Planning Lunches at Noon (PLAN) Monthly Webinar Series

Welcome to the October 2025 PLAN Webinar!

"Outreach Session for Updated New Hampshire Stormwater Manual"

Check out OPD's Planning and Zoning Training webpage for:

- Slides and recording of past PLAN Webinars and conferences
- Planning Board and Zoning Board 101 slides and recordings
- Planning Board and Zoning Board Handbooks
- Optional Tests and Certificates

New Hampshire Department of BUSINESS AND ECONOMIC AFFAIRS

Outreach Session for Updated New Hampshire Stormwater Manual

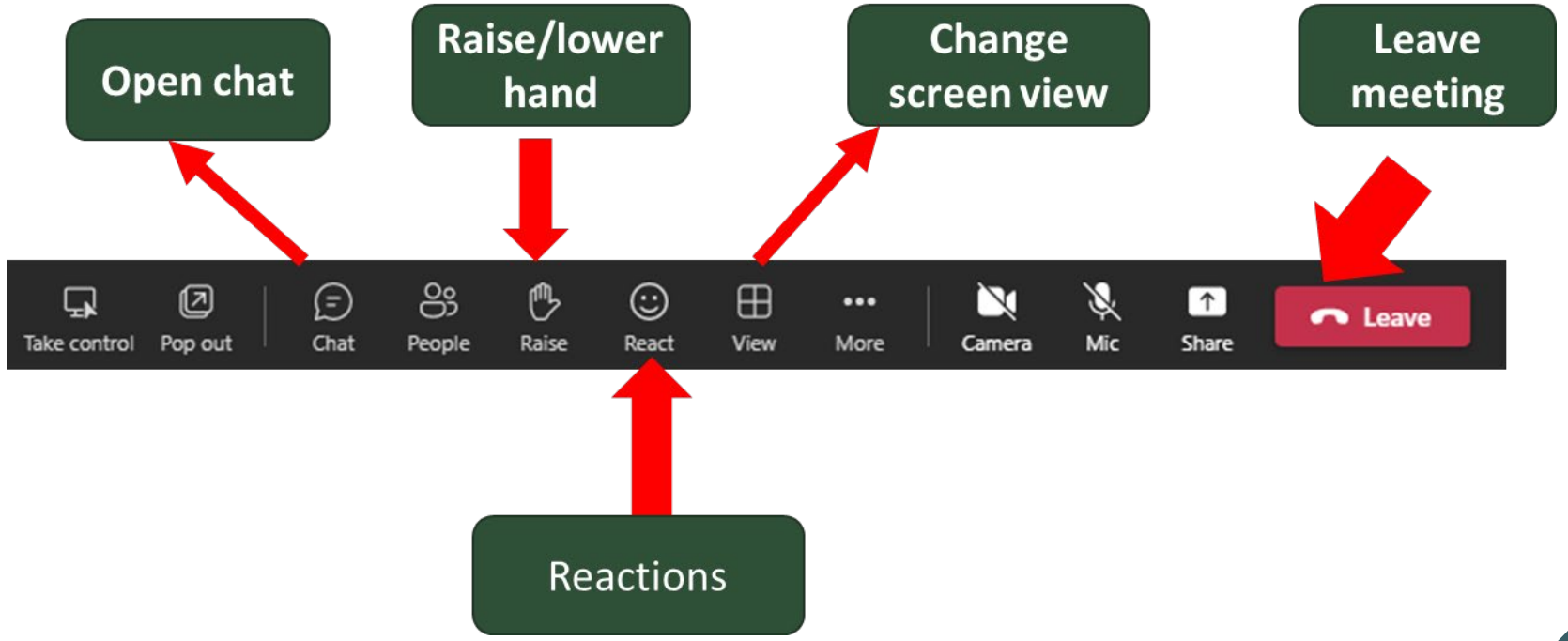
Office of Planning and Development
NH Department of Business and Economic Affairs

October 16, 2025

New Hampshire Department of BUSINESS AND ECONOMIC AFFAIRS

How To Participate

- For questions, type them into the chat box
- We will do our best to answer all questions by the end of the webinar



New Hampshire Department of BUSINESS AND ECONOMIC AFFAIRS

Outreach Session for Updated New Hampshire Stormwater Manual

BEA OPD Planning Lunches at Noon

October 16, 2025

12:00 pm to 1:30 pm

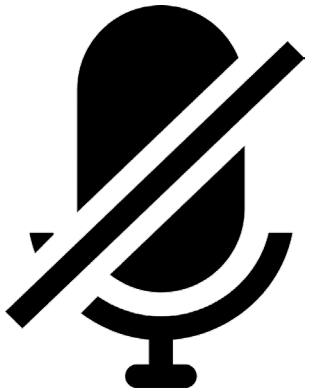
NEW HAMPSHIRE DEPARTMENT OF Environmental Services

UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER

COMPREHENSIVE ENVIRONMENTAL INC

Welcome

- **Good housekeeping items**
  - Presented by NHDES, UNHSC, and CEI.
  - Please hold questions until the Q&A portion.
    - Chat is open to leave questions - please keep microphone muted until the Q&A portion.
  - This session will be recorded and posted on the UNHSC website.



Agenda

- **Introduction**
- **Overview of Stormwater Manual Content Updates**
- **Alteration of Terrain Crosswalk**
- **Technical Examples**
- **MS4 Compliance & Municipal Resources**
- **Next Steps**
- **Questions & Answers** (~30 minutes)

Presenters

Deb Loiselle	Jamie Houle	David Roman	Mike Schlosser
Stormwater Coordinator	Director	Principal Engineer	AoT Bureau Land Resources Management
NHDES Watershed Management Bureau	UNH Stormwater Center	CEI	NHDES AoT

Introduction

Acknowledgements

Thank you!

- Manual project team:

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Emily DiFranco, (*formerly CEI*)

Nicole Haggerty, *CEI*

Robert Hartzel, *CEI*

Erin Holmes, (*formerly NHDES*)

Dr. Jamie Houle, *University of New Hampshire Stormwater Center*

Steve Landry, NHDES *Watershed Management Bureau*

Deb Loiselle, NHDES *Watershed Management Bureau*

David Neils, *NHDES Watershed Management Bureau Administrator*

David Roman, *CEI*

Acknowledgements

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- Acknowledgement to additional support and assistance:

Andrea Bejtlich, *NHDES Watershed Management Bureau*

Jeff Blecharczyk, *NHDES Wetlands Bureau*

Steven Couture, *NHDES Watershed Management Bureau*

Pauline Crocker, *NHDES Watershed Management Bureau*

Dr. Shane Csiki, *NHDES State Geological Survey*

Jennifer Czysz, *Strafford Regional Planning Commission*

Calvin Diessner, *NHDES Wetlands Bureau*

Kenneth Edwardson, *NHDES Watershed Management Bureau*

Hayley Franz, *NHDES Wastewater Engineering Bureau*

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Thomas Swenson, *NHDES Watershed Management Bureau*

James Tilley, *NHDES Watershed Management Bureau*

Mary Ann Tilton, *NHDES Wetlands Bureau*

Jonathan Whaland, *NHDES Drinking Water and Groundwater Bureau*

Ethan Widrick, *NHDES Wastewater Engineering Bureau (formerly NHDES)*

Matthew Wood, *NHDES Watershed Management Bureau*

Acknowledgements

Thank you!

- Acknowledgement to Expert Panel reviewers:

Matthew Stamas, Michelle Vuto, Newton Tedder, and Danielle Gaito, *EPA*

Ben Lundsted and Rebecca Balke, *City of Manchester*

Mark Hemmerlein and Kevin Nyhan, *NHDOT*

Dawn Tuomala, *Town of Merrimack*

Ridgely Mauck, *NHDES- AoT*

Jeff Marcoux and Sally Soule, *NHDES- WAS*

Theresa McGovern, *VHB* and Bill Arcieri, *(formerly VHB)*

Gretchen Young, *City of Rochester*

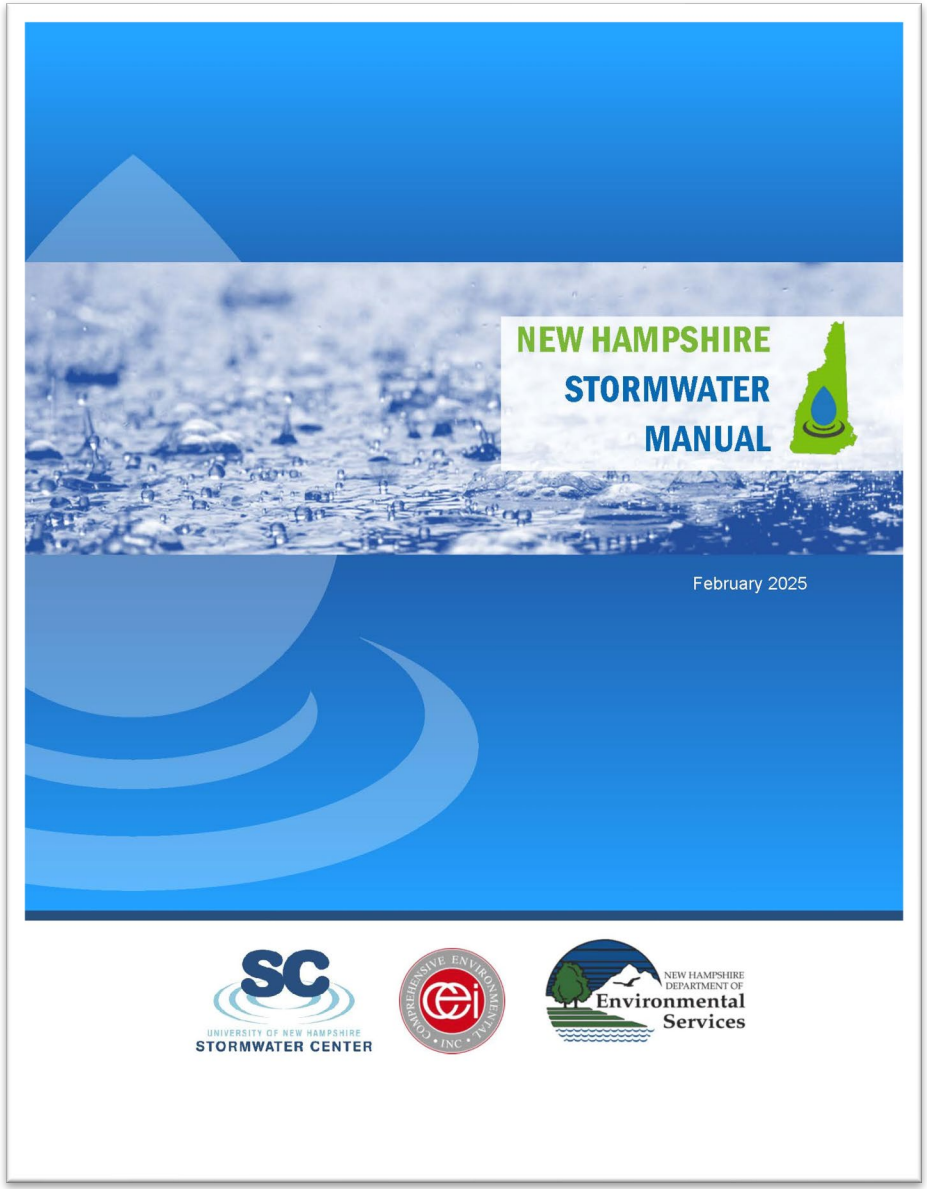
Background

Why are we here?

- Public outreach session to discuss 2025 Manual updates

Why was the Manual updated?

- 2008 Manual is now over 15 years old
- Updated State-of-the-Practice



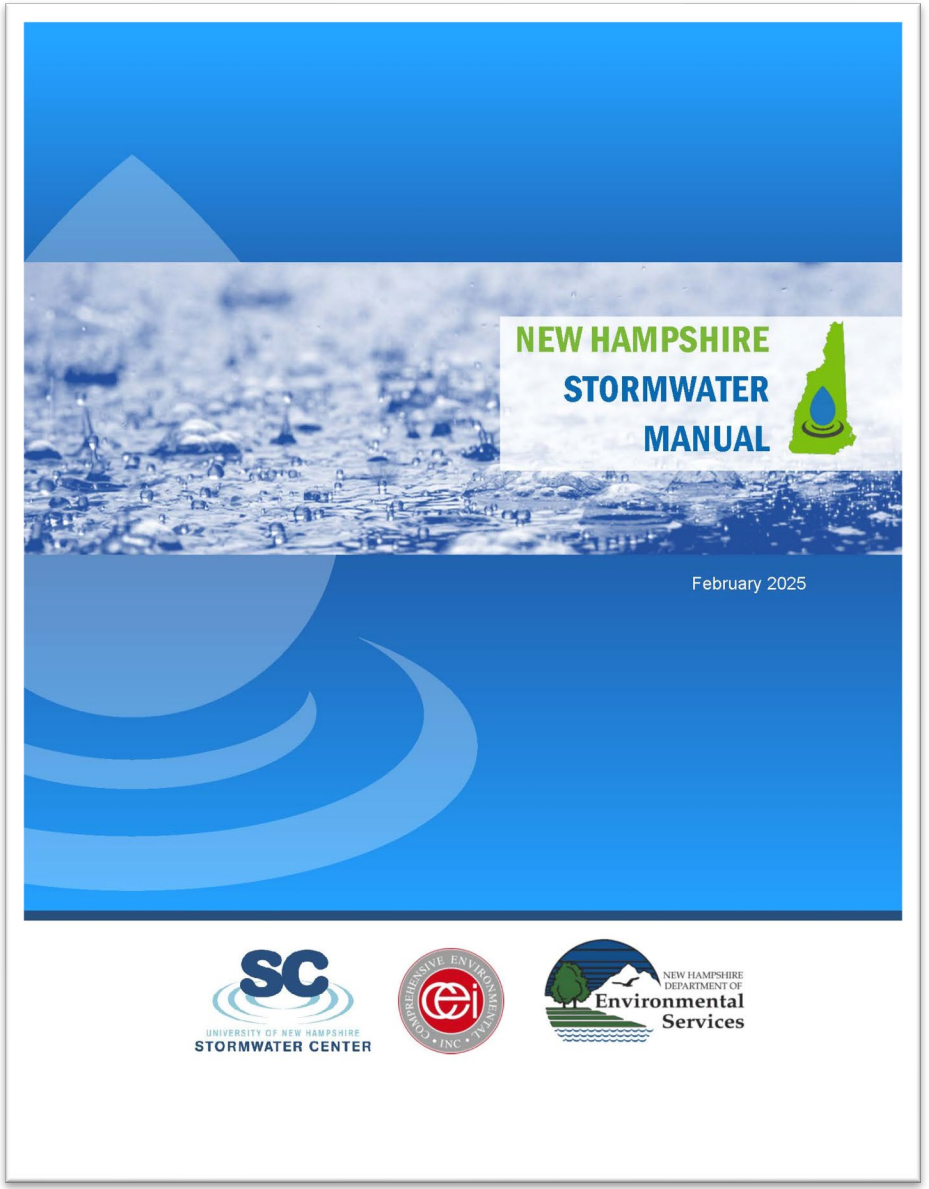
Background

What was the Manual update process?

- Needs Assessment – collaboration with project team and stakeholders
- Expert panel reviewers

How will the Manual be managed and updated moving forward?

- Updated periodically as the State-of-the-Practice advances



Funding Sources

- Clean Water Act grant through EPA
- Clean Water State Revolving Fund through NHDES

Outreach Funding Source

- New England Environmental Finance Center

What Does the 2025 Manual Provide?

- Technical guidance compiling state-of-the-science recommendations
- References to pertinent State and Federal permitting programs with updated rules and regulations

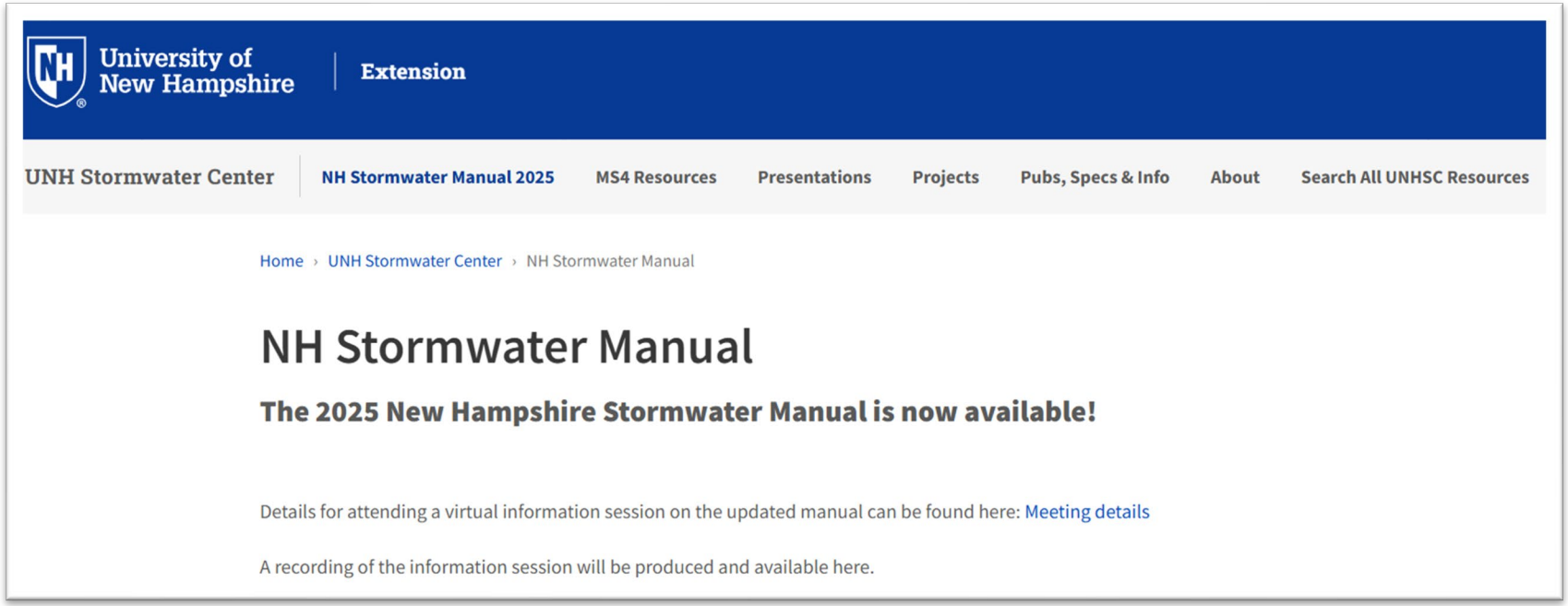
Similar to the 2008 Manual, the 2025 Manual is a guidance document, **not a regulatory document**.

Individuals are encouraged to reach out to the program staff for additional information.

Manual Stewardship

- Transferred from NHDES to UNHSC

https://extension.unh.edu/stormwater-center/nh-stormwater-manual



And More.....

Overview of Content Updates

(not an exhaustive list)

Overview of General Content Updates

- New Concepts
- General Content (*e.g., regulatory updates*)
- New Topics (*e.g., emerging contaminants*)
- Design Criteria and Methods (*e.g., WPS*)
- SCM Selection
- SCM and E&SC Fact Sheets
- Overall Formatting and Organization

New Concepts

State-of-the-Practice

- Guidance intended to represent to latest science-based research
- In some cases, "a step ahead" or different from regulatory requirements and related design criteria
- Indicated in Manual by "**NH plus**" icon

Applicants and designers must refer to applicable permit requirements to ensure compliance.

New Concepts

Watershed Protection Standard (WPS)

- Developed based on research by EPA in the Taunton, MA watershed
- To provide communities with a resilient site development alternative for stormwater management
- **Goal:** Drive watershed back to pre-development conditions by using LID and Green Infrastructure SCMs

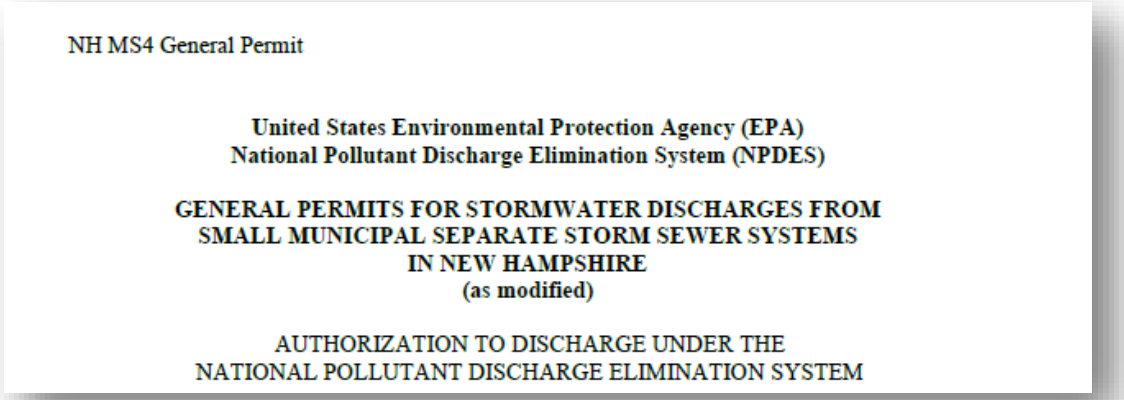
New Concepts

"BMPs" → "SCMs"

- Updated terminology to be consistent with EPA
- New name, same goal
- Other recommended practices (e.g., construction management) are still BMPs

Regulatory References

- Updated regulation and permitting references
  - 2024 NHDES AoT
  - 2022 EPA CGP
  - 2017 EPA NH MS4 Permit, modified 2020
  - Draft 2024 EPA MA MS4 Permit


NH MS4 General Permit

United States Environmental Protection Agency (EPA)
National Pollutant Discharge Elimination System (NPDES)

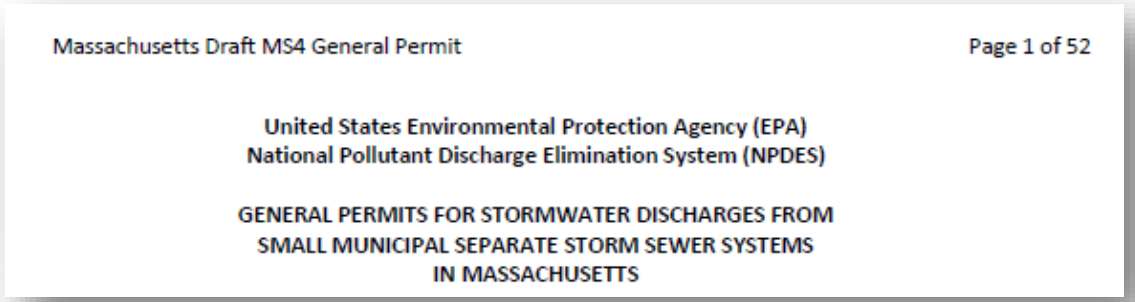
GENERAL PERMITS FOR STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS IN NEW HAMPSHIRE
(as modified)

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM


Rules as amended effective 9-24-2024 (adopted rules noted)

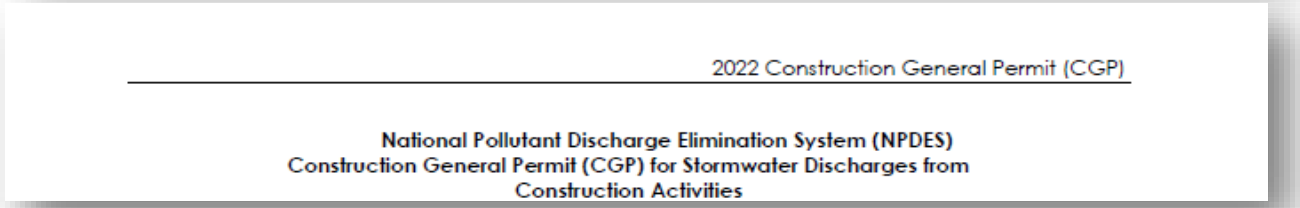
CHAPTER Env-Wq 1500 ALTERATION OF TERRAIN

Statutory Authority: RSA 485-A:6, VIII; RSA 485-A:17


Massachusetts Draft MS4 General Permit Page 1 of 52

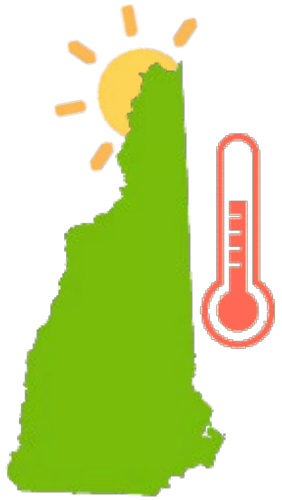
United States Environmental Protection Agency (EPA)
National Pollutant Discharge Elimination System (NPDES)

GENERAL PERMITS FOR STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS IN MASSACHUSETTS

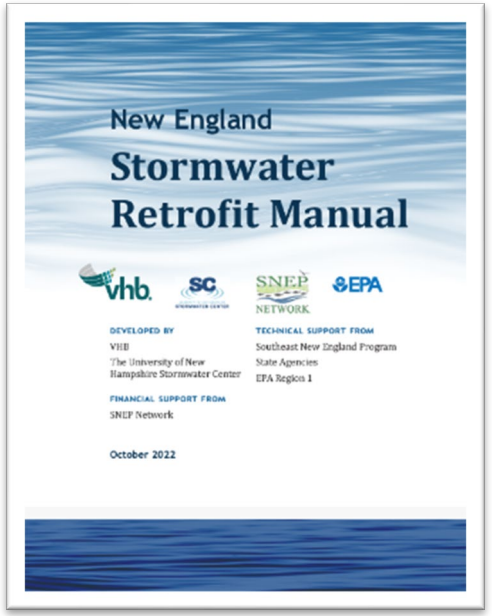

2022 Construction General Permit (CGP)

National Pollutant Discharge Elimination System (NPDES)
Construction General Permit (CGP) for Stormwater Discharges from Construction Activities

New Topics



- Harmful Algal Blooms
- Emerging contaminants (e.g., PFAs)
- Climate adaptation and resiliency
- Additional municipal stormwater management programs
  - Asset management
  - IDDE program
  - NHDES Green SnowPro certification program
  - Public education and outreach program
- Stormwater grants and funding opportunities
- Retrofits



Design Criteria and Methods

Watershed Protection Standard (WPS)

- **Step 1 – Site Design**: Emphasize pre-dev. hydrology (e.g., preserve watershed function, LID)
- **Step 2 – Retention**: Design SCMs so DSV is expected to yield no net increase in nutrient discharge.
- **Step 3 – Treatment**: If retention goal can't be met, design for 90% TSS, 60% TP, and 50% TN removal.
- **Other Requirements** – Make sure other applicable requirements are met (e.g., peak rate).

UNHSC has developed a **WPS Calculator** to standardize SCM sizing for retention:
https://scholars.unh.edu/stormwater/130/

Design Criteria & Methods

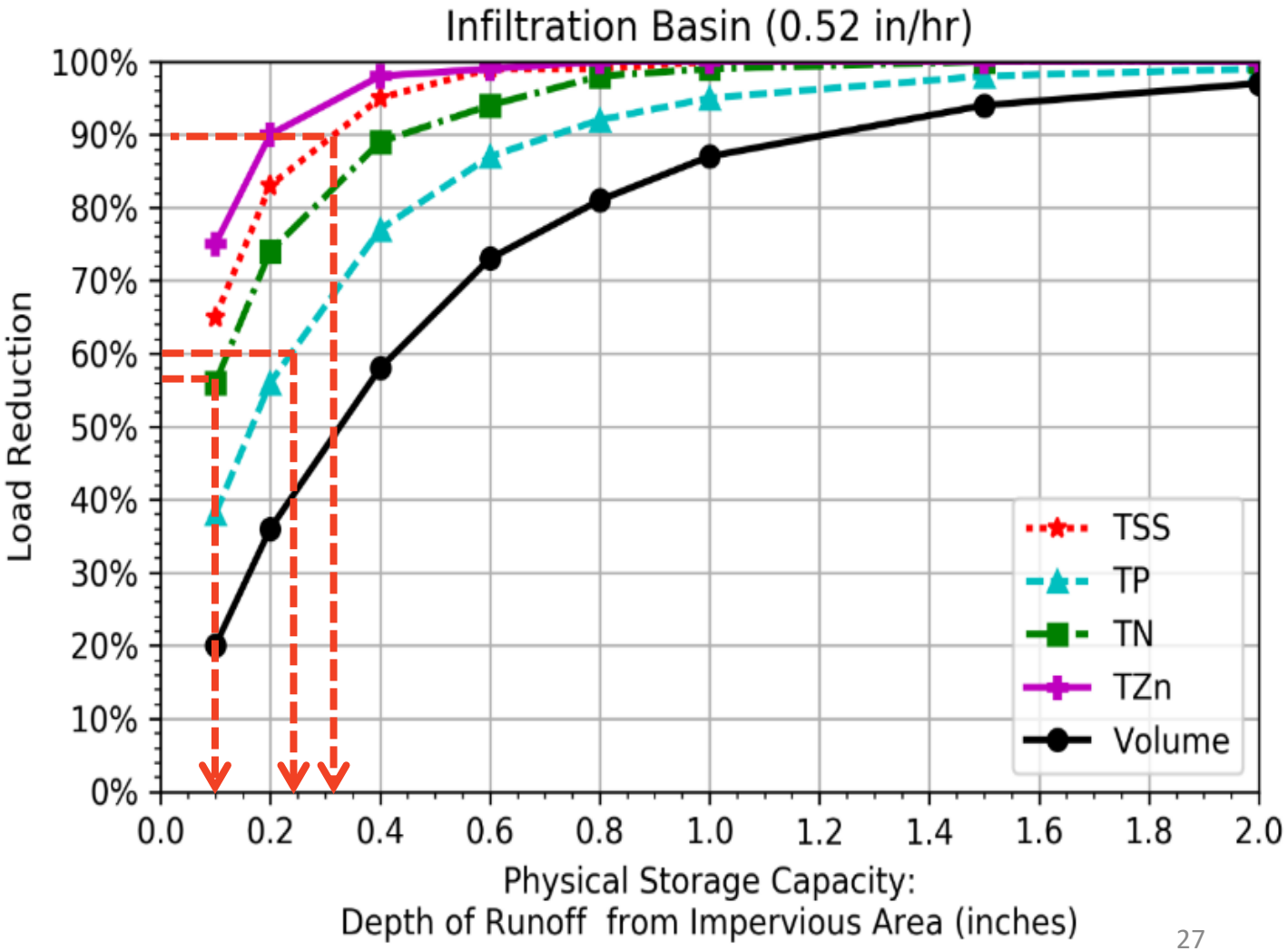
Pollutant Removal via EPA Performance Curves

To meet pollutant removal targets:

- 90% TSS ~ **0.32 inches**
- 60% TP ~ 0.25 inches
- 50% TN < 0.1 inches

Resources for Pollutant Tracking and Accounting:

- UNHSC webpage: *https://extension.unh.edu/stormwater-center*
- EPA Performance Curves: *https://extension.unh.edu/stormwater-center/ms4-resources*
- NHDES MS4 Resources webpage: *https://www.nhms4.des.nh.gov/*
- NHDES Pollutant Tracking and Accounting Project (PTAP) resources: *https://www.nhms4.des.nh.gov/nh-resources/pollutant-tracking-and-accounting-project-ptap*



Design Criteria & Methods

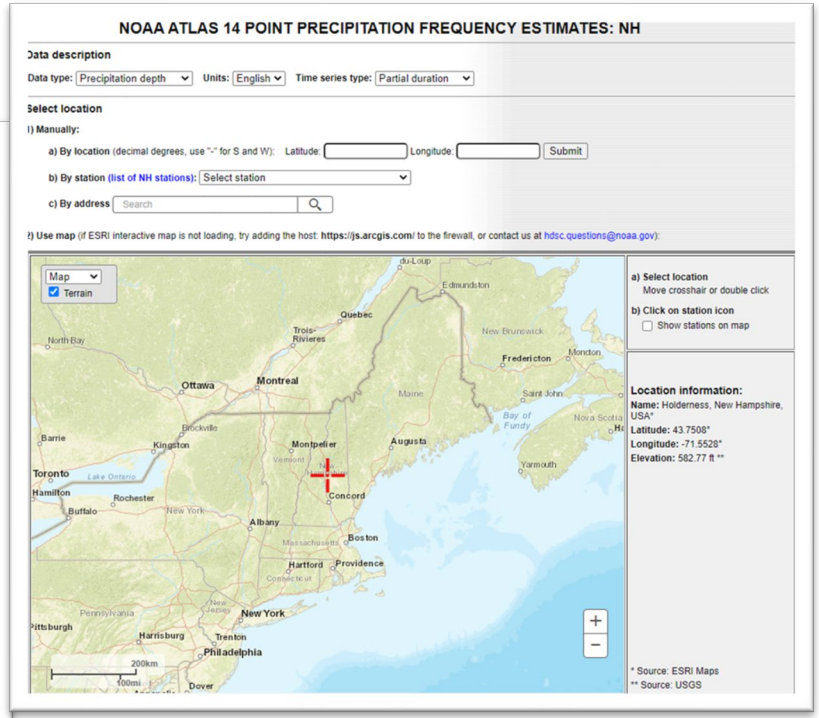
Precipitation Data

TP40 → NOAA Atlas 14

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.338** (0.265-0.430)	**0.393** (0.308-0.501)	**0.483** (0.377-0.617)	**0.558** (0.434-0.717)	**0.662** (0.496-0.883)	**0.742** (0.543-1.01)	**0.822** (0.581-1.15)	**0.906** (0.612-1.31)	**1.02** (0.661-1.52)	**1.10** (0.699-1.69)
10-min	**0.479** (0.376-0.609)	**0.557** (0.437-0.710)	**0.685** (0.535-0.876)	**0.791** (0.615-1.02)	**0.938** (0.703-1.25)	**1.05** (0.770-1.43)	**1.16** (0.824-1.63)	**1.28** (0.866-1.85)	**1.44** (0.937-2.16)	**1.56** (0.990-2.39)
15-min	**0.563** (0.442-0.716)	**0.655** (0.514-0.835)	**0.806** (0.630-1.03)	**0.931** (0.722-1.20)	**1.10** (0.827-1.47)	**1.24** (0.905-1.68)	**1.37** (0.969-1.92)	**1.51** (1.02-2.18)	**1.70** (1.10-2.54)	**1.84** (1.16-2.81)
30-min	**0.761** (0.597-0.968)	**0.886** (0.695-1.13)	**1.09** (0.851-1.39)	**1.26** (0.980-1.62)	**1.50** (1.12-2.00)	**1.68** (1.23-2.28)	**1.86** (1.31-2.60)	**2.04** (1.38-2.96)	**2.30** (1.49-3.44)	**2.50** (1.58-3.81)
60-min	**0.959** (0.752-1.22)	**1.12** (0.876-1.42)	**1.38** (1.08-1.76)	**1.59** (1.24-2.04)	**1.89** (1.42-2.52)	**2.12** (1.55-2.88)	**2.34** (1.66-3.29)	**2.58** (1.75-3.74)	**2.90** (1.88-4.34)	**3.15** (1.99-4.81)
2-hr	**1.21** (0.956-1.53)	**1.42** (1.12-1.79)	**1.75** (1.38-2.22)	**2.03** (1.58-2.59)	**2.41** (1.82-3.22)	**2.69** (2.00-3.68)	**3.00** (2.16-4.26)	**3.36** (2.28-4.84)	**3.91** (2.54-5.82)	**4.38** (2.78-6.64)
3-hr	**1.38** (1.09-1.74)	**1.62** (1.28-2.04)	**2.02** (1.59-2.55)	**2.34** (1.84-2.98)	**2.80** (2.13-3.73)	**3.13** (2.34-4.27)	**3.49** (2.54-4.98)	**3.95** (2.68-5.67)	**4.67** (3.04-6.92)	**5.29** (3.36-8.00)
6-hr	**1.70** (1.36-2.13)	**2.03** (1.62-2.55)	**2.57** (2.04-3.23)	**3.02** (2.38-3.82)	**3.64** (2.79-4.84)	**4.09** (3.08-5.57)	**4.59** (3.38-6.55)	**5.24** (3.57-7.48)	**6.29** (4.11-9.28)	**7.23** (4.61-10.9)
12-hr	**2.07** (1.66-2.58)	**2.52** (2.02-3.14)	**3.26** (2.61-4.07)	**3.88** (3.08-4.86)	**4.72** (3.64-6.24)	**5.34** (4.04-7.23)	**6.02** (4.45-8.53)	**6.90** (4.72-9.79)	**8.32** (5.45-12.2)	**9.57** (6.12-14.3)
24-hr	**2.45** (1.98-3.02)	**3.02** (2.44-3.73)	**3.96** (3.19-4.91)	**4.75** (3.79-5.91)	**5.82** (4.51-7.64)	**6.61** (5.03-8.89)	**7.48** (5.55-10.5)	**8.59** (5.89-12.1)	**10.4** (6.81-15.1)	**11.9** (7.65-17.7)



4.75
(3.79-5.91)

Fitted Value
(Lower Confidence – Upper Confidence)

SCM Selection

Performance Expectations (Tiers)

1 **Tier 1** SCMs can typically be designed to meet the Watershed Protection Standard (WPS) for retention while providing the highest level of pollutant reduction and meeting site design criteria for groundwater recharge and peak runoff control.

2 **Tier 2** SCMs can typically provide a moderate level of pollutant reduction but may not meet all site design criteria.

3 **Tier 3** SCMs typically provide the lowest level of pollutant reduction and may not meet all site design criteria.

N/A **Non-Applicable** SCMs may be an integral part of a conveyance system or treatment train but cannot meet site design criteria on their own.

SCM Selection

Performance Expectations (Tiers)

	SCM Tier	Chapter Env-Wq 1500 Reference	Applicable EPA Performance Curve	Unit Operation and Process (UOP)	Can SCM Meet NHDES AoT (Env-Wq 1500) Design Criteria if Properly Designed?[5]			
					Pollutant Removal (*1507.03*)	Groundwater Recharge (*1507.04*)	Channel Protection *(1507.05)*	Peak Control *(1507.06)*
Nonstructural Source Controls								
Catch Basin Cleaning	**N/A**	--	--	Source Control	No	No	No	No
Structural Treatment								
Bioretention System (Infiltrating)	**1**	1508.07 Infiltration Practices	Infiltration Basin	Infiltration	Yes	Yes	Yes	Yes
Gravel Wetland	**2**	1508.05 Gravel Wetlands	Gravel Wetland	Biological	Yes	No	Yes	Yes
Sand Filter	**3**	1508.08 Filtering Practices	Sand Filter	Filtering	Yes	No	No	Varies

SCM Selection

Pollutant Removal Capabilities

	Applicable EPA Performance Curve	Pollutant of Concern				
		TN	TP	TSS	Metals	Bacteria
Nonstructural Source Controls						
Catch Basin Cleaning	--	No	No	No	No	No
Structural Treatment						
Bioretention System (Infiltrating)	Infiltration Basin	Yes	Yes	Yes	Yes	Yes
Bioretention System (Filtering)	Biofiltration	No	Yes	Yes	Yes	Yes
Extended Dry Detention Pond	Dry Pond	No	No	No	Yes	Yes
Flow-Through Treatment Swale	Grass Swale	No	No	Yes	No	No
Sand Filter	Sand Filter	No	Yes	Yes	Yes	Yes
Wet Pond	Wet Pond	No	Yes	Yes	Yes	No

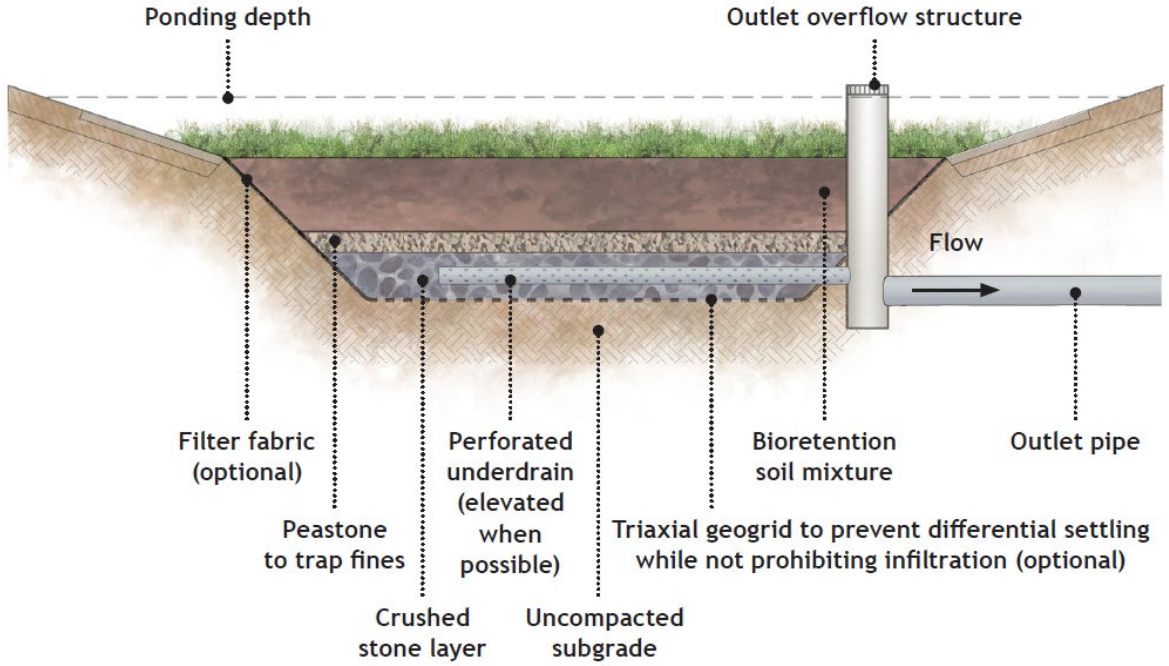
Yes = Likely to provide significant reduction of target pollutant.

No = Unlikely to provide significant reduction of target pollutant.

SCM Updates

New Fact Sheets
Catch Basin Cleaning
Leaf Litter Pickup

Updated Fact Sheets
Added infiltrating version of: Tree Box Filter, Permeable Pavement, Bioretention System
Added Bioretention with ISR to Bioretention Systems
Stormwater Ponds (5 types)→ Wet Pond and Extended Dry Detention Pond
Stormwater Wetlands (4 types)→ Stormwater Wetland and Gravel Wetland
Vegetated Buffers → IA Disconnection



Bioretention System

(Source: SNEP 2022 New England Retrofit Manual)

SCM Updates

New Content

Added consideration to wildlife protection laws for SCM maintenance

Added tables noting the ability of the SCM to meet AoT requirements

Maintenance Requirements

- Maintenance activities need to comply with laws that protect wildlife, including but not limited to RSA 209:8, RSA 209:9, RSA 209:10, and RSA 212-A:7.

Ability to Meet AoT Requirements

Can SCM Meet AoT Requirements if Properly Designed?[1,2]

AoT Requirement[3]	Permeable Pavement (Infiltrating)	Permeable Pavement (Filtering)
Pollutant Removal (AoT 1507.03)	Yes	Yes
Groundwater Recharge (AoT 1507.04)	Yes	No
Channel Protection (AoT 1507.05)	Yes	Yes
Peak Runoff Control (AoT 1507.06)	Yes	Yes

[1] *See **Chapter 4 (Design Criteria)** for more information.*

[2] *Refer to Env-Wq 1508.07 Infiltration Practices/ Env-Wq 1508.08 Filtering Practices for all SCM AoT requirements.*

[3] *In accordance with Env-Wq 1507.07 Long-Term Maintenance, all SCMs should have a mechanism to provide on-going inspections and maintenance so long as the practices are expected to be used.*

Erosion & Sediment Control Measure Updates

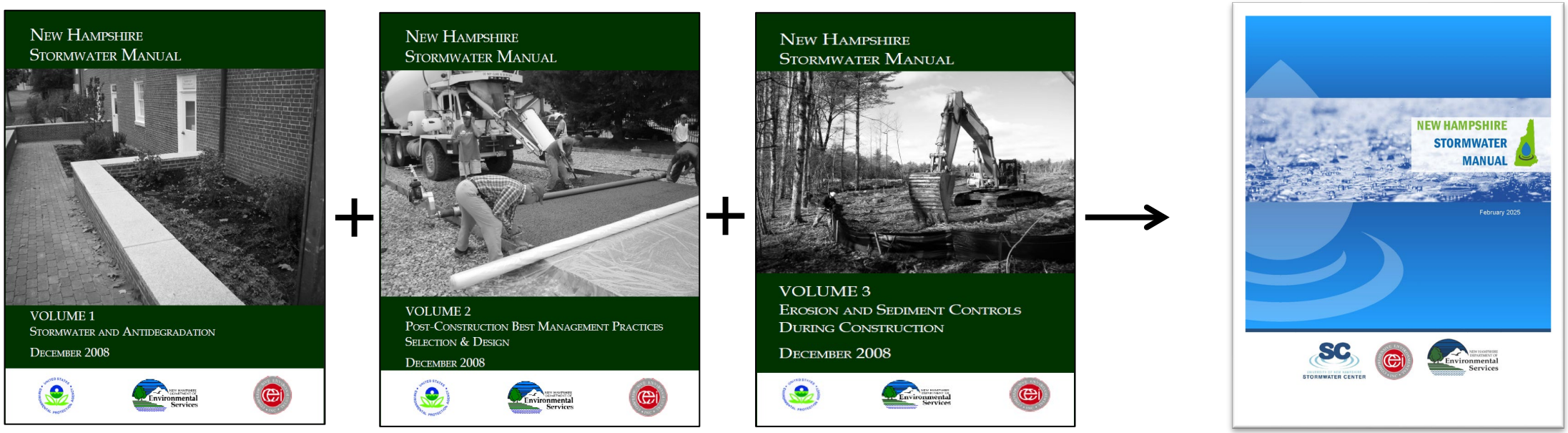
New Fact Sheets
Tree Preservation and Protection
Turbidity Curtain

Updated Fact Sheets
Added wildlife friendly considerations for blankets and matting
Erosion Control Mix Berms → Erosion Control Mix Berm, Filter Sock

(Source: NHDES Environmental Fact Sheet SP-1- Erosion Control for Construction within the Protected Shoreland)

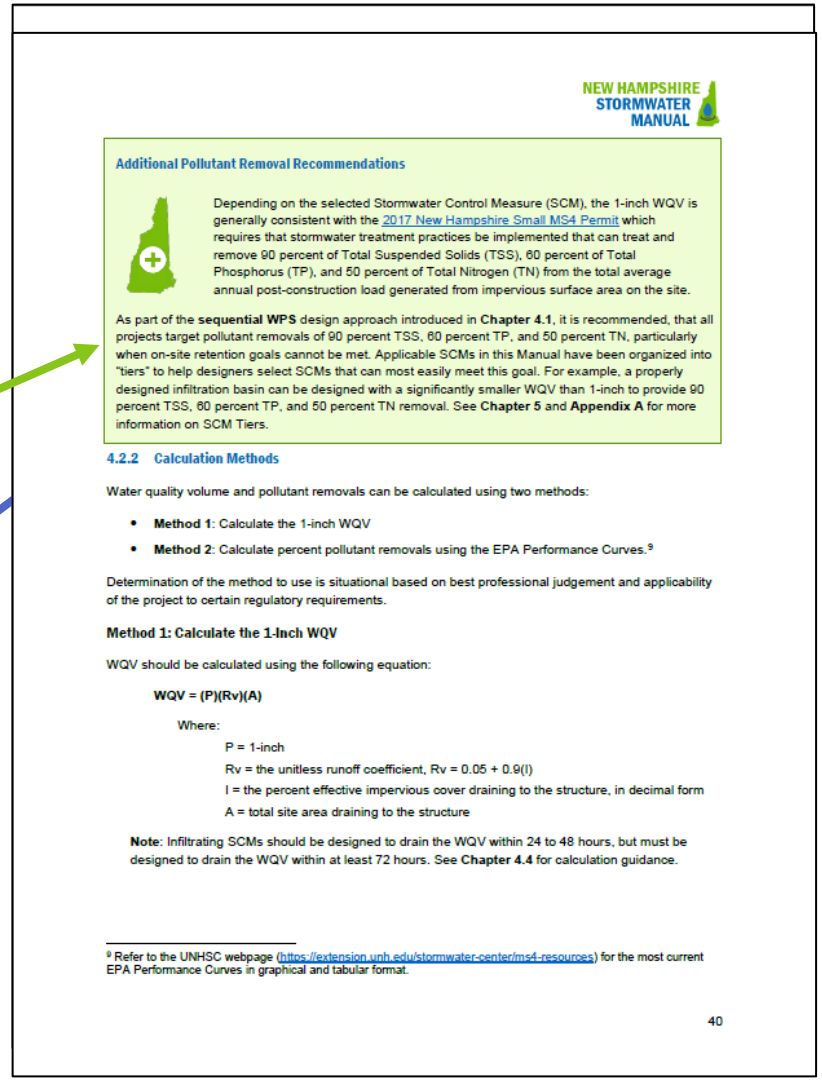
Manual Preview – Key Formatting Changes

- Combined 3 existing volumes (2008) into 1 document (2025)
  - Chapters 1-6
  - Appendix A. Stormwater Control Measure Fact Sheets
  - Appendix B. Erosion and Sediment Control Fact Sheets



Manual Preview – Key Formatting Changes

- New cover page
- In color
- Searchable headings (i.e., live links)
- Callout boxes for key concepts
- Standardized example calculation boxes



NEW HAMPSHIRE STORMWATER MANUAL

Additional Pollutant Removal Recommendations

Depending on the selected Stormwater Control Measure (SCM), the 1-inch WQV is generally consistent with the 2017 New Hampshire Small MS4 Permit which requires that stormwater treatment practices be implemented that can treat and remove 90 percent of Total Suspended Solids (TSS), 60 percent of Total Phosphorus (TP), and 50 percent of Total Nitrogen (TN) from the total average annual post-construction load generated from impervious surface area on the site.

As part of the **sequential WPS** design approach introduced in **Chapter 4.1**, it is recommended, that all projects target pollutant removals of 90 percent TSS, 60 percent TP, and 50 percent TN, particularly when on-site retention goals cannot be met. Applicable SCMs in this Manual have been organized into "tiers" to help designers select SCMs that can most easily meet this goal. For example, a properly designed infiltration basin can be designed with a significantly smaller WQV than 1-inch to provide 90 percent TSS, 60 percent TP, and 50 percent TN removal. See **Chapter 5** and **Appendix A** for more information on SCM Tiers.

4.2.2 Calculation Methods

Water quality volume and pollutant removals can be calculated using two methods:

- **Method 1**: Calculate the 1-inch WQV
- **Method 2**: Calculate percent pollutant removals using the EPA Performance Curves.[9]

Determination of the method to use is situational based on best professional judgement and applicability of the project to certain regulatory requirements.

Method 1: Calculate the 1-Inch WQV

WQV should be calculated using the following equation:

WQV = (P)(Rv)(A)

Where:

P = 1-inch

Rv = the unitless runoff coefficient, Rv = 0.05 + 0.9(I)

I = the percent effective impervious cover draining to the structure, in decimal form

A = total site area draining to the structure

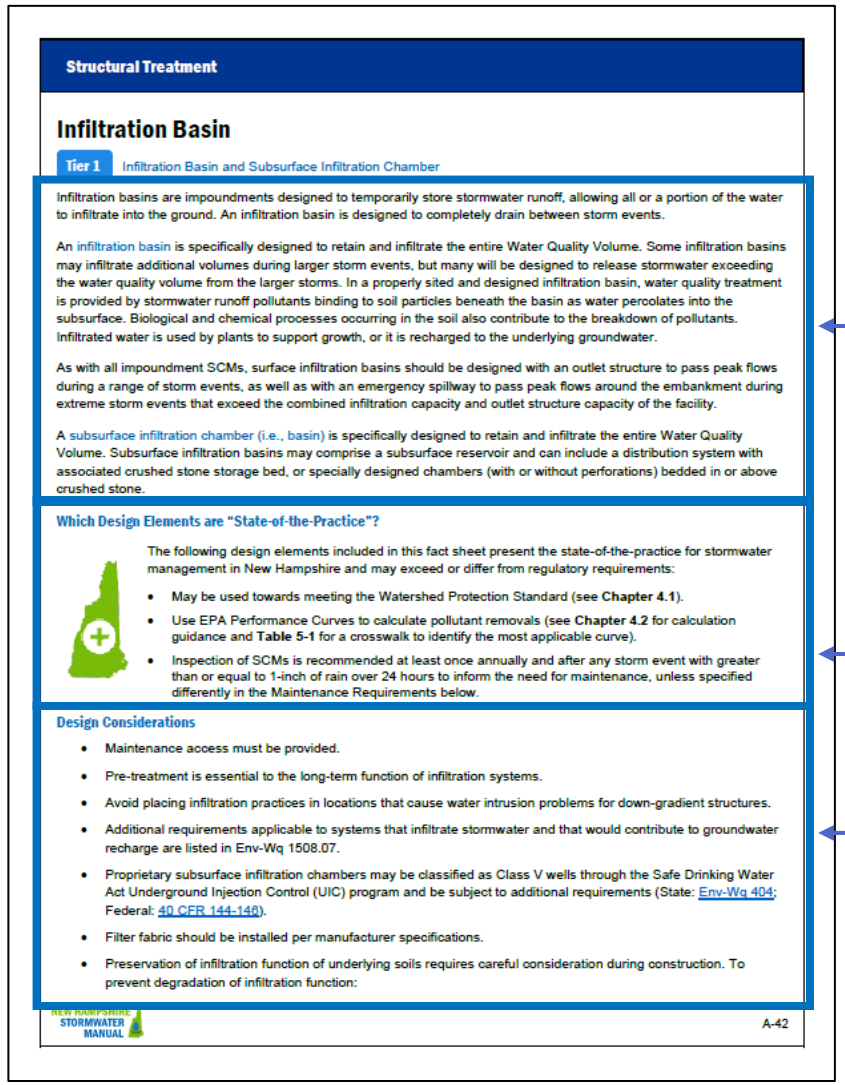
Note: Infiltrating SCMs should be designed to drain the WQV within 24 to 48 hours, but must be designed to drain the WQV within at least 72 hours. See **Chapter 4.4** for calculation guidance.

[9] Refer to the UNHSC webpage (https://extension.unh.edu/stormwater-center/ms4-resources) for the most current EPA Performance Curves in graphical and tabular format.

40

Manual Preview – Key Formatting Changes

- Updated Fact Sheet formatting



Structural Treatment

Infiltration Basin

Tier 1 Infiltration Basin and Subsurface Infiltration Chamber

Infiltration basins are impoundments designed to temporarily store stormwater runoff, allowing all or a portion of the water to infiltrate into the ground. An infiltration basin is designed to completely drain between storm events.

An infiltration basin is specifically designed to retain and infiltrate the entire Water Quality Volume. Some infiltration basins may infiltrate additional volumes during larger storm events, but many will be designed to release stormwater exceeding the water quality volume from the larger storms. In a properly sited and designed infiltration basin, water quality treatment is provided by stormwater runoff pollutants binding to soil particles beneath the basin as water percolates into the subsurface. Biological and chemical processes occurring in the soil also contribute to the breakdown of pollutants. Infiltrated water is used by plants to support growth, or it is recharged to the underlying groundwater.

As with all impoundment SCMs, surface infiltration basins should be designed with an outlet structure to pass peak flows during a range of storm events, as well as with an emergency spillway to pass peak flows around the embankment during extreme storm events that exceed the combined infiltration capacity and outlet structure capacity of the facility.

A subsurface infiltration chamber (i.e., basin) is specifically designed to retain and infiltrate the entire Water Quality Volume. Subsurface infiltration basins may comprise a subsurface reservoir and can include a distribution system with associated crushed stone storage bed, or specially designed chambers (with or without perforations) bedded in or above crushed stone.

Which Design Elements are "State-of-the-Practice"?

The following design elements included in this fact sheet present the state-of-the-practice for stormwater management in New Hampshire and may exceed or differ from regulatory requirements:

- May be used towards meeting the Watershed Protection Standard (see **Chapter 4.1**).
- Use EPA Performance Curves to calculate pollutant removals (see **Chapter 4.2** for calculation guidance and **Table 5-1** for a crosswalk to identify the most applicable curve).
- Inspection of SCMs is recommended at least once annually and after any storm event with greater than or equal to 1-inch of rain over 24 hours to inform the need for maintenance, unless specified differently in the Maintenance Requirements below.

Design Considerations

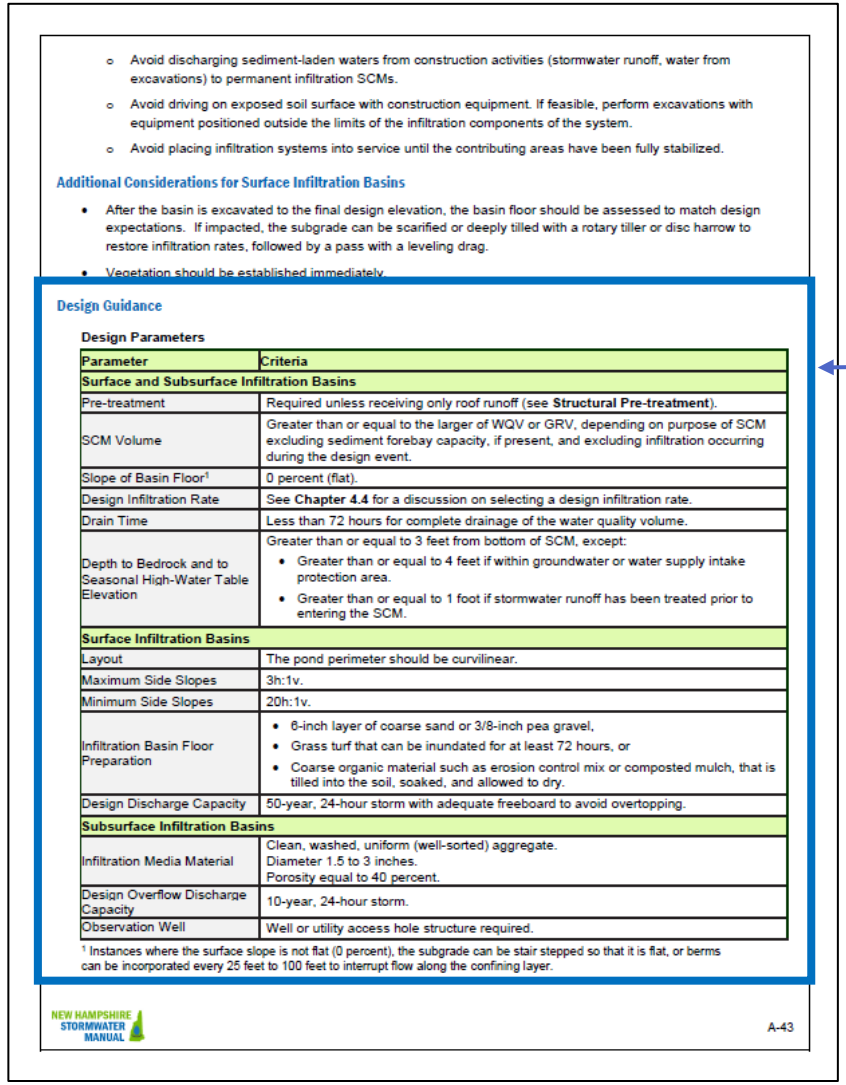
- Maintenance access must be provided.
- Pre-treatment is essential to the long-term function of infiltration systems.
- Avoid placing infiltration practices in locations that cause water intrusion problems for down-gradient structures.
- Additional requirements applicable to systems that infiltrate stormwater and that would contribute to groundwater recharge are listed in Env-Wq 1508.07.
- Proprietary subsurface infiltration chambers may be classified as Class V wells through the Safe Drinking Water Act Underground Injection Control (UIC) program and be subject to additional requirements (State: Env-Wq 404; Federal: 40 CFR 144-146).
- Filter fabric should be installed per manufacturer specifications.
- Preservation of infiltration function of underlying soils requires careful consideration during construction. To prevent degradation of infiltration function:

NEW HAMPSHIRE STORMWATER MANUAL A-42

Introduction to SCM

"State-of-the-Practice" Design Elements

Design Considerations



- Avoid discharging sediment-laden waters from construction activities (stormwater runoff, water from excavations) to permanent infiltration SCMs.
- Avoid driving on exposed soil surface with construction equipment. If feasible, perform excavations with equipment positioned outside the limits of the infiltration components of the system.
- Avoid placing infiltration systems into service until the contributing areas have been fully stabilized.

Additional Considerations for Surface Infiltration Basins

- After the basin is excavated to the final design elevation, the basin floor should be assessed to match design expectations. If impacted, the subgrade can be scarified or deeply tilled with a rotary tiller or disc harrow to restore infiltration rates, followed by a pass with a leveling drag.
- Vegetation should be established immediately.

Design Guidance

Design Parameters

Parameter	Criteria
Surface and Subsurface Infiltration Basins	
Pre-treatment	Required unless receiving only roof runoff (see **Structural Pre-treatment**).
SCM Volume	Greater than or equal to the larger of WQV or GRV, depending on purpose of SCM excluding sediment forebay capacity, if present, and excluding infiltration occurring during the design event.
Slope of Basin Floor[1]	0 percent (flat).
Design Infiltration Rate	See **Chapter 4.4** for a discussion on selecting a design infiltration rate.
Drain Time	Less than 72 hours for complete drainage of the water quality volume.
Depth to Bedrock and to Seasonal High-Water Table Elevation	Greater than or equal to 3 feet from bottom of SCM, except: • Greater than or equal to 4 feet if within groundwater or water supply intake protection area. • Greater than or equal to 1 foot if stormwater runoff has been treated prior to entering the SCM.
Surface Infiltration Basins	
Layout	The pond perimeter should be curvilinear.
Maximum Side Slopes	3h:1v.
Minimum Side Slopes	20h:1v.
Infiltration Basin Floor Preparation	• 6-inch layer of coarse sand or 3/8-inch pea gravel, • Grass turf that can be inundated for at least 72 hours, or • Coarse organic material such as erosion control mix or composted mulch, that is tilled into the soil, soaked, and allowed to dry.
Design Discharge Capacity	50-year, 24-hour storm with adequate freeboard to avoid overtopping.
Subsurface Infiltration Basins	
Infiltration Media Material	Clean, washed, uniform (well-sorted) aggregate. Diameter 1.5 to 3 inches. Porosity equal to 40 percent.
Design Overflow Discharge Capacity	10-year, 24-hour storm.
Observation Well	Well or utility access hole structure required.

[1] Instances where the surface slope is not flat (0 percent), the subgrade can be stair stepped so that it is flat, or berms can be incorporated every 25 feet to 100 feet to interrupt flow along the confining layer.

NEW HAMPSHIRE STORMWATER MANUAL A-43

Design Guidance/ Design Parameters table

Manual Preview – Key Formatting Changes

- Updated Fact Sheet formatting

Maintenance Requirements

- Maintenance activities need to comply with laws that protect wildlife, including but not limited to RSA 209:8, RSA 209:9, RSA 209:10, and RSA 212-A:7.
- Removal of debris from inlet and outlet structures.
- Removal of accumulated sediment.
- Inspection and repair of outlet structures and accessories.
- Inspection of infiltration components at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24-hour period, with maintenance or rehabilitation conducted as warranted by such inspection.
- Inspection of pre-treatment measures at least twice annually, and removal of accumulated sediment as warranted by inspection, but no less than once annually.
- If an infiltration system does not drain within 72 hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore infiltration function, including but not limited to removal of accumulated sediments or reconstruction of the infiltration basin.
- Vegetation should be inspected at least annually, and maintained in healthy condition, including pruning, removal, and replacement of dead or diseased vegetation, and removal of invasive species.

Additional Requirements for Surface Infiltration Basins:

- Periodic mowing of embankments.
- Removal of woody vegetation from embankments.
- Inspection and repair of embankments and spillways.

Maintenance Requirements

Ability to Meet AoT Requirements

Can SCM Meet AoT Requirements if Properly Designed?[1,2]

AoT Requirement[3]	Infiltration Basin	Subsurface Infiltration Basin
Pollutant Removal (AoT 1507.03)	Yes	Yes
Groundwater Recharge (AoT 1507.04)	Yes	Yes
Channel Protection (AoT 1507.05)	Yes	Yes
Peak Runoff Control (AoT 1507.06)	Yes	Yes

[1] *See **Chapter 4 (Design Criteria)** for more information.*

[2] *Refer to Env-Wq 1508.07 Infiltration Practices for all SCM AoT requirements.*

[3] *In accordance with Env-Wq 1507.07 Long-Term Maintenance, all SCMs should have a mechanism to provide on-going inspections and maintenance so long as the practices are expected to be used.*

NEW HAMPSHIRE STORMWATER MANUAL A-44

Ability to Meet AoT Requirements

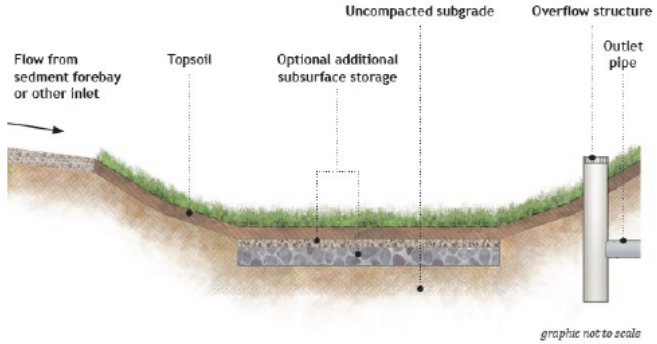
Maintenance Requirements

Example Design Schematics

Example Design Schematics

Infiltration Basin

Profile



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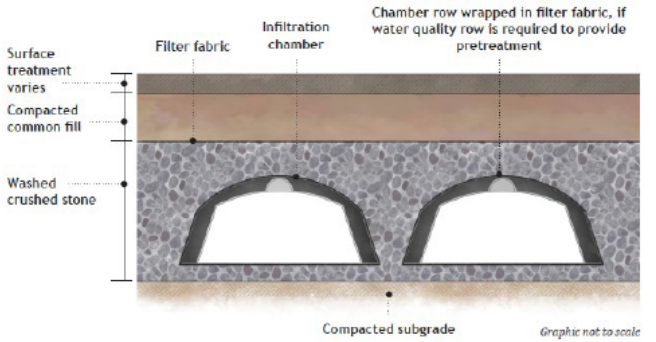
Subsurface Infiltration Chamber

Profile



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Alteration of Terrain Crosswalk

(How does the Manual connect to AoT?)

How Does the Manual Connect to AoT?

Topic	AoT	Manual
Overview of Chapter 1500 AoT Permitting Program	Env-Wq 1500	Chapter 3.2.3
WQV/ WQF Calculations (including new WQV/ WQF Redevelopment requirements)	Env-Wq 1507.03	Chapter 4.2-4.3
Groundwater Recharge Calculations	Env-Wq 1507.04	Chapter 4.4
Design Infiltration Rate	Env-Wq 1504.14	Chapter 4.5
Effective Impervious Cover (EIC) and Undisturbed Cover (UDC)	Env-Wq 1504.07	Chapter 4.6
Channel Protection Calculations	Env-Wq 1507.05	Chapter 4.7
Peak Runoff Control Calculations	Env-Wq 1507.06	Chapter 4.8
AoT Documentation Requirements	Env-Wq 1504	Chapter 5.1.2
Inspection and Maintenance Manual	Env-Wq 1507.07	Chapter 5.5.2

Note: All AoT requirements are **not** included in the Manual. Designers must directly reference regulations for all applicable requirements.

How Does the Manual Connect to AoT? (cont.)

	SCM Tier	Chapter Env-Wq 1500 Reference	Can SCM Meet NHDES AoT (Env-Wq 1500) Design Criteria if Properly Designed?			
			Pollutant Removal (*1507.03*)	Groundwater Recharge (*1507.04*)	Channel Protection (*1507.05*)	Peak Control (*1507.06*)
Nonstructural Source Controls						
Catch Basin Cleaning	N/A	--	No	No	No	No
Structural Treatment						
Bioretention System (Infiltrating)	1	1508.07 Infiltration Practices	Yes	Yes	Yes	Yes
Gravel Wetland	2	1508.05 Gravel Wetlands	Yes	No	Yes	Yes
Sand Filter	3	1508.08 Filtering Practices	Yes	No	No	Varies

Ability to Meet AoT Requirements

Can SCM Meet AoT Requirements if Properly Designed?[1,2]

AoT Requirement[3]	Permeable Pavement (Infiltrating)	Permeable Pavement (Filtering)
Pollutant Removal (AoT 1507.03)	Yes	Yes
Groundwater Recharge (AoT 1507.04)	Yes	No
Channel Protection (AoT 1507.05)	Yes	Yes
Peak Runoff Control (AoT 1507.06)	Yes	Yes

[1] *See **Chapter 4 (Design Criteria)** for more information.*

[2] *Refer to Env-Wq 1508.07 Infiltration Practices/ Env-Wq 1508.08 Filtering Practices for all SCM AoT requirements.*

[3] *In accordance with Env-Wq 1507.07 Long-Term Maintenance, all SCMs should have a mechanism to provide on-going inspections and maintenance so long as the practices are expected to be used.*

AoT Crosswalk for Select Design Criteria

Topic	AoT Requirements	Manual State-of-the-Practice Guidance
SCM Design Elements	Traditional SCM-specific design elements	State-of-the-Practice design elements
Pollutant Removal	1-inch WQV TP: Infiltration or amended filter media TN: Gravel wetland or Bioretention with ISR **only**	Sequential WPS design approach
Groundwater Recharge	Calculation of Groundwater Recharge Volume (GRV)	Sequential WPS design approach
Peak Runoff Control	Post-development peak discharge < pre-development for 10- and 50-year, 24 hr storms.	Consider designing to higher depths (e.g., 100-yr storm) for sites that discharge to receiving areas sensitive to changes in upstream development

SCM Design Elements

- Differences in SCMs and associated design elements
  - "Plus" icon to identify criteria that exceeds or differs from state permitting requirements
  - Key references:
    - SNEP 2022 New England Stormwater Retrofit Manual
    - UNHSC Publications and Specifications

Goal:

To present State-of-the-Practice criteria, representing the latest science-based research and where the field is heading, for improved ability to manage stormwater

SCM Design Elements Example

Gravel Wetlands

AoT Requirements

Env-Wq 1508.05 Stormwater Treatment Practices: Gravel Wetlands. If a gravel wetland is used, the system shall be designed in accordance with "UNHSC Subsurface Gravel Wetland Design Specifications", January 2022, available as noted in Appendix B, with the stipulation that the system shall have:

(a) A sediment forebay as specified in Env-Wq 1508.12; and

(b) Two treatment bays, each of which is designed to filter at least 45% of the WQV.

Source. #12342, eff 8-15-17 (formerly in Env-Wq 1508.04(f) in #9817-A, eff 12-1-10 (See Revision Note #3 at chapter heading for Env-Wq 1500); ss by #13758, eff 9-28-23 (see Revision Note #4 at chapter heading for Env-Wq 1500)

Manual State-of-the-Practice Recommendations

- Updated design recommendations for elevated **8-inch** underdrains
- Use EPA Performance Curves to calculate pollutant removals

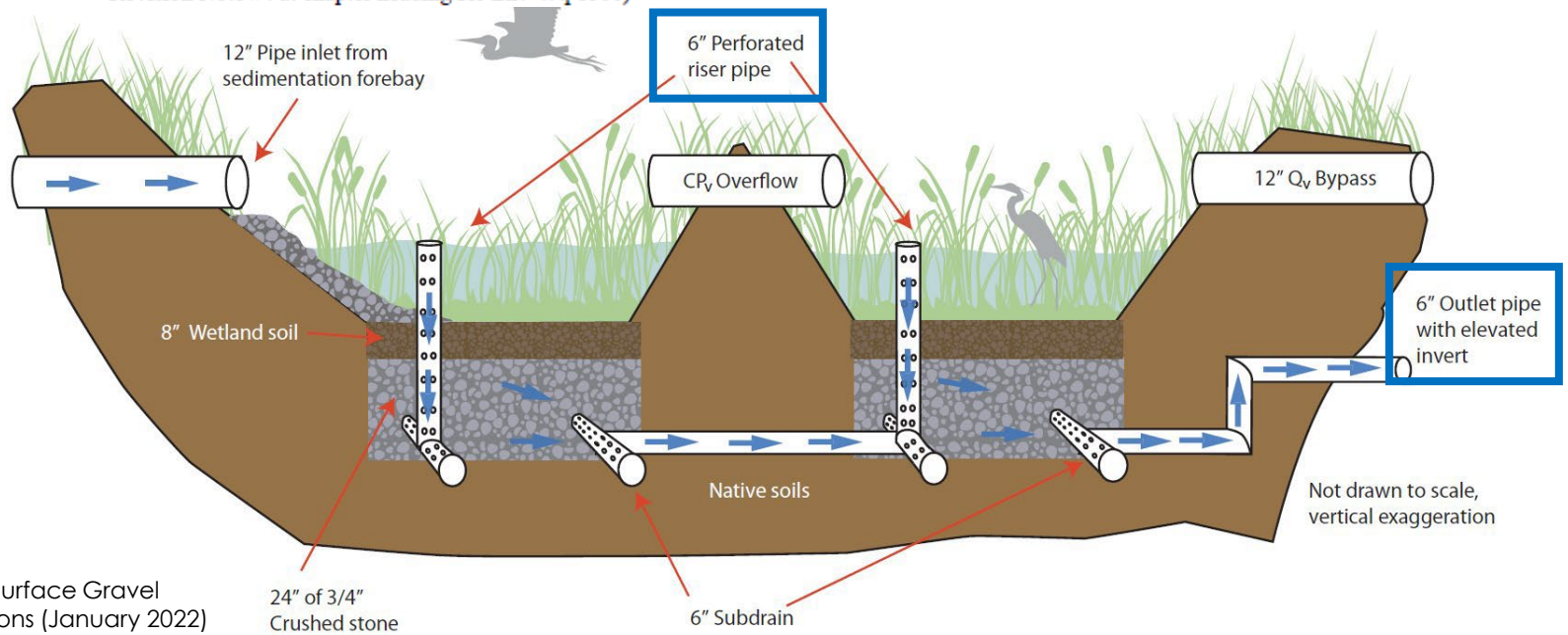


Image Source: UNHSC Subsurface Gravel Wetland Design Specifications (January 2022)

SCM Design Elements Example

Bioretention System (Filtering)

AoT Requirements

(m) If the practice includes a bioretention system, the following requirements also shall be met:

(1) The ponding area, including the storage area above the filter and the filter media voids, shall store 100% or more of the WQV;

(2) The contributing drainage area shall be less than 5 acres;

(3) The filter media shall be a minimum 18 inches deep;

(4) The filter media shall consist of one of the mixtures specified in (l)(4), above;

(5) Side slopes shall not exceed 3:1;

(6) The surface shall be covered with a minimum of 3-inches of organic material; and

(7) The surface area shall be covered with grasses or have the following planting design plan:

a. Only native, non-invasive species shall be used;

b. Plant layout shall be random and natural;

c. Woody vegetation shall not be used near inflow locations;

d. Vegetation directly over the filter media shall be limited to facultative wetland species as specified in National List of Plant Species that Occur in Wetlands: Northeast (Region 1), May 1988, published by U.S. Fish and Wildlife Services, available at https://digitalmedia.fws.gov/cdm/ref/collection/document/id/1348, or other species that can withstand periodic inundation, as determined by a certified wetland scientist;

e. Trees or large shrubs shall be planted along the perimeter; and

f. The plan shall establish a perimeter tree canopy with an understory of shrubs and herbaceous plants;

Manual State-of-the-Practice Recommendations

- Bioretention Soil Mixture: **2021 UNHSC Bioretention Soil Specification**
- Depth of Bioretention Soil Mixture: Greater than or equal to **12 inches** based on planned vegetation survival
- Updated **planting guidance**
- **Elevated underdrains**

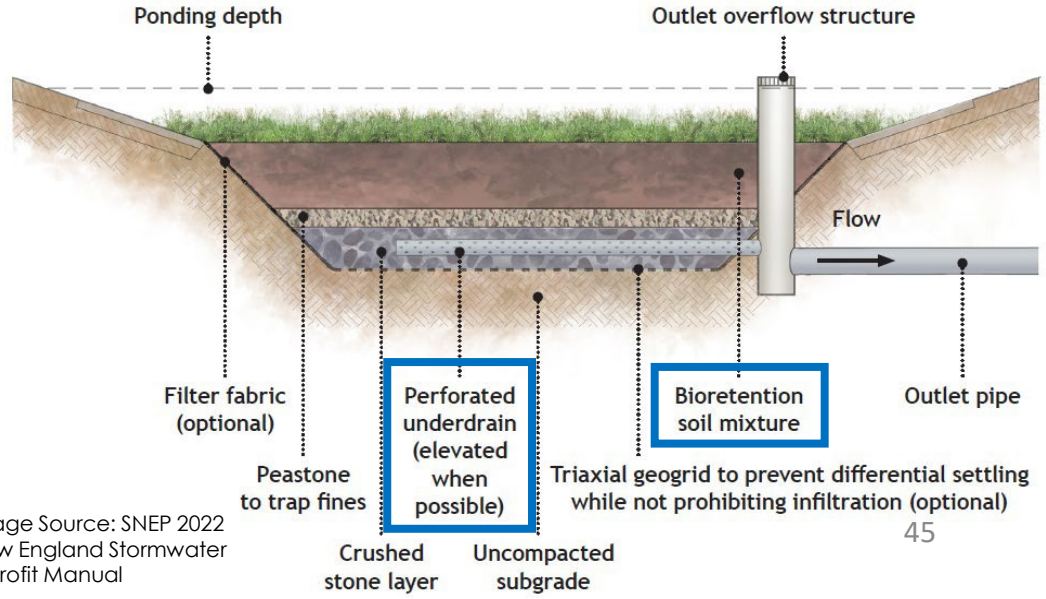


Image Source: SNEP 2022 New England Stormwater Retrofit Manual

Pollutant Removal in Impaired Watersheds

AoT Requirements

Phosphorus Impaired

- Infiltration practices (1508.07);
- Bioretention system with ISR (1508.06) or filtering practices (1508.08) with **amended filter media**;
- Have pollutant removal efficiencies ≥ the above; or
- Demonstrate by pollutant loading analysis that there will be no increase in phosphorus loading to the surface water

Nitrogen Impaired

- Gravel wetlands (1508.05)
- Bioretention systems with ISR (1508.06)

Manual State-of-the-Practice Recommendations

Sequential WPS design approach:

- Retention of 1-inch should exceed treatment requirements
- Certain SCMs can be designed with a significantly smaller WQV than 1-inch to provide 90% TSS, 60% TP, and 50% TN based on **EPA PRCs**

Note on Amended Filter Media:

Key for effective implementation = proper installation

- Covalent iron additive
  - Materials must be **homogeneously mixed**
  - Difficult to source

Groundwater Recharge

AoT Requirements

Calculating GRV (1504.12)

- GRV = $(A_I)(R_d)$
  - A_I = total area of effective on-site impervious surface after development
  - R_d = groundwater recharge depth based on HSG

Soil Group	R_d (inches)
A	0.40
B	0.25
C	0.10
D	0.00

Groundwater Recharge Requirements (1507.04)

- Capture and infiltrate GRV using Groundwater Recharge Practices (1508.17)

Manual State-of-the-Practice Recommendations

Sequential WPS design approach: Intended to replace the need for calculation of the GRV to meet antidegradation goals better (i.e., if WPS is met, GRV will be met)

- 1-inch retention volume

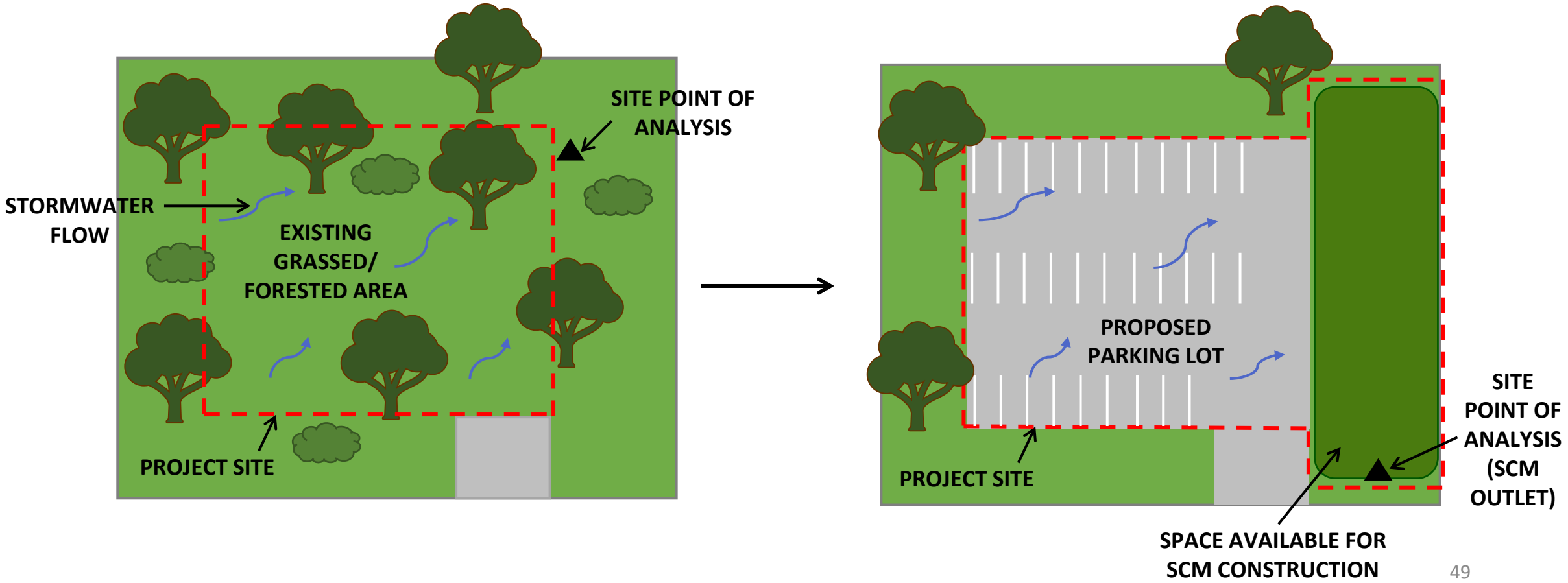
	SCM Tier	Can SCM Meet NHDES AoT (Env-Wq 1500) Design Criteria if Properly Designed?
		Groundwater Recharge (*1507.04*)
Structural Treatment		
Bioretention System (Infiltrating)	1	Yes
"Hybrid" Bioretention System (i.e., Infiltrating Bioretention System with ISR)	1	Yes
Infiltration Basin	1	Yes
Infiltration Trench	1	Yes
Permeable Pavement (Infiltrating)	1	Yes
Subsurface Infiltration Chamber	1	Yes
Dry Well	2	Yes
Impervious Area Disconnection	2	Yes
Leaching Catch Basin	2	Yes
Roof Drip Edge (Infiltrating)	2	Yes
Tree Box Filter (Infiltrating)	2	Yes

Technical Examples

(Calculate SCM Sizing based on Design Criteria)

Example Project Site

Given: One acre of forested area is proposed to be developed as a new parking lot. Find the required DSV of a **proposed infiltration basin** for WPS, GRV (multiple methods), and pollutant removal, then calculate the required SCM footprint. Soils were determined to be HSG B with a saturated hydraulic conductivity of 1.02 in/hr in accordance with **Chapter 4.5** of the Manual.



Note: Images are not to scale, for visualization purposes only.

Sizing For Watershed Protection Standard (WPS)

Determine the DSV required to meet the WPS (i.e., expected to yield no increase in nutrient discharge) using the UNHSC WPS Calculator.

	Notes	Parameter	Abbrev.	Units	SCM 1
Input: Site & SCM	*Site*	ID			EXAMPLE
		Date			9/1/25
		Location			BUSY TOWN
		Description/Notes			PARKING LOT TREATMENT
	Watershed	**Impervious** Drainage Area	IA	ac	1.000
	Stormwater Control Measure	Stormwater Control Measure	SCM	-	Surface Infiltration Practice
		Applicable Performance Curve *(See Crosswalk)*	-	-	*Surface Infiltration*
		Infiltration Rate *(0.05-8.27)*	IR	in/hr	1.02
		Pervious Hydrologic Soil Group	HSG_{perv}	-	B
Output	*WPS Design Requirement*	**Design Storage Volume**	**DSV**	**cf**	**2,178**
		Physical Storage Capacity	**PSC**	**in**	**0.60**
		Pervious Area (*for IC Disconnection*)	**PA**	**ac**	**N/A**
	Performance Curve Removal Efficiencies	Removal Efficiency: Volume	Vol_{RE}	-	80%
		Removal Efficiency: P	P_{RE}	-	94%
		Removal Efficiency: N	N_{RE}	-	97%
		Removal Efficiency: TSS	TSS_{RE}	-	97%
		Removal Efficiency: Zn	Zn_{RE}	-	96%
		Removal Efficiency: Bacteria	FIB_{RE}	-	92%

UNHSC WPS Calculator: https://scholars.unh.edu/stormwater/130/

Inputs

Outputs
DSV of 2,178 cf to meet the WPS

Sizing for Pollutant Removal

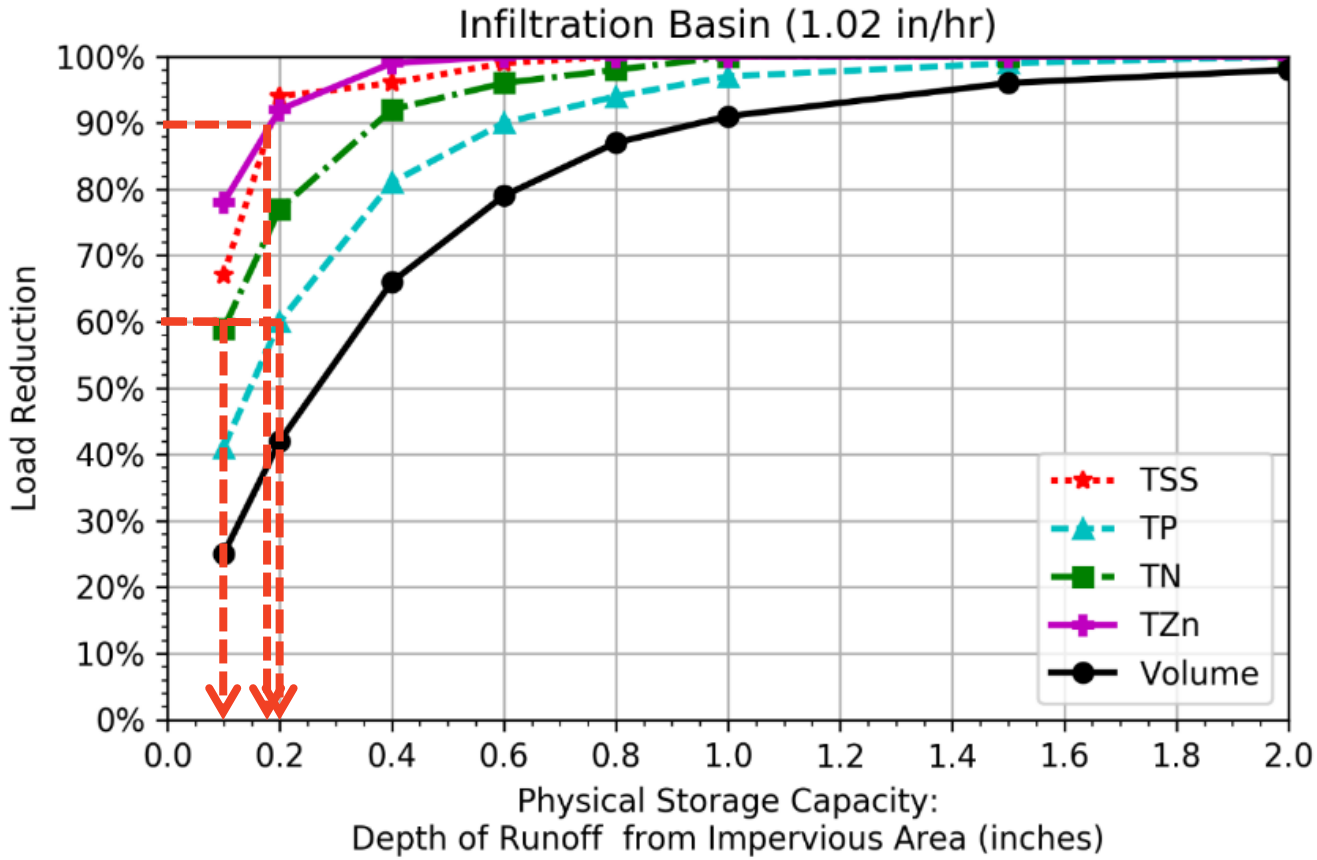
Determine the DSV required to meet 90% TSS/ 60% TP/ 50% TN pollutant removal using EPA PRCs.

- 90% TSS ~ 0.18 in
- 60% TP ~ 0.20 in
- 50% TN < 0.10 in

DSV = (Runoff depth)(Impervious Area)

= (0.20 in/12 in/ft)(1 ac * 43,560 sf/ac)

= **726 cf**



WPS

DSV = **2,178 cf**

Sizing for Groundwater Recharge

Determine the DSV required to meet groundwater recharge requirements using the following methods: WPS (Continuous Dynamic Sizing), AoT GRV, Static Sizing, and Simple Dynamic Sizing.

WPS

DSV = **2,178 cf**

AoT GRV

Recharge depth for HSG B as specified in Env-Wq 1504.12

GRV = $(A_I)(R_d)$ = 1 acre * 0.25 in = 0.25 ac-in = **908 cf**

Static Sizing (MassDEP)

Assume a Target Depth Factor of 1 inch

Recharge Volume (Rv) = (Target Depth Factor)(Impervious Area)

= [(1 inch/12 in/ft)][(1 acre)(43,560 sf/ac)] = **3,630 cf**

Simple Dynamic Sizing (MassDEP)

2 hours

DSV = (Bottom area)(Depth) = {Rv / [Depth + (Ksat)(Allowable drawdown)]}(Depth)

= {3,630 cf / [3 ft + (1.02 in/hr/12 in/ft)(2 hr)]}(3 ft) = **3,435 cf**

Comparative Sizing for Groundwater Recharge (cont.)

Compare the DSV required to meet groundwater recharge requirements using the following methods: WPS (Continuous Dynamic Sizing), AoT GRV, Static Sizing, and Simple Dynamic Sizing.

Static Sizing (MassDEP) – 1 inch recharge

DSV = **3,630 cf**

Simple Dynamic Sizing (MassDEP) – 1 inch recharge

DSV = **3,435 cf**

WPS (Continuous Dynamic Sizing) – 1 inch retention

DSV = **2,178 cf**

AoT GRV - 0.25 inches of recharge

DSV = **908 cf**

Note: The WPS DSV (i.e., 1 inch retention) is still smaller than MassDEP's Static and Simple Dynamic methods, which account for 1-inch recharge because the WPS was developed based on **Continuous Simulation**.

Proposed Example Design

Determine the dimensions of the proposed infiltration basin to meet the WPS DSV and confirm that drain time is equal to or less than 72 hours.

WPS	Pollutant Removal	GRV
DSV = 2,178 cf	**DSV = 726 cf**	**DSV = 908 cf**

WPS DSV > GRV DSV > Pollutant Removal DSV
(i.e., AoT GRV and pollutant removal goals will be met when designing for WPS DSV)

DSV = Water storage volume of storage structure before bypass

$= L * [(W_{bottom} + W_{top@Dmax})/2] * D$

DSV equation for infiltration basin (Surface Infiltration) from Table 3-5 of 2017 NH MS4 Permit Attachment 3 of Appendix F

Length (ft)	Design Depth (ft)	Side Slopes	W_{bottom} (ft)	$W_{top@Dmax}$ (ft)	DSV (cf)
40	3	3:1	10	28	**2,280**

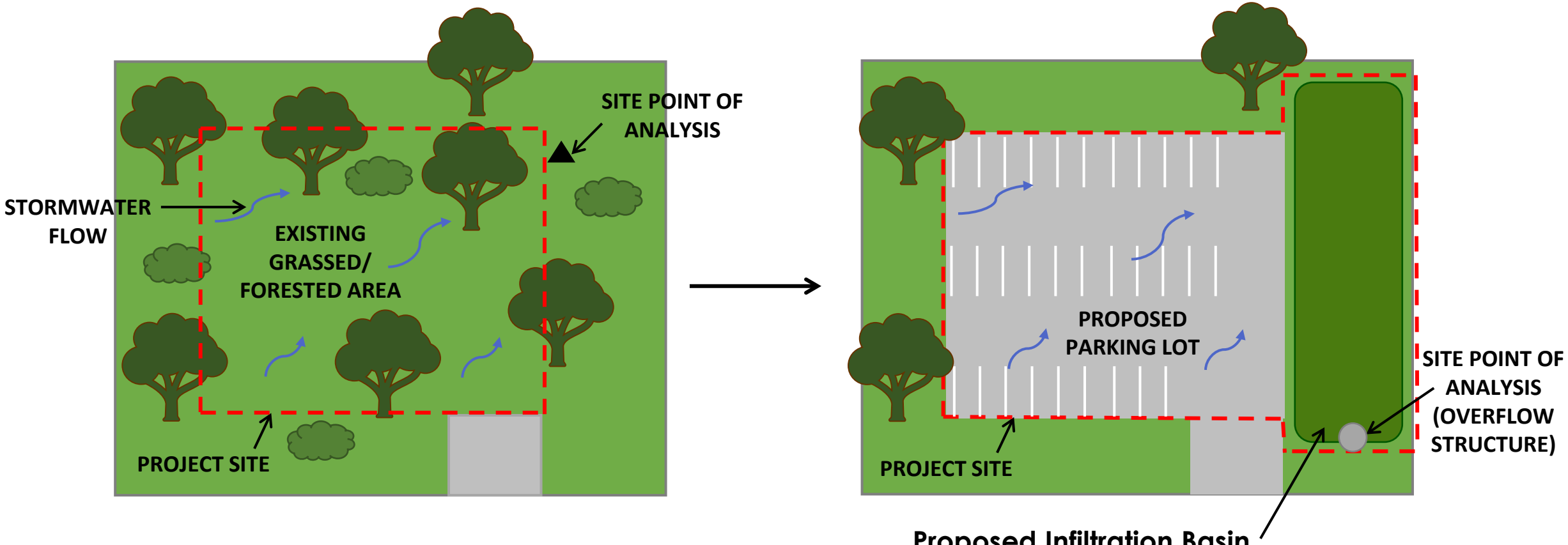
Proposed DSV of **2,280 cf** > WPS DSV of 2,178 cf ✓

Drain time = DSV/(Ksat)(Bottom area) = 2,280 cf / (1.02 in/hr)(1ft/12 in)(400 sf) = 67 hrs < 72 hrs ✓

Proposed Example Design

Maximum DSV dictated by WPS. Design must also demonstrate compliance with pretreatment, channel protection, and peak discharge rate requirements.

Peak rate and channel protection requirements remain unchanged.



Note: Images are not to scale, for visualization purposes only.

MS4 Compliance and Municipal Resources

Stormwater Site Plan Regulation Updates

- [Draft] Model Post Construction Stormwater Management Standards for Site Plan Review Regulations by UNHSC
- Provides recommendations for stormwater management standards for new development and redevelopment- **generally consistent** with DRAFT 2024 MA MS4 permit
  - Site Design (E&SC, LID, etc.)
  - Water Quality (WPS)
  - Stormwater Management Plan Criteria
  - Inspection and Maintenance Responsibilities

The most up-to-date version will be available here: https://extension.unh.edu/stormwater-center/nh-stormwater-manual

NH MS4 Compliance Resources

- NH Stormwater Regional Coalitions' MS4 website

www.nhms4.des.nh.gov/

- UNHSC MS4 website

extension.unh.edu/stormwater-center/ms4-resources

- EPA Region 1 Stormwater Tools in New England website

www.epa.gov/npdes-permits/stormwater-tools-new-england

Municipal Stormwater Management Programs

- Stormwater Asset Management
- Stormwater Utilities
- IDDE Program
- NHDES Green SnowPro
- Public Outreach
- Municipal Ordinances
- Easements and Deed Restrictions

See **Chapter 2.2.2** of the Manual for more information

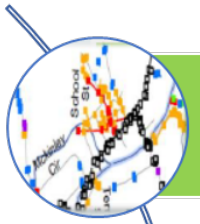
Stormwater Grants and Funding Opportunities

- NHDES Funding Programs
  - Watershed Assistance Grants
  - Water Quality Planning Grants
  - Clean Water State Revolving Fund (SRF)
    - SRF planning funds for communities to update regulations
    - SRF funding for SCM construction projects
  - Coastal Resilience Grants
- Additional resources listed in **Table 2-2** of Manual

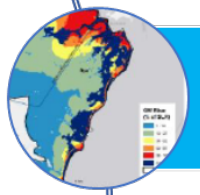
https://www.epa.gov/cwsrf/overview-clean-water-state-revolving-fund-eligibilities

www.des.nh.gov/business-and-community/loans-and-grants

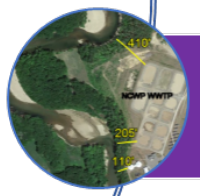
New Hampshire CWSRF Loan Program
Stormwater & Nonpoint Source Categories



Asset Management Program



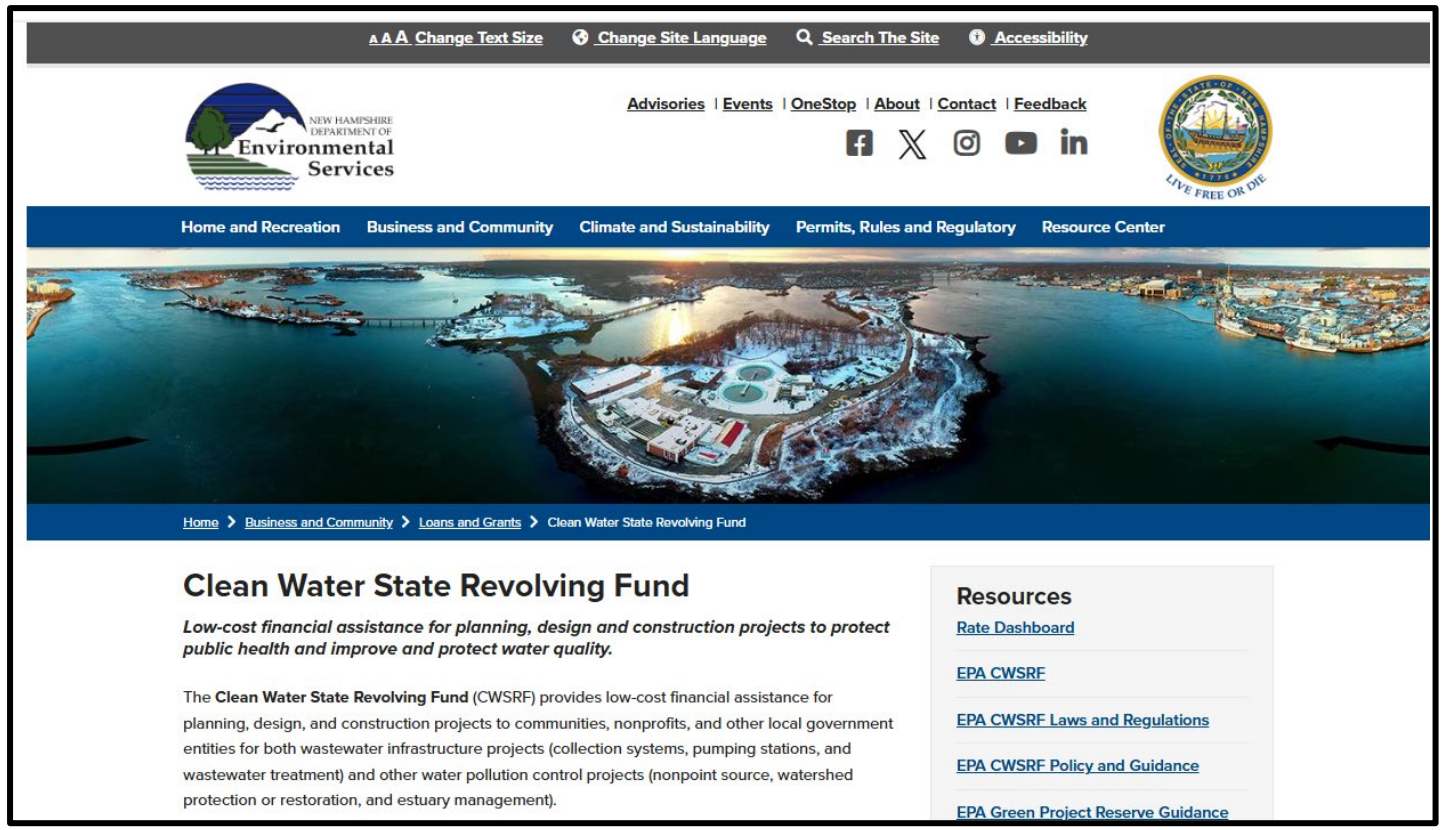
Planning Projects



Infrastructure w/Planning Component Projects

Infrastructure Projects

New Hampshire CWSRF Loan Program Stormwater & Nonpoint Source Categories

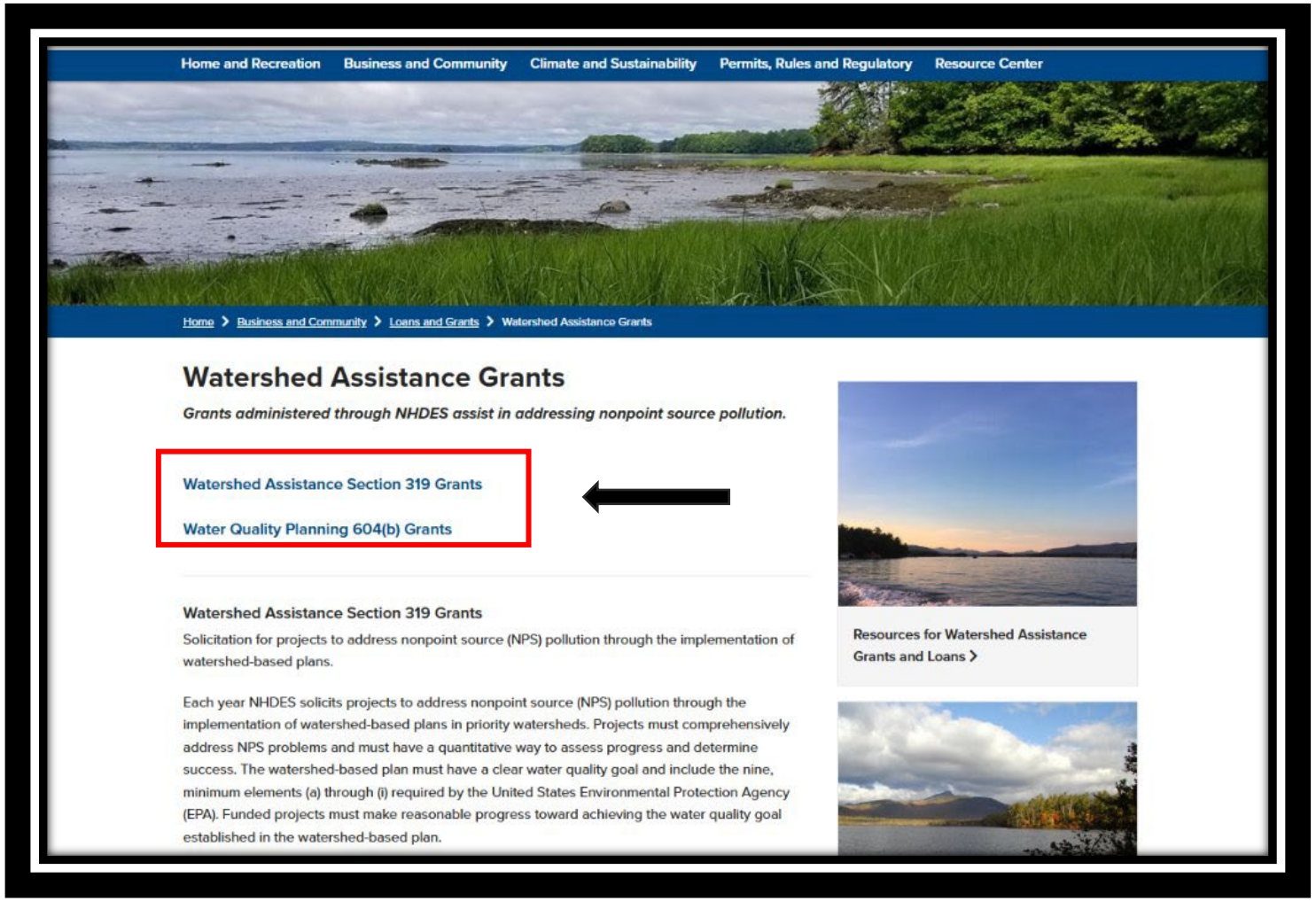


General Information

- Annual solicitation
  - *Typically* in March
    ***2025 solicitation closed**
- NHDES Annual Water Infrastructure Webinar Series
  - *Typically* in April
- Pre-applications
  - *Typically* due on or around June 1st
- Eligible Applicants
  - Only government entities can receive principal/loan forgiveness

[Clean Water State Revolving Fund | NH Department of Environmental Services]

New Hampshire EPA Grants 604 (b) & 319



[Watershed Assistance Grants | NH Department of Environmental Services]

Each year, the New Hampshire Department of Environmental Services (NHDES) receives passthrough grants from the United States Environmental Protection Agency (EPA) to fund projects to conduct water quality planning and implementation

New Hampshire EPA Grants
604(b) (Planning) & 319 (Implementation)

When

- Requests for Letters of Intent (LOIs) are **published in late June or early July** each year with **Letters of Intent due mid-September.** Projects are selected in October and Full Proposals are due in December 2025. Funding is from FY25, so it should be stable for this year. The exact amount of available funding is unknown at this moment. We should know within the next month or so.

Who Can Apply

- Governmental subdivisions and nonprofit organizations are eligible to receive Watershed Assistance Grants. Examples include:
- Municipalities
- Regional Planning Commissions
- Nonprofit Organizations
- County Conservation Districts
- State Agencies
- Watershed Associations
- Lake, Pond or River Associations
- Public Water Suppliers
- Designated River Local Advisory Committees

IMPORTANT NOTE: A LOI consultation is required. Please contact the applicable project manager. If you are unsure of who your project manager would be, contact Andrea Bejtlich at Andrea.l.Bejtlich@des.nh.gov.

Next Steps

Next Steps

- Effective date of Manual: **February 2025**
- Additional upcoming outreach sessions to be **advertised on UNHSC website**
- FAQ document
- The 2025 Manual will be reviewed and updated periodically as the State-of-the-Practice advances and regulations are updated

Questions?

2025 Manual Access Link:
https://extension.unh.edu/stormwater-center/nh-stormwater-manual

NEXT PLAN Webinar: October 16th

2025 New Hampshire Stormwater Manual Informational Session

New Hampshire Department of
BUSINESS AND
ECONOMIC AFFAIRS

Q&A

THANK YOU

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