

Wilcox & Barton INC.

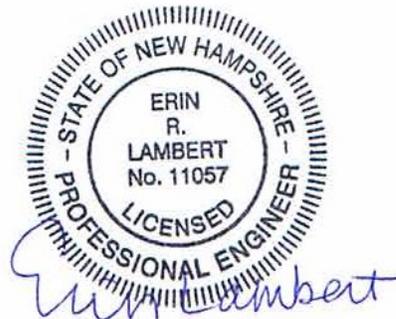
CIVIL • ENVIRONMENTAL • GEOTECHNICAL

STORMWATER MANAGEMENT PLAN for

Banks Chevrolet Parking Lot Reconstruction
234 Airport Road
Concord, NH 03301

Prepared for:
Banks Chevrolet
C/O Fred Booth
137 Manchester Street
Concord, NH 03301

Prepared by:
Wilcox & Barton, Inc.
2 Home Ave.
Concord, NH 03301
Contact: Erin Lambert, PE, (603) 369-4190 x527



Wilcox & Barton, Inc.
Project No.: BACC0005

November 19, 2025

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1.0 NHDES ALTERATION OF TERRAIN APPLICATION



ALTERATION OF TERRAIN PERMIT APPLICATION

Water Division / Land Resources Management

[Check the status of your application](#)



RSA / Rule: RSA 485-A:17, Env-Wq 1500

Administrative Use Only	Administrative Use Only	Administrative Use Only	File Number:
			Check No.
			Amount:
			Initials:

1. APPLICANT INFORMATION (INTENDED PERMIT HOLDER)			
Applicant Name: Banks Chevrolet/Daval Realty Associates LLC		Contact Name: Fred Booth	
Email: Fred.Booth@banksautos.com		Daytime Telephone: (603) 229-4004	
Mailing Address: 137 Manchester Street			
Town/City: Concord		State: NH	ZIP Code: 03301
2. APPLICANT'S AGENT INFORMATION If none, check here: <input checked="" type="checkbox"/>			
Agent's Name:		Contact Name:	
Email:		Daytime Telephone:	
Address:			
Town/City:		State:	ZIP Code:
3. PROPERTY OWNER INFORMATION (IF DIFFERENT FROM APPLICANT) Check here if more than one property owner, and attach additional sheets as necessary: <input type="checkbox"/>			
Owner's Name:		Contact Name:	
Email:		Daytime Telephone:	
Mailing Address:			
Town/City:		State:	ZIP Code:
4. PROPERTY OWNER'S AGENT INFORMATION If none, check here: <input checked="" type="checkbox"/>			
Business Name:		Contact Name:	
Email:		Daytime Telephone:	
Address:			
Town/City:		State:	ZIP Code:
5. CONSULTANT INFORMATION If none, check here: <input type="checkbox"/>			
Engineering Firm: Wilcox & Barton, Inc.		Contact Name: Erin Lambert, P.E.	
Email: ELambert@wilcoxandbarton.com		Daytime Telephone: (603) 731-9883	
Address: 2 Home Ave			
Town/City: Concord		State: NH	ZIP Code: 03301

6. PROJECT TYPE			
<input type="checkbox"/> Excavation Only	<input type="checkbox"/> Residential	<input checked="" type="checkbox"/> Commercial	<input type="checkbox"/> Golf Course
<input type="checkbox"/> Agricultural	<input type="checkbox"/> Land Conversion	<input type="checkbox"/> Other:	<input type="checkbox"/> School <input type="checkbox"/> Municipal
7. PROJECT LOCATION INFORMATION			
Project Name: Banks Chevrolet Parking Lot Reconstruction			
Street/Road Address: 234 Airport Road			
Town/City: Concord		County: Merrimack	
Tax Map: 782	Block: Z	Lot Number: 8	Unit:
Post-development, will the proposed project withdraw from or directly discharge to any of the following? If yes, identify the purpose.			
1. Stream or Wetland Purpose:	<input type="checkbox"/> Yes	<input type="checkbox"/> Withdrawal	<input type="checkbox"/> Discharge
	<input checked="" type="checkbox"/> No		
2. Artificial pond created by impounding a stream or wetland Purpose:	<input type="checkbox"/> Yes	<input type="checkbox"/> Withdrawal	<input type="checkbox"/> Discharge
	<input checked="" type="checkbox"/> No		
3. Unlined pond dug into the water table Purpose:	<input type="checkbox"/> Yes	<input type="checkbox"/> Withdrawal	<input type="checkbox"/> Discharge
	<input checked="" type="checkbox"/> No		
Post-development, will the proposed project discharge to:			
• Within one-quarter mile of a surface water impaired for phosphorus and/or nitrogen? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes			
• Within one-quarter mile of a Class A surface water or within the watershed area of an Outstanding Resource Water? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes			
• Within one-quarter mile of a lake or pond not covered previously? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes			
Is the project a High Load area? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
If yes, specify the type of high load land use or activity:			
Is the project within a Water Supply Intake Protection Area (WSIPA)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Is the project within a Groundwater Protection Area (GPA)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Will the well setbacks identified in Env-Wq 1508.02 be met? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
For more details on the restrictions in these areas, read Chapter 3.1 in Volume 2 of the NH Stormwater Manual.			
Is any part of the property within the 100-year floodplain? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
If yes: Cut volume: cubic feet within the 100-year floodplain.			
Fill volume: cubic feet within the 100-year floodplain.			
<input type="checkbox"/> Project is within ¼ mile of a designated river Name of River:			
<input checked="" type="checkbox"/> Project is not within ¼ mile of a designated river.			
<input type="checkbox"/> Project is within a Coastal/Great Bay Region community.			
<input checked="" type="checkbox"/> Project is not within a Coastal/Great Bay Region community.			
8. BRIEF PROJECT DESCRIPTION (PLEASE DO NOT REPLY "SEE ATTACHED")			
The project involves paving an existing gravel parking area to be used for employee parking at 234 Airport Road in Concord to support the Banks Chevrolet Car Dealership located across Old Suncook Road. The redevelopment of the gravel parking area results in an overall decrease of impervious cover to the site that will be transitioned to landscaped areas (24,170 SF decrease). Supporting infrastructure including stormwater improvements, lighting, and landscaping are proposed.			

9. IF APPLICABLE, DESCRIBE ANY WORK STARTED PRIOR TO RECEIVING PERMIT.

N/A

10. ADDITIONAL REQUIRED INFORMATION

A. Date a copy of the application was sent to the municipality, as required by Env-Wq 1503.05(e) (Env-Wq 1503.05(c)(6), requires proof that a completed application form, checklist, plans and specifications, and all other supporting materials have been sent or delivered to the governing body of each municipality in which the project is proposed): 11/19/2025
(Attach proof of delivery)

B. Date a copy of the application was sent to the local river advisory committee, if required by Env-Wq 1503.05(e) (Env-Wq 1503.05(c)(6), requires proof that a completed application form, checklist, plans and specifications, and all other supporting materials have been sent or delivered to the Local River Advisory Committee, if the project is within ¼ mile of a designated river): N/A
(Attach proof of delivery)

C. Type of plan required: Land Conversion Detailed Development Excavation, Grading and Reclamation
 Steep Slope

D. Additional plans required: Stormwater Drainage and Hydrologic Soil Groups Source Control
 Chloride Management

E. Total area of disturbance, in square feet 82,600 SF (redevelopment for Banks Chevrolet across street in 2020).

F. Additional impervious cover as a result of the project, in square feet (use "-" to indicate a net reduction in impervious coverage). - 24,170 SF (decrease to site)
Total final impervious cover, in square feet 118,110 SF

G. Total undisturbed cover, in square feet 220,335 SF

H. Number of lots proposed: 1

I. Total length of roadway, in linear feet: 0

J. Name(s) of receiving water(s): Merrimack River

K. Identify all other NHDES permits required for the project. For each, indicate whether an application has been filed and is pending. If the required approval has been issued, provide the permit number, registration date, or approval letter number, as applicable.

Type of Approval	Application Filed?	Pending?	If Issued
1. Water Supply Approval	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/>	Permit number:
2. Wetlands Permit	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/>	Permit number:
3. Shoreland Permit	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/>	Registration date:
4. UIC Registration	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/>	Approval letter date:
5. Large/Small Community Well Approval	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/>	Permit number:
6. Large Groundwater Withdrawal Permit	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/>	Permit number:
7. Other:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

L. List all species identified by the Natural Heritage Bureau as threatened or endangered or of concern:
Frosted Elf, Karner Blue Butterfly, Pitch Pine, Clasping Milkweed, Golden Heather, Houghton's Umbrella Sedge, Upright False Bindweed, Wild Lupine.

Vertebrate Species: Eastern Hognose Snake, Eastern Meadowlark, Grasshopper Sparrow, Northern Black Racer, Northern Leopard Frog, Spotted Turtle, and Wood Turtle.

M. Using the NHDES [OneStop Data Mapper](#) with the [Surface Water Impairment layer](#) turned on, list the impairments identified for each receiving water. If no pollutants are listed, enter "N/A."

N/A

N. Did the applicant or applicant's agent have a pre-application meeting with Alteration of Terrain Bureau staff?

Yes No

If yes, name of staff member:

O. Will blasting of bedrock be required? Yes No If yes, estimated quantity of blast rock in cubic yards:

If yes, [standard blasting Best Management Practices](#) notes must be placed on the plans.

NOTE: If greater than 5,000 cubic yards of blast rock will be generated, a groundwater monitoring program must be developed and submitted to NHDES. Contact Alteration of Terrain Bureau staff for additional detail.

11. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN THE ORDER LISTED BELOW)**LOOSE:**

- Signed application form, with attached proof(s) of delivery.
- Check for the application fee, calculated using the [fee schedule](#) available on the NHDES [Land Development page](#).
- Color copy of a USGS map with the property boundaries outlined (1" = 2,000' scale).
- If the applicant is not the property owner, proof that the applicant will have a legal right to undertake the project on the property if a permit is issued to the applicant.

BOUND, IN A REPORT, IN THE FOLLOWING ORDER:

- Copy of the signed application form and application checklist.
- Copy of the check.
- Copy of the USGS map with the property boundaries outlined (1" = 2,000' scale).
- Narrative of the project with a summary table of the peak discharge rate for the off-site discharge points.
- Printout of NHDES [OneStop Mapper](#) with "Surface Water Impairments" layer turned on.
- Printout of NHDES [OneStop Mapper](#) with Alteration of Terrain screening layers turned on.
- Printout of Natural Heritage Bureau [DataCheck Tool](#) letter and any relevant correspondence with New Hampshire Fish and Game.
- USDA [Web Soil Survey Map](#) with project's watershed outlined.
- Aerial photograph (1" = 2,000' scale with the site boundaries outlined).
- Photographs representative of the site.
- Groundwater recharge volume calculations (include one [Best Management Practices worksheet](#) per permit application).
- Drainage analysis, stamped by a professional engineer (see "Application Checklist" at the end of this document).
- Riprap apron or other energy dissipation or stability calculations.
- Site Specific Soil Survey report, stamped and with a certification note prepared by the soil scientist that the survey was done in accordance with the [Site Specific Soil Mapping standards](#) of the Society of Soil Scientists of Northern New England.
- Infiltration Feasibility Report (example online) [Env-Wq 1503.08(f)(3)].
- [Registration and Notification Form](#) for [Stormwater](#) Infiltration to Groundwater (UIC Registration-for underground systems only, including drywells and trenches).
- Inspection and maintenance manual with, if applicable, long term maintenance agreements [Env-Wq 1503.08(g)].
- Source control plan.

PLANS:

- One set of design plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details).
- Pre- and post-development color-coded soil plans on 11" x 17" (see Application Checklist for details).
- Pre- and post-construction drainage area plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details).

100-YEAR FLOODPLAIN REPORT:

- All information required in Env-Wq 1503.09, submitted as a separate report.

ADDITIONAL INFORMATION RE: NUTRIENTS, CLIMATE

- See Application Checklist (Attachment A) for details.

- REVIEW APPLICATION FOR COMPLETENESS. CONFIRM INFORMATION LISTED ON THE APPLICATION IS INCLUDED WITH SUBMITTAL.**

12. REQUIRED SIGNATURES

By signing below, I certify that:

- The information contained in or otherwise submitted with this application is true, complete, and not misleading to the best of my knowledge and belief;
- I understand that the submission of false, incomplete, or misleading information constitutes grounds for the department to deny the application, revoke any permit that is granted based on the information, and/or refer the matter to the board of professional engineers established by RSA 310-A:3 if I am a professional engineer; and
- I understand that I am subject to the penalties specified in New Hampshire law for falsification in official matters, currently RSA 641:3.

APPLICANT

APPLICANT'S AGENT:

Signature: *Frederick Booth* Date: 11/17/25

Name (print or type): FREDERICK H. BOOTH Title: "

PROPERTY OWNER

PROPERTY OWNER'S AGENT:

Signature: _____ Date: _____

Name (print or type): _____ Title: _____

ALTERATION OF TERRAIN PERMIT ATTACHMENT A: APPLICATION CHECKLIST

Check each box to indicate the item has been provided, or indicate why it does not apply.

DESIGN PLANS

- Plans printed on 34 - 36" by 22 - 24" white paper.
- Professional Engineer stamp.
- Wetland delineation.
- Temporary erosion control measures.
- Treatment for all stormwater runoff from impervious surfaces such as roadways (including gravel roadways), parking areas, and nonresidential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the New Hampshire Stormwater Management Manual.
- Pre-existing 2-foot contours.
- Proposed 2-foot contours.
- Drainage easements protecting the drainage/treatment structures.
- Compliance with state statute governing fill and dredge in [wetlands](#), RSA 482- A. Note that artificial detention in wetlands is prohibited.
- Compliance with the New Hampshire [Shoreland Protection Act](#), RSA 483-B.
- Benching – needed if you have more than 20 feet change in elevation on a 2:1 slope, 30 feet change in elevation on a 3:1 slope, 40 feet change in elevation on a 4:1 slope.
- Check to see if any proposed ponds require [state dam permits](#).

DETAILS

- Typical roadway cross-section.
- Detention basin with inverts noted on the outlet structure.
- Stone berm level spreader.
- Outlet protection – riprap aprons.
- A general installation detail for an erosion control blanket.
- Silt fences or mulch berm.
- Storm drain inlet protection. Note that since hay bales must be embedded 4 inches into the ground, they are not to be used on hard surfaces such as pavement.
- Hay bale barriers.
- Stone check dams.
- Gravel construction exit.
- Temporary sediment trap.
- The treatment BMPs proposed.
- Any innovative BMPs proposed.

CONSTRUCTION SEQUENCE / EROSION CONTROL

- Note that the project must be managed to meet the requirements and intent of RSA 430:53 and Agr 3800 relative to [invasive species](#).
- Note that perimeter controls shall be installed prior to earth moving operations.
- Note that temporary water diversion (swales, basins, etc.) must be used as necessary until areas are stabilized.
- Note that ponds and swales shall be installed early on in the construction sequence (before rough grading the site).
- Note that all ditches and swales shall be stabilized prior to directing runoff to them.
- Note that all roadways and parking lots shall be stabilized within 72 hours of achieving finished grade.
- Note that all cut and fill slopes shall be seeded or loamed within 72 hours of achieving finished grade
- Note that all erosion controls shall be inspected weekly AND after every half-inch of rainfall.
- Note the limits on the open area allowed, see Env-Wq 1505.02 for detailed information.

Example note: The smallest practical area shall be disturbed during construction, but in no case shall exceed 5 acres at any one time before disturbed areas are stabilized.

- Note the definition of the word “stable.”

Example note: An area shall be considered stable if one of the following has occurred:

- Base course gravels have been installed in areas to be paved.
- A minimum of 85 percent vegetated growth has been established.
- A minimum of 3 inches of non-erosive material such stone or riprap has been installed.
- Or, erosion control blankets have been properly installed.

- Note the limit of time an area may be exposed.

Example note: All areas shall be stabilized within 45 days of initial disturbance.

- Provide temporary and permanent seeding specifications. Note that although reed canary grass is listed in the Green Book; it is a problematic species according to the Wetlands Bureau and therefore should not be specified.
- Provide winter construction notes that meet or exceed our standards.

Standard Winter Notes:

- All proposed vegetated areas that do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.
- All ditches or swales which do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.
- After October 15, incomplete road or parking surfaces where work has stopped for the winter season shall be protected with a minimum of 3 inches of crushed gravel per NHDOT item 304.3.
- Note at the end of the construction sequence that “Lot disturbance, other than that shown on the approved plans, shall not commence until after the roadway has the base course to design elevation and the associated drainage is complete and stable.” – This note is applicable to single/duplex family subdivisions, when lot development is not part of the permit.

DRAINAGE ANALYSES

Please provide double-side 8 ½" × 11" sheets where possible but, **do not** reduce the text such that more than one page fits on one side.

- Professional Engineer stamp.
- Rainfall amount obtained from the [Northeast Regional Climate Center](#). Include extreme precipitation table as obtained from this source.
- Drainage analyses, in the following order:
 - Pre-development analysis: Drainage diagram.
 - Pre-development analysis: Area Listing and Soil Listing.
 - Pre-development analysis: Node listing 1-year (if applicable), 2-year, 10-year and 50-year.
 - Pre-development analysis: Full summary of the 10-year storm.
 - Post-development analysis: Drainage diagram.
 - Post-development analysis: Area Listing and Soil Listing.
 - Post-development analysis: Node listing for the 2-year, 10-year and 50-year.
 - Post-development analysis: Full summary of the 10-year storm.
- Review the Area Listing and Soil Listing reports
 - Hydrologic Soil Groups (HSG) match the HSGs on the soil maps provided.
 - There is the same or less HSG A soil area after development (check for each HSG).
 - There is the same or less "woods" cover in the post-development.
 - Undeveloped land was assumed to be in "good" condition.
 - The amount of impervious cover in the analyses is correct.

Note: A good check is to subtract the total impervious area used in the pre-analysis from the total impervious area used in the post-analysis. For residential projects without demolition occurring, a good check is to take this change in impervious area, subtract out the roadway and divide the remaining by the number of houses or units proposed. Do these numbers make sense?

- Check the storage input used to model the ponds.
- Check to see if the artificial berms pass the 50-year storm, i.e., make sure the constructed berms on ponds are not overtopped.
- Check the outlet structure proposed and make sure it matches that modeled.
- Check to see if the total areas in the pre and post analyses are same.
- Confirm the correct NRCS storm type was modeled (Coos, Carroll and Grafton counties are Type II, all others Type III).

PRE- AND POST-CONSTRUCTION DRAINAGE AREA PLANS

- Plans printed on 34 - 36" by 22 - 24" on white paper.
- Submit these plans separate from the soil plans.
- A north arrow.
- A scale.
- Labeled subcatchments, reaches and ponds.

- Tc lines.
- A clear delineation of the subcatchment boundaries.
- Roadway station numbers.
- Culverts and other conveyance structures.

PRE- