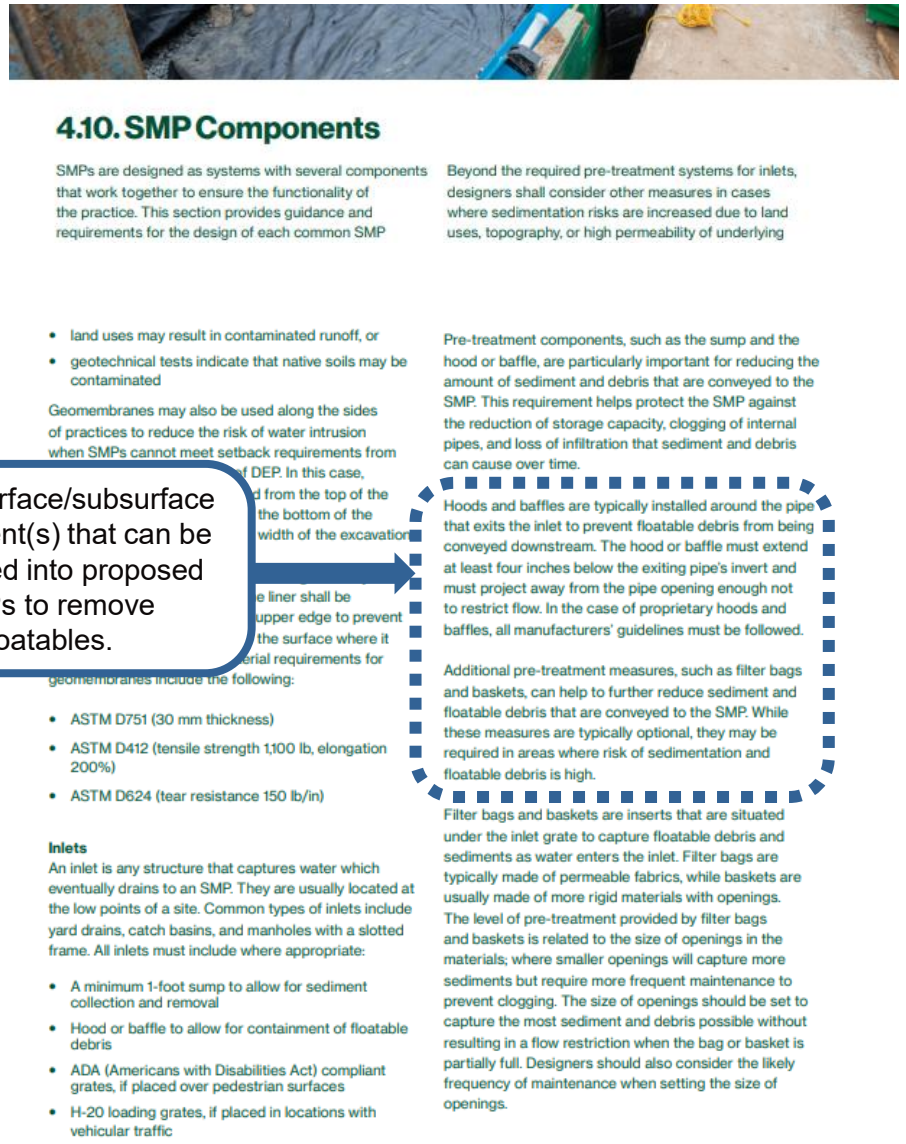
✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Floatables?

Floatables Step 1: Identify SMP-specific surface and subsurface components for floatable removal

Refer to NYC SWM Section 4.10 to identify suitable surface and/or subsurface components that can be incorporated with proposed SMP(s).



4.10. SMP Components

SMPs are designed as systems with several components that work together to ensure the functionality of the practice. This section provides guidance and requirements for the design of each common SMP

Beyond the required pre-treatment systems for inlets, designers shall consider other measures in cases where sedimentation risks are increased due to land uses, topography, or high permeability of underlying

- land uses may result in contaminated runoff, or
- geotechnical tests indicate that native soils may be contaminated

Geomembranes may also be used along the sides of practices to reduce the risk of water intrusion when SMPs cannot meet setback requirements from

DEP. In this case,

from the top of the

the bottom of the

width of the excavation

liner shall be

upper edge to prevent

the surface where it

erial requirements for

geomembranes include the following:

- ASTM D751 (30 mm thickness)
- ASTM D412 (tensile strength 1,100 lb, elongation 200%)
- ASTM D624 (tear resistance 150 lb/in)

Inlets

An inlet is any structure that captures water which eventually drains to an SMP. They are usually located at the low points of a site. Common types of inlets include yard drains, catch basins, and manholes with a slotted frame. All inlets must include where appropriate:

- A minimum 1-foot sump to allow for sediment collection and removal
- Hood or baffle to allow for containment of floatable debris
- ADA (Americans with Disabilities Act) compliant grates, if placed over pedestrian surfaces
- H-20 loading grates, if placed in locations with vehicular traffic

Pre-treatment components, such as the sump and the hood or baffle, are particularly important for reducing the amount of sediment and debris that are conveyed to the SMP. This requirement helps protect the SMP against the reduction of storage capacity, clogging of internal pipes, and loss of infiltration that sediment and debris can cause over time.

Hoods and baffles are typically installed around the pipe that exits the inlet to prevent floatable debris from being conveyed downstream. The hood or baffle must extend at least four inches below the exiting pipe's invert and must project away from the pipe opening enough not to restrict flow. In the case of proprietary hoods and baffles, all manufacturers' guidelines must be followed.

Additional pre-treatment measures, such as filter bags and baskets, can help to further reduce sediment and floatable debris that are conveyed to the SMP. While these measures are typically optional, they may be required in areas where risk of sedimentation and floatable debris is high.

Filter bags and baskets are inserts that are situated under the inlet grate to capture floatable debris and sediments as water enters the inlet. Filter bags are typically made of permeable fabrics, while baskets are usually made of more rigid materials with openings. The level of pre-treatment provided by filter bags and baskets is related to the size of openings in the materials; where smaller openings will capture more sediments but require more frequent maintenance to prevent clogging. The size of openings should be set to capture the most sediment and debris possible without resulting in a flow restriction when the bag or basket is partially full. Designers should also consider the likely frequency of maintenance when setting the size of openings.

Select surface/subsurface component(s) that can be integrated into proposed SMPs to remove floatables.

Notes:

- The examples provided in Section 4.10 is not exhaustive nor prescriptive, and applicants may propose additional surface/subsurface practices to mitigate floatables.

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Floatables?

Floatables Step 1: Identify SMP-specific surface and subsurface components for floatable removal

Integrate appropriate surface components in the SMP design and drawings.

Typical SMP surface components for floatables removal include:

- *Grates for overflow (e.g. beehive grates)*
- *Catch basin cleaning*
- *Litter baskets*

Reference: NYC Water Flickr Images

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

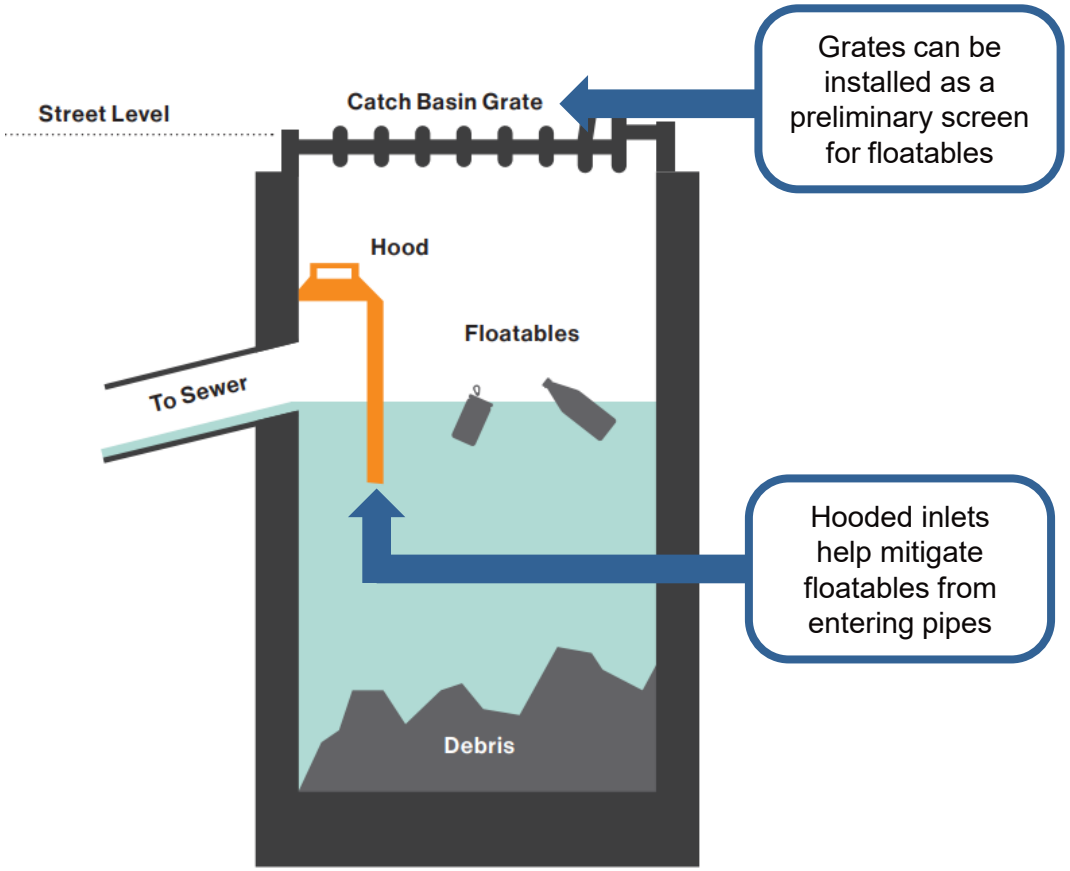
What is the removal requirement for Floatables?

Floatables Step 1: Identify SMP-specific surface and subsurface components for floatable removal

Integrate appropriate subsurface components in the SMP design and drawings.

Typical SMP subsurface components for floatables removal include:

- *Sumps*
- *Hooded Inlets*
- *Filter Baskets*
- *Hydrodynamic Separators*



Reference:
NYC Stormwater Management Program (September 2025)

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Floatables?

Floatables Step 2: Document appropriate SMP maintenance in the O&M Manual

Refer to NYC SWM Chapter 5 and identify O&M tasks that can be added to project O&M Manual to reduce floatables.

Example SMP: *Filtration Bioretention*

O&M Tasks for Floatables Removal:

- *Surface*
  - Trash/Sediment Removal
  - Outlet Cleaning
- *Subsurface*
  - Inlet Filter Cleaning
  - Inlet Cleaning

Table 5.2. Routine Maintenance Tasks and Frequencies for Bioretention, Rain Gardens and Stormwater Planters

Task	Description	Frequency
Watering	Watering of new plantings during the first two years of establishment	During extended dry periods of no significant precipitation within 7 days, or as needed based on plant condition
Weeding	Removal of non-native or undesirable vegetation	Quarterly at minimum during the growing season or more frequently based on ongoing inspections
Mulching	Mulching of planting beds	Once annually for the first two growing seasons or until beds have filled in
Vegetation Management	Cutting and trimming of detrital herbaceous vegetation from the previous growing season to four to six inches above the ground	Annually in late winter or early spring prior to break in dormancy
Sediment Removal	Removal of accumulated sediment and debris from practice areas	Twice per year or more frequently if needed based on ongoing inspections (note: leaves and other natural materials can be left in place if they do not impede conveyance)
Pipe Cleaning	Hydraulic cleaning of inflow, outflow and underdrain piping	As warranted based on video pipe inspections conducted every three years
Inlet Filter Cleaning	Emptying of inlet filter bags and/or baskets	Minimum quarterly or more frequently based on ongoing inspections
Inlet Cleaning	Vacuum cleaning of accumulated sediment and debris within inlets sumps and hoods	Minimum annually or more frequently if debris accumulation is rapid based on ongoing and annual inspections
Outlet Cleaning	Removal of accumulated sediment and debris from risers (vacuum cleaning), trash racks, and spillways and clearing sediment from orifices and outlet control structures to prevent clogging	Annually at minimum or more frequently based on ongoing and annual inspections
Erosion Control	Stabilization of eroded soil areas with vegetative or mechanical means	As warranted based on ongoing inspections

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Floatables?

Floatables Step 2: Document appropriate SMP maintenance in the O&M Manual

Complete Section 2.3 of the NYCDEP O&M Manual Template with maintenance tasks for each SMP, including surface practices supporting removal of floatables.

Example SMP: *Filtration Bioretention*

O&M Tasks for Floatables Removal:

- *Surface*
  - Trash/Sediment Removal
  - Catch Basin Cleaning
  - Outlet Cleaning

Table 2.1: Filtration Bioretention SMP Inspection & Maintenance

ACTIVITY	FREQUENCY
ONGOING	
Watering: Watering of new plantings during the first two years of establishment	*During extended dry periods of no significant precipitation within 7 days, or as needed based on plant condition*
Weeding: Removal of non-native or undesirable vegetation	*Quarterly at minimum during the growing season or more frequently based on ongoing inspections*
Mulching: Mulching of planting beds	*Once annually for the first two growing seasons or until beds have filled in*
Trash/Sediment Removal: Removal of accumulated sediment and debris from practice areas	*Twice per year or more frequently if needed based on ongoing inspections*
Catch Basin Cleaning: Removal of garbage and refuse collected on grates and stormwater inlets	*Minimum quarterly or more frequently based on ongoing inspections*
Pipe Cleaning: Hydraulic cleaning of inflow, outflow and underdrain piping	*As warranted based on video pipe inspections conducted every three years*
Inlet Filter Cleaning: Emptying of inlet filter bags and/or baskets	*Minimum quarterly or more frequently based on ongoing inspections*
Inlet Cleaning: Vacuum cleaning of accumulated sediment and debris within inlets sumps and hoods	*Minimum annually or more frequently if debris accumulation is rapid based on ongoing and annual inspections*
Outlet Cleaning: Removal of accumulated sediment and debris from risers (vacuum cleaning), trash racks, and spillways and clearing sediment from orifices and outlet control structures to prevent clogging	*Annually at minimum or more frequently based on ongoing and annual inspections*

Reference: NYCDEP O&M Manual Template

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Floatables?

Floatables Step 2: Document appropriate SMP maintenance in the O&M Manual

Complete Section 2.3 of the NYCDEP O&M Manual Template with maintenance tasks for each SMP, including subsurface practices supporting removal of floatables.

Example SMP: *Filtration Bioretention*

O&M Tasks for Floatables Removal:

- *Subsurface*
  - Inlet Filter Cleaning
  - Inlet Cleaning

Table 2.1: Filtration Bioretention SMP Inspection & Maintenance

ACTIVITY	FREQUENCY
ONGOING	
Watering: Watering of new plantings during the first two years of establishment	*During extended dry periods of no significant precipitation within 7 days, or as needed based on plant condition*
Weeding: Removal of non-native or undesirable vegetation	*Quarterly at minimum during the growing season or more frequently based on ongoing inspections*
Mulching: Mulching of planting beds	*Once annually for the first two growing seasons or until beds have filled in*
Trash/Sediment Removal: Removal of accumulated sediment and debris from practice areas	*Twice per year or more frequently if needed based on ongoing inspections*
Catch Basin Cleaning: Removal of garbage and refuse collected on grates and stormwater inlets	*Minimum quarterly or more frequently based on ongoing inspections*
Pipe Cleaning: Hydraulic cleaning of inflow, outflow and underdrain piping	*As warranted based on video pipe inspections conducted every three years*
Inlet Filter Cleaning: Emptying of inlet filter bags and/or baskets	*Minimum quarterly or more frequently based on ongoing inspections*
Inlet Cleaning: Vacuum cleaning of accumulated sediment and debris within inlets sumps and hoods	*Minimum annually or more frequently if debris accumulation is rapid based on ongoing and annual inspections*
Outlet Cleaning: Removal of accumulated sediment and debris from risers (vacuum cleaning), trash racks, and spillways and clearing sediment from orifices and outlet control structures to prevent clogging	*Annually at minimum or more frequently based on ongoing and annual inspections*

Reference: NYCDEP O&M Manual Template

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

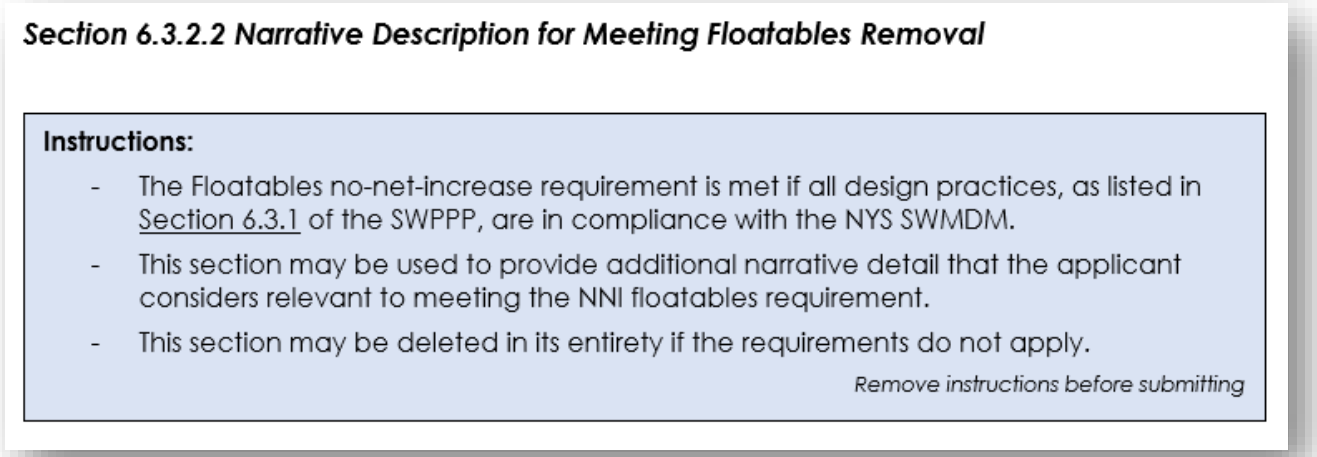
What is the removal requirement for Floatables?

Floatables Step 3: Include floatables removal narrative description in SWPPP

Complete Section 6.3.2.2 of the NYCDEP SWPPP Template to provide a narrative description of how proposed SMP-specific garbage and refuse removal features (in design and maintenance) help meet Required Floatable Removal.

Information to Include in Narrative:

- Explanation of design and functionality of floatable removal component(s)
- Utility plan showing floatable removal component location(s)
- Relevant floatable removal component design details and specifications



Section 6.3.2.2 Narrative Description for Meeting Floatables Removal

Instructions:

- The Floatables no-net-increase requirement is met if all design practices, as listed in Section 6.3.1 of the SWPPP, are in compliance with the NYS SWMDM.
- This section may be used to provide additional narrative detail that the applicant considers relevant to meeting the NNI floatables requirement.
- This section may be deleted in its entirety if the requirements do not apply.

Remove instructions before submitting

Reference: NYCDEP SWPPP Template

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for <u>Floatables</u>?

Identifying SMP Components for Required Floatable Removal:

- **Step 1:** Identify SMP-specific surface and subsurface components for floatable removal
- **Step 2:** Document appropriate SMP maintenance in the O&M Manual
- **Step 3:** Include floatables removal narrative description in SWPPP

Required Documentation:

✓ Floatable Mitigation Tasks in O&M Manual

Table 2.1: Filtration Bioretention SMP Inspection & Maintenance

ACTIVITY	FREQUENCY
ONGOING	
Watering: Watering of new plantings during the first two years of establishment	*During extended dry periods of no significant precipitation within 7 days, or as needed based on plant condition*
Weeding: Removal of non-native or undesirable vegetation	*Quarterly at minimum during the growing season or more frequently based on ongoing inspections*
Mulching: Mulching of planting beds	*Once annually for the first two growing seasons or until beds have filled in*
Trash/Sediment Removal: Removal of accumulated sediment and debris from practice areas	*Twice per year or more frequently if needed based on ongoing inspections*
Catch Basin Cleaning: Removal of garbage and refuse collected on grates and stormwater inlets	*Minimum quarterly or more frequently based on ongoing inspections*
Pipe Cleaning: Hydraulic cleaning of inflow, outflow and underdrain piping	*As warranted based on video pipe inspections conducted every three years*
Inlet Filter Cleaning: Emptying of inlet filter bags and/or baskets	*Minimum quarterly or more frequently based on ongoing inspections*
Inlet Cleaning: Vacuum cleaning of accumulated sediment and debris within inlets sumps and hoods	*Minimum annually or more frequently if debris accumulation is rapid based on ongoing and annual inspections*
Outlet Cleaning: Removal of accumulated sediment and debris from risers (vacuum cleaning), trash racks, and spillways and clearing sediment from orifices and outlet control structures to prevent clogging	*Annually at minimum or more frequently based on ongoing and annual inspections*

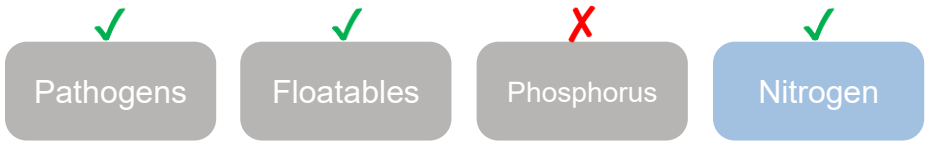
✓ Narrative Description in SWPPP

Section 6.3.2.2 Narrative Description for Meeting Floatables Removal

Instructions:

- The Floatables no-net-increase requirement is met if all design practices, as listed in <u>Section 6.3.1</u> of the SWPPP, are in compliance with the NYS SWMDM.
- This section may be used to provide additional narrative detail that the applicant considers relevant to meeting the NNI floatables requirement.
- This section may be deleted in its entirety if the requirements do not apply.

Remove instructions before submitting



No-Net-Increase Criteria

What is the removal requirement for <u>Nitrogen</u>?

Calculating Required Total Nitrogen Removal:

- **Step 1:** Nitrogen Load Calculation
- **Step 2:** SMP Nitrogen Removal Calculation
- **Step 3:** No-Net-Increase Verification

Reference: NYC SWM Appendix B

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

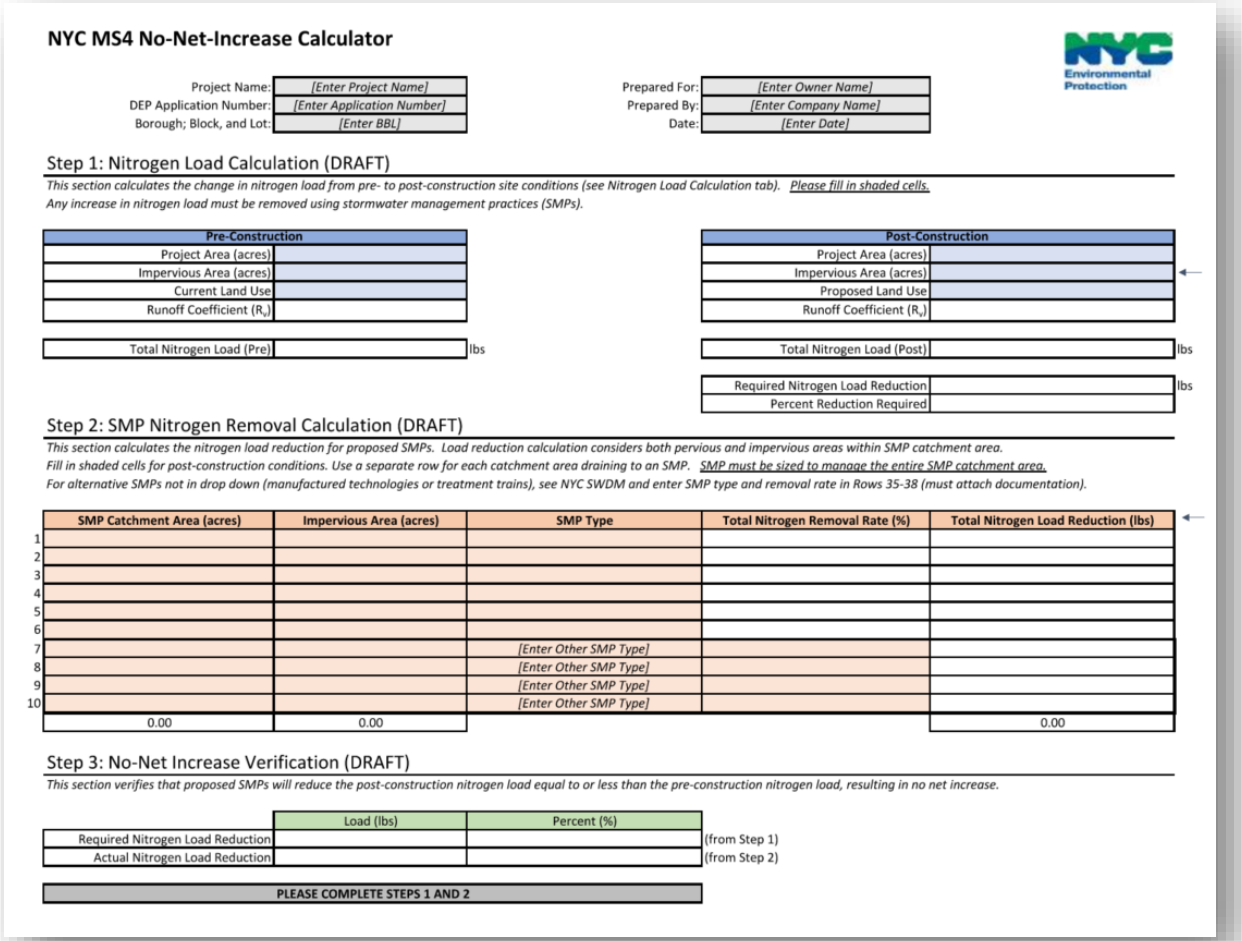
No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Goal: Determine required Total Nitrogen Load Reduction and the nitrogen load reduction for proposed SMPs.

The NYC MS4 No-Net-Increase Calculator for Nitrogen by NYCDEP is recommended for use to complete and document these calculations to be included with in SWPPP.

Reference: NYC SWM Appendix B



NYC MS4 No-Net-Increase Calculator

NYC Environmental Protection

Project Name:	[Enter Project Name]	Prepared For:	[Enter Owner Name]
DEP Application Number:	[Enter Application Number]	Prepared By:	[Enter Company Name]
Borough; Block, and Lot:	[Enter BBL]	Date:	[Enter Date]

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction		Post-Construction	
Project Area (acres)		Project Area (acres)	
Impervious Area (acres)		Impervious Area (acres)	
Current Land Use		Proposed Land Use	
Runoff Coefficient (R_v)		Runoff Coefficient (R_v)	
Total Nitrogen Load (Pre)	lbs	Total Nitrogen Load (Post)	lbs
		Required Nitrogen Load Reduction	lbs
		Percent Reduction Required	

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7			[Enter Other SMP Type]		
8			[Enter Other SMP Type]		
9			[Enter Other SMP Type]		
10			[Enter Other SMP Type]		
	0.00	0.00			0.00

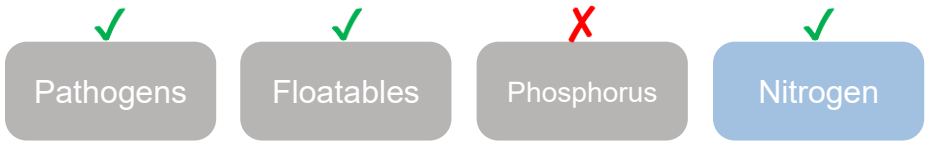
Step 3: No-Net Increase Verification (DRAFT)

This section verifies that proposed SMPs will reduce the post-construction nitrogen load equal to or less than the pre-construction nitrogen load, resulting in no net increase.

	Load (lbs)	Percent (%)	
Required Nitrogen Load Reduction			(from Step 1)
Actual Nitrogen Load Reduction			(from Step 2)

PLEASE COMPLETE STEPS 1 AND 2

Note:
Step-by-step instructions to utilize this calculator can be found in Appendix B of the NYC Stormwater Manual.



No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Calculating Required Total Nitrogen Removal:

- **Step 1:** Nitrogen Load Calculation
  - **Step 1a**: Establish site contributing impervious area
  - **Step 1b**: Establish land use type
  - **Step 1c**: Complete site-wide nitrogen reduction calculation

Reference: NYC SWM Appendix B

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1A: Establish Contributing Impervious Area

Compare pre- and post-construction site plans to determine how much new impervious area is considered for Target NNI calculations for Nitrogen.

$$A_{site} = 33{,}174\ sf = \mathbf{0.76\ acre}$$

Concept Map: *Existing Site Cover*

Concept Map: *Proposed Site Cover*

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1a: Establish Contributing Impervious Area

Identify pre-construction pervious and impervious areas, to determine existing impervious cover.

$$A_{Imp,pre} = 0\ sf = \mathbf{0.00\ acre}$$

Concept Map: *Existing Site Cover*

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Total Contributing Area: *33,174 sf*
- Total Impervious Surface Area: 0 *sf*
- Impervious Surface Area in LOD: *0 sf*
- Pervious Surface Area in LOD: *31,860 sf*
- Pervious Surface Area outside LOD: *1,314 sf*

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1a: Establish Contributing Impervious Area

Identify post-construction pervious and impervious areas, to determine proposed impervious cover.

$$A_{Imp,post} = Total\ Impervious - Proposed\ Pervious$$

$$A_{Imp,post} = 12{,}750\ sf - 4{,}400\ sf = 8{,}350\ sf = \mathbf{0.19\ acre}$$

Concept Map: *Proposed Site Cover*

Proposed pervious surface areas (green roofs, porous pavement, vegetated SMPs, etc.) are not included in post impervious areas.

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Total Contributing Area: *33,174 sf*
- Total Impervious Surface Area: 12,750 *sf*
- Impervious Surface Area in LOD: *8,350 sf*
- Pervious Surface Area in LOD: *19,110 sf*
- Pervious Surface Area outside LOD: *1,314 sf*
- Pervious Surface Area on Roof: *4,400 sf*

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1b: Establish Land Use Type

Use Table 3-1 from NYC SWM Appendix B to determine land use type for pre- and post- construction land use conditions.

Case Study Scope: A *vacant lot* is being developed into an *apartment building*.

Pre-Construction **Land Use** →

Post-Construction **Land Use** →

Table 3-1. Median EMCs for TN

NYC Land Use	NYC Zoning Districts	Similar or Applicable Land Uses From NOI	EMC for TN (mg/L)
Commercial	C1-C8	Institutional/School, Municipal	2.08
Industrial/Manufacturing	M1-M3	Linear Utility, Well Drilling Activity (Oil, Gas, etc.), Road/ Highway, Parking Lot	2.10
Vacant/Open Space	NA	Forest, Pasture/Open Land, Cultivated Land, Recreational/ Sports Field, Bike Path/Trail, Clearing/Grading, Demolition/No Redevelopment	1.50
Lower-Density Residential	R1-R5	Single Family Home/Subdivision	2.10
Moderate- and Higher-Density Residential	R6-R10	Town Home Residential, Multifamily Residential	2.41

Note: mg/L = milligrams per liter.

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Pre-Construction & Post-Construction Land Use

Considerations:

- Pre-construction and post-construction land use is determined by the site's actual use, not by its zoning designation assigned by the NYC Department of City Planning.
- The pre-construction land use must represent the most amount of impervious surface within the last 5 years prior to proposed development.
- Example: *If a vacant lot not under use is zoned in a lower-density residential district, the land use will be considered "Vacant/Open Space" instead of "Lower-Density Residential."*

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1c: Complete Site-Wide Nitrogen Reduction Calculation

Enter inputs into 'Nitrogen Load Calculation' section of the NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate site-wide NNI requirement for Nitrogen.

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	
Impervious Area (acres)	
Current Land Use	
Runoff Coefficient (R_v)	

Total Nitrogen Load (Pre)		lbs

Post-Construction	
Project Area (acres)	
Impervious Area (acres)	
Proposed Land Use	
Runoff Coefficient (R_v)	

Total Nitrogen Load (Post)		lbs

Required Nitrogen Load Reduction		lbs
Percent Reduction Required		

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1c: Complete Site-Wide Nitrogen Reduction Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate pre-construction TN Load.

User Inputs

$A_{Site} = 0.76\ acre$

$I_{pre} = 0.00\ acre$

$Land\ Use =$ Vacant/Open Space

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.

Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.00
Current Land Use	Vacant/Open Space
Runoff Coefficient (R_v)	
Total Nitrogen Load (Pre)	lbs

Post-Construction	
Project Area (acres)	
Impervious Area (acres)	
Proposed Land Use	
Runoff Coefficient (R_v)	
Total Nitrogen Load (Post)	lbs
Required Nitrogen Load Reduction	lbs
Percent Reduction Required	

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1c: Complete Site-Wide Nitrogen Reduction Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate pre-construction TN Load.

User Inputs

$A_{Site} = 0.76\ acre$

$I_{pre} = 0.00\ acre$

$Land\ Use =$ Vacant/Open Space

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.

Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.00
Current Land Use	Vacant/Open Space
Runoff Coefficient (R_v)	0.20
Total Nitrogen Load (Pre)	0.08 lbs

Post-Construction	
Project Area (acres)	
Impervious Area (acres)	
Proposed Land Use	
Runoff Coefficient (R_v)	
Total Nitrogen Load (Post)	lbs
Required Nitrogen Load Reduction	lbs
Percent Reduction Required	

Calculator Outputs

$R_{v,pre} = 0.20$

$TN_{pre} = \mathbf{0.08\ lb}$

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1c: Complete Site-Wide Nitrogen Reduction Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate post-construction TN Load.

This impervious area does not include surface area of green roofs, porous pavement, vegetated SMPs, or other landscaped areas. See note in the NNI calculator.

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.00
Current Land Use	Vacant/Open Space
Runoff Coefficient (R_v)	0.20

Total Nitrogen Load (Pre)	0.08	lbs

Post-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.19
Proposed Land Use	Moderate-/Higher-Density Residential
Runoff Coefficient (R_v)	

Total Nitrogen Load (Post)		lbs

Required Nitrogen Load Reduction		lbs
Percent Reduction Required		

User Inputs

$A_{Site} = 0.76\ acre$

$I_{post} = 0.19\ acre$

$Land\ Use =$ Moderate-/Higher-Density Residential

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1c: Complete Site-Wide Nitrogen Reduction Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate post-construction TN Load.

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.00
Current Land Use	Vacant/Open Space
Runoff Coefficient (R_v)	0.20
Total Nitrogen Load (Pre)	0.08 lbs

Post-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.19
Proposed Land Use	Moderate-/Higher-Density Residential
Runoff Coefficient (R_v)	0.28
Total Nitrogen Load (Post)	0.17 lbs
Required Nitrogen Load Reduction	lbs
Percent Reduction Required	

User Inputs

$A_{Site} = 0.76\ acre$

$I_{post} = 0.19\ acre$

$Land\ Use =$ Moderate-/Higher-Density Residential

Calculator Outputs

$R_{v,post} = 0.28$

$TN_{post} = \mathbf{0.17\ lb}$

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 1c: Complete Site-Wide Nitrogen Reduction Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate required Nitrogen Load Reduction.

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.00
Current Land Use	Vacant/Open Space
Runoff Coefficient (R_v)	0.20

Total Nitrogen Load (Pre)	0.08	lbs

Post-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.19
Proposed Land Use	Moderate-/Higher-Density Residential
Runoff Coefficient (R_v)	0.28

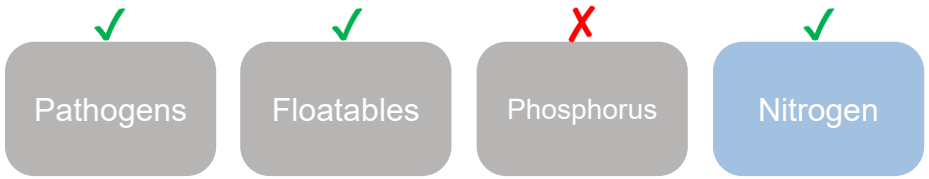
Total Nitrogen Load (Post)	0.17	lbs

Required Nitrogen Load Reduction	**0.09**	lbs
Percent Reduction Required	**55%**	

Final Outputs

Required Nitrogen Load Reduction = 0.09 lb

% Reduction Required = 55%



No-Net-Increase Criteria

What is the removal requirement for <u>Nitrogen</u>?

Calculating Required Total Nitrogen Removal:

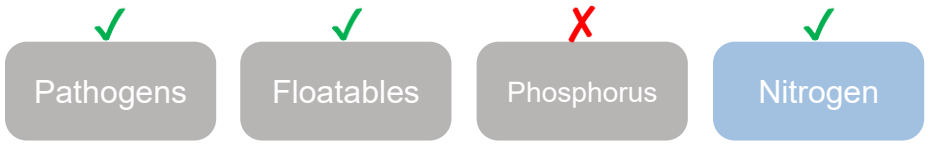
- **Step 1:** Nitrogen Load Calculation
  - **Step 1A**: Establish site contributing impervious area
  - **Step 1B**: Establish land use type
  - **Step 1C**: Complete site-wide nitrogen reduction calculation

$$Required\ Nitrogen\ Load\ Reduction$$

$$= \mathbf{0.09}\ \boldsymbol{lb}$$

$$= \mathbf{55\%\ reduction}$$

Reference: NYC SWM Appendix B



No-Net-Increase Criteria

What is the removal requirement for <u>Nitrogen</u>?

Calculating Required Total Nitrogen Removal:

- **Step 2:** SMP Nitrogen Removal Calculation
  - **Step 2A:** Establish SMP catchment and impervious area
  - **Step 2B:** Select/input appropriate total nitrogen removal rate per SMP
  - **Step 2C:** Complete SMP Nitrogen Removal Calculation

Reference: NYC SWM Appendix B

Concept Map: *Green Roof Contributing Impervious Area*

Tier 3 SMP Design

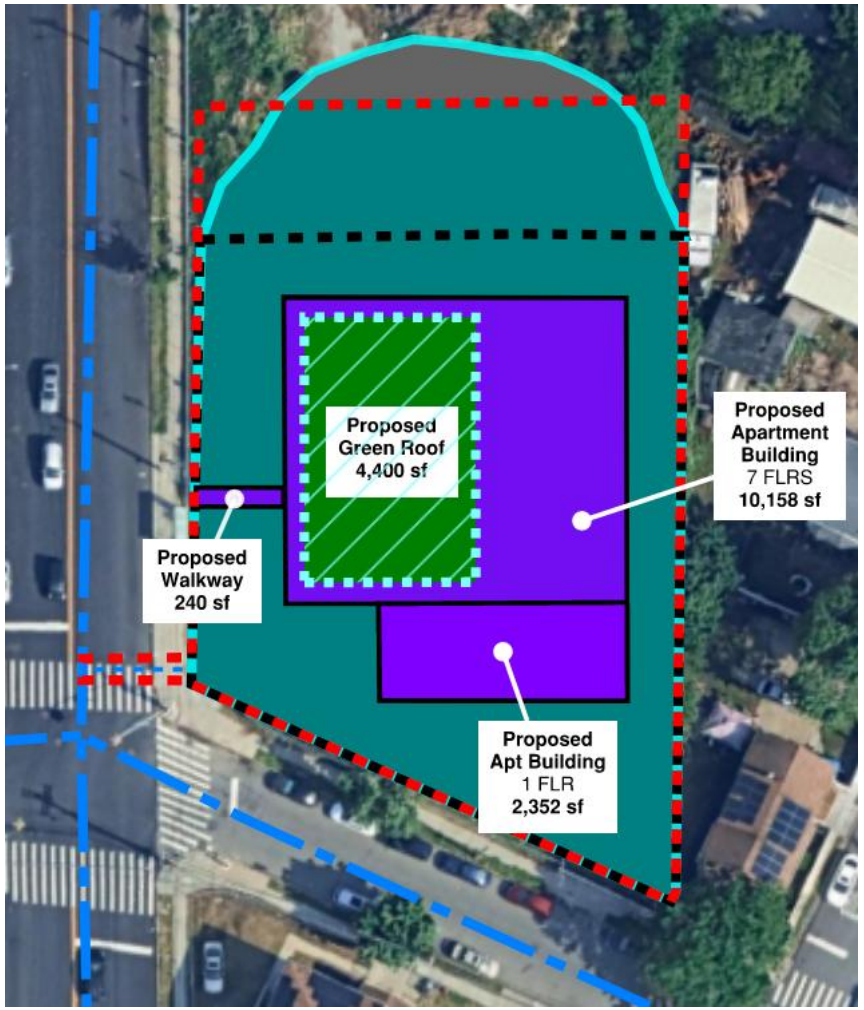
What are the Tier 3 SMP requirements?

Nitrogen Step 2a: Establish SMP catchment and impervious area

Identify post-construction SMP catchment area and contributing impervious area of each SMP.

$A_{TDA,GR} = 4{,}400\ sf = \mathbf{0.10\ acre}$

$A_{Imp,GR} = 0\ sf = \mathbf{0.00\ acre}$



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Total Contributing Area: *33,174 sf*
- SMP Catchment Area: *4,400 sf*
- Impervious Surface Area in LOD: *8,350 sf*
- Pervious Surface Area in LOD: *19,110 sf*
- Pervious Surface Area outside LOD: *1,314 sf*
- Pervious Surface Area on Roof: *4,400 sf*

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

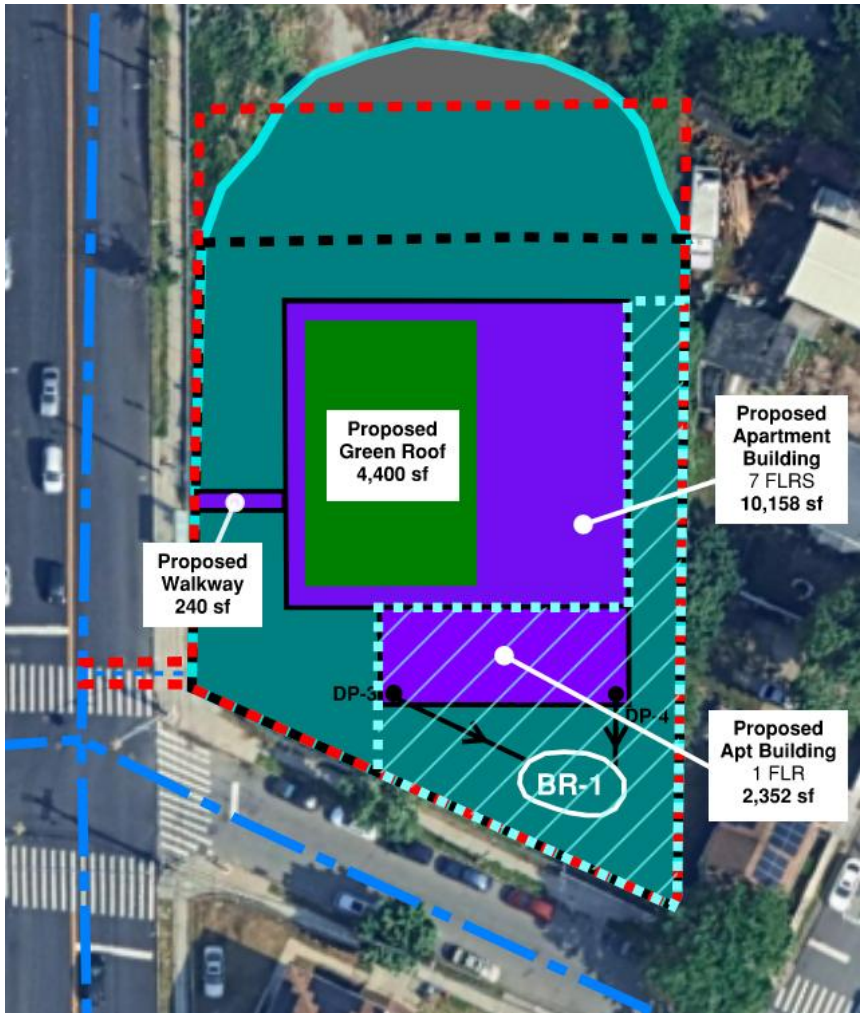
Nitrogen Step 2a: Establish SMP catchment and impervious area

Identify post-construction SMP catchment area and contributing impervious area of each SMP.

$$A_{TDA,BR} = 8{,}419\ sf = \mathbf{0.19\ acre}$$

$$A_{Imp,BR} = 2{,}352\ sf = \mathbf{0.05\ acre}$$

Concept Map: *Bioretention Contributing Impervious Area*



LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Total Contributing Area: *33,174 sf*
- SMP Catchment Area: *8,419 sf*
- Impervious Surface Area in LOD: *8,350 sf*
- Pervious Surface Area in LOD: *19,110 sf*
- Pervious Surface Area outside LOD: *1,314 sf*
- Pervious Surface Area on Roof: *4,400 sf*

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2a: Establish SMP catchment and impervious area

Identify post-construction SMP catchment area and contributing impervious area of each SMP.

$$A_{TDA,DT} = A_{Site} - A_{TDA,GR} - A_{TDA,BR}$$

$$= 33{,}174\ sf - 4{,}400\ sf - 8{,}419\ sf = 20{,}355\ sf = \mathbf{0.47\ acre}$$

$$A_{Imp,DT} = A_{Imp,Post} - A_{SMP,GR} - A_{Imp,BR}$$

$$= 12{,}750\ sf - 4{,}400\ sf - 2{,}352\ sf = 5{,}998\ sf = \mathbf{0.14\ acre}$$

Concept Map: *Detention Tank Contributing Impervious Area*

LEGEND

- Limit of Property: *26,330 sf*
- Limit of Disturbance (LOD): *32,874 sf*
- Total Contributing Area: *33,174 sf*
- SMP Catchment Area: *20,355 sf*
- Impervious Surface Area in LOD: *8,350 sf*
- Pervious Surface Area in LOD: *19,110 sf*
- Pervious Surface Area outside LOD: *1,314 sf*
- Pervious Surface Area on Roof: *4,400 sf*

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2a: Establish SMP catchment and impervious area

Enter inputs for contributing drainage and impervious areas for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7			*[Enter Other SMP Type]*		
8			*[Enter Other SMP Type]*		
9			*[Enter Other SMP Type]*		
10			*[Enter Other SMP Type]*		
	0.00	0.00			0.00

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2a: Establish SMP catchment and impervious area

Enter the SMP Type in the appropriate row(s).

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2			Rain Garden		
3			Bioretention		
4			Porous Pavement		
5			Infiltration Trench		
6			Stormwater and Rainwater Reuse		
7			Turf Field		
8			Bioretention with Underdrain		
9			Porous Pavement with Underdrain		
10			Sand Filter (Filtration)		
			Green Roof		
			Constructed Wetlands		
	0.00	0.00	Ponds		0.00

Rows for pre-set SMP Types

Rows for alternative SMP Types

The calculator includes pre-set SMP Types that can be selected, where the associated Total Nitrogen Removal Rate will auto-populate

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2a: Establish SMP catchment and impervious area

Enter inputs for SMP catchment area and impervious areas for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*		
8	0.19	0.05	*Bioretention with Underdrain + Filter*		
9	0.47	0.14	*Proprietary Filter*		
10					
	0.76	0.19			

Rows for pre-set SMP Types

Rows for alternative SMP Types

Calculator Outputs

$A_{site} = 0.76\ acre$

$I_{post} = 0.17\ acre$

User Inputs

$A_{TDA,GR} = 0.10\ acre$ $A_{Imp,GR} = 0.00\ acre$

$A_{TDA,BR} = 0.19\ acre$ $A_{Imp,BR} = 0.05\ acre$

$A_{TDA,DT} = 0.47\ acre$ $A_{Imp,DT} = 0.14\ acre$

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2b: Select/input appropriate total nitrogen removal rate per SMP

Enter inputs of TN Removal Rates for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	
9	0.47	0.14	*Proprietary Filter*		
0					
	0.76	0.19			

Rows for alternative SMP Types

If a SMP treatment train is implemented, follow NYC SWM Appendix B for TN removal rate calculation

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2b: Select/input appropriate total nitrogen removal rate per SMP

Enter inputs of TN Removal Rates for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	
9	0.47	0.14	*Proprietary Filter*	51%	
0					
	0.76	0.19			

Rows for alternative SMP Types

$$Rr = [1 - (1 - rr1) * (1 - rr2)] * 100$$

$Rr = overall\ removal\ rate\ (\%)$

$rr\# = removal\ rate\ for\ SMP\#\ (\%)$

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2b: Select/input appropriate total nitrogen removal rate per SMP

Enter inputs of TN Removal Rates for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	
9	0.47	0.14	*Proprietary Filter*	51%	
0					
	0.76	0.19			

Rows for alternative SMP Types

$$Rr = [1 - (1 - rr1) * (1 - rr2)] * 100$$

$Rr = overall\ removal\ rate\ (\%)$

$rr\# = removal\ rate\ for\ SMP\#\ (\%)$

$$Rr_{GR+PF} = [1 - (1 - rr_{GR}) * (1 - rr_{PF})] * 100$$

$$Rr_{GR+PF} = [1 - (1 - 0.35) * (1 - 0.51)] * 100$$

$$Rr_{GR+PF} = 68\%$$

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2b: Select/input appropriate total nitrogen removal rate per SMP

Enter inputs of TN Removal Rates for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	
9	0.47	0.14	*Proprietary Filter*	51%	
10					
	0.76	0.19			

Rows for alternative SMP Types

$$Rr = [1 - (1 - rr1) * (1 - rr2)] * 100$$

$Rr = overall\ removal\ rate\ (\%)$

$rr\# = removal\ rate\ for\ SMP\#\ (\%)$

$$Rr_{BR+PF} = [1 - (1 - rr_{BR}) * (1 - rr_{PF})] * 100$$

$$Rr_{BR+PF} = [1 - (1 - 0.40) * (1 - 0.51)] * 100$$

$$Rr_{BR+PF} = 71\%$$

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2b: Select/input appropriate total nitrogen removal rate per SMP

Enter inputs of TN Removal Rates for each SMP into NYC MS4 No-Net-Increase Calculator for Nitrogen.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	
9	0.47	0.14	*Proprietary Filter*	51%	
10					
	0.76	0.19			

Rows for alternative SMP Types

For proprietary products, use verified TN Removal Rate provided by manufacturer and tested by third-party

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Removal Rates for Proprietary Products

Considerations:

- Removal rates for proprietary products must be verified via third-party testing. Accepted third-party verification is determined by NYS DEC as noted in the Construction Stormwater Toolbox.
- Refer to the section “Verified Proprietary Practices for New Development” for the process of how to have a proprietary practice accepted for use.
- Removal rates used in calculations can only be used if the same configuration is implemented as that from verified third-party testing, matching the specifications. For custom configurations and designs, removal rates must be verified through third-party testing specific to that configuration.

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2c: Complete SMP Nitrogen Removal Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate total nitrogen reduction for each SMP.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	0.01
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	0.03
9	0.47	0.14	*Proprietary Filter*	51%	0.06
10					
	0.76	0.19			

User Inputs

Rows for alternative SMP Types

Calculator Outputs

$TN\ Reduction_{GR} = 0.01\ lbs$

$TN\ Reduction_{BR} = 0.03\ lbs$

$TN\ Reduction_{DT} = 0.06\ lbs$

Tier 3 SMP Design

What are the Tier 3 SMP requirements?

Nitrogen Step 2c: Complete SMP Nitrogen Removal Calculation

Enter inputs into NYC MS4 No-Net-Increase Calculator for Nitrogen to calculate total nitrogen reduction for each SMP.

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

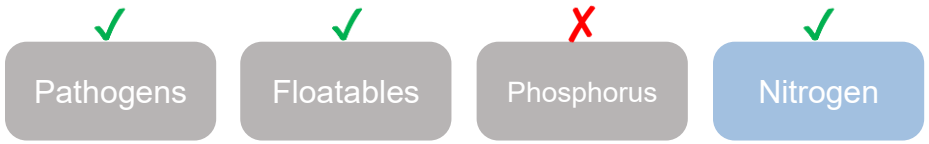
This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	0.01
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	0.03
9	0.47	0.14	*Proprietary Filter*	51%	0.06
0					
	0.76	0.19			0.11

Rows for alternative SMP Types

Final Output

Provided Nitrogen Load Reduction = 0.11 lb



No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Calculating Required Total Nitrogen Removal:

- **Step 2:** SMP Nitrogen Removal Calculation
  - **Step 2a:** Establish SMP catchment and impervious area
  - **Step 2b:** Select/input appropriate total nitrogen removal rate per SMP
  - **Step 2c:** Complete SMP Nitrogen Removal Calculation

$$Provided\ Nitrogen\ Load\ Reduction$$

$$= \mathbf{0.11}\ \boldsymbol{lb}$$

Reference: NYC SWM Appendix B

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 3: No-Net-Increase Verification

Review outputs in NYC MS4 No-Net-Increase Calculator for Nitrogen to verify Actual Nitrogen Load Reduction meets site-wide removal requirement for Nitrogen.

Step 3: No-Net Increase Verification (DRAFT)

This section verifies that proposed SMPs will reduce the post-construction nitrogen load equal to or less than the pre-construction nitrogen load, resulting in no net increase.

	Load (lbs)	Percent (%)	
Required Nitrogen Load Reduction	**0.09**	**55%**	(from Step 1)
Actual Nitrogen Load Reduction	**0.11**	**62%**	(from Step 2)

NO-NET-INCREASE REQUIREMENTS MET

✓

✓ Pathogens ✓ Floatables ✗ Phosphorus ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Nitrogen Step 3: No-Net-Increase Verification

Print and include a copy of the NYC MS4 No-Net-Increase Calculator for Nitrogen in the SWPPP application, verifying the project meets Required Nitrogen Removal.

NYC MS4 No-Net-Increase Calculator

Project Name:	*Design Guidance Case Study C*	Prepared For:	*[Enter Owner Name]*
DEP Application Number:	*[Enter Application Number]*	Prepared By:	*[Enter Company Name]*
Borough; Block, and Lot:	*[Enter BBL]*	Date:	*[Enter Date]*

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.00
Current Land Use	Vacant/Open Space
Runoff Coefficient (R_v)	0.20
Total Nitrogen Load (Pre)	0.08 lbs

Post-Construction	
Project Area (acres)	0.76
Impervious Area (acres)	0.19
Proposed Land Use	Moderate-/Higher-Density Residential
Runoff Coefficient (R_v)	0.28
Total Nitrogen Load (Post)	0.17 lbs
Required Nitrogen Load Reduction	**0.09** lbs
Percent Reduction Required	**55%**

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)
1					
2					
3					
4					
5					
6					
7	0.10	0.00	*Green Roof + Filter*	68%	0.01
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	0.03
9	0.47	0.14	*Proprietary Filter*	51%	0.06
10					
	0.76	0.19			0.11

Step 3: No-Net Increase Verification (DRAFT)

This section verifies that proposed SMPs will reduce the post-construction nitrogen load equal to or less than the pre-construction nitrogen load, resulting in no net increase.

	Load (lbs)	Percent (%)	
Required Nitrogen Load Reduction	**0.09**	**55%**	(from Step 1)
Actual Nitrogen Load Reduction	**0.11**	**62%**	(from Step 2)

NO-NET-INCREASE REQUIREMENTS MET

✓ Pathogens | ✓ Floatables | ✗ Phosphorus | ✓ Nitrogen

No-Net-Increase Criteria

What is the removal requirement for Nitrogen?

Calculating Required Total Nitrogen Removal:

- **Step 1:** Nitrogen Load Calculation
- **Step 2:** SMP Nitrogen Removal Calculation
- **Step 3:** No-Net-Increase Verification

Reference: NYC SWM Appendix B

Required Documentation:

✓ Completed calculations included in SWPPP

NYC MS4 No-Net-Increase Calculator

NYC Environmental Protection

Project Name:	*Design Guidance Case Study C*	Prepared For:	*[Enter Owner Name]*
DEP Application Number:	*[Enter Application Number]*	Prepared By:	*[Enter Company Name]*
Borough; Block, and Lot:	*[Enter BBL]*	Date:	*[Enter Date]*

Step 1: Nitrogen Load Calculation (DRAFT)

This section calculates the change in nitrogen load from pre- to post-construction site conditions (see Nitrogen Load Calculation tab). Please fill in shaded cells.
Any increase in nitrogen load must be removed using stormwater management practices (SMPs).

Pre-Construction		Post-Construction		
Project Area (acres)	0.76	Project Area (acres)	0.76	
Impervious Area (acres)	0.00	Impervious Area (acres)	0.19	←
Current Land Use	Vacant/Open Space	Proposed Land Use	Moderate-/Higher-Density Residential	
Runoff Coefficient (R_v)	0.20	Runoff Coefficient (R_v)	0.28	
Total Nitrogen Load (Pre)	0.08 lbs	Total Nitrogen Load (Post)	0.17	lbs
		Required Nitrogen Load Reduction	**0.09**	lbs
		Percent Reduction Required	**55%**	

Step 2: SMP Nitrogen Removal Calculation (DRAFT)

This section calculates the nitrogen load reduction for proposed SMPs. Load reduction calculation considers both pervious and impervious areas within SMP catchment area.
Fill in shaded cells for post-construction conditions. Use a separate row for each catchment area draining to an SMP. SMP must be sized to manage the entire SMP catchment area.
For alternative SMPs not in drop down (manufactured technologies or treatment trains), see NYC SWDM and enter SMP type and removal rate in Rows 35-38 (must attach documentation).

	SMP Catchment Area (acres)	Impervious Area (acres)	SMP Type	Total Nitrogen Removal Rate (%)	Total Nitrogen Load Reduction (lbs)	
1						
2						
3						
4						
5						
6						
7	0.10	0.00	*Green Roof + Filter*	68%	0.01	
8	0.19	0.05	*Bioretention with Underdrain + Filter*	71%	0.03	
9	0.47	0.14	*Proprietary Filter*	51%	0.06	
10						
	0.76	0.19			0.11	←

Step 3: No-Net Increase Verification (DRAFT)

This section verifies that proposed SMPs will reduce the post-construction nitrogen load equal to or less than the pre-construction nitrogen load, resulting in no net increase.

	Load (lbs)	Percent (%)	
Required Nitrogen Load Reduction	**0.09**	**55%**	(from Step 1)
Actual Nitrogen Load Reduction	**0.11**	**62%**	(from Step 2)

NO-NET-INCREASE REQUIREMENTS MET

Confirming all Requirements are Met

Confirming All Requirements Were Met

Are all requirements met?

SMP ID	Required $WQ_{V,SMP}$ (cf)	V_{SMP} (cf)	Provided WQ_V, (cf)	Provided RR_V (cf)	Provided V_V (cf)
GR-1	523	550	523	523	0
BR-1	373	708	373	283	0
DT-1	1,698*	2,016	802	0	1,970

*Requirement is driven by V_V in this case, not WQ_V

Site-Wide Parameters	WQ_V (cf)	RR_V (cf)	V_V (cf)
Total Volume Provided	1,698	806	1,970
Total Volume Required	1,698	606 (*Minimum*)	1,970
Remaining Volume to be Managed	0	-	0

No-Net-Increase for Nitrogen

	Load (lbs)	Percent (%)	
Required Nitrogen Load Reduction	**0.09**	**55%**	(from Step 1)
Actual Nitrogen Load Reduction	**0.11**	**62%**	(from Step 2)

NO-NET-INCREASE REQUIREMENTS MET

Questions

NYC Environmental Protection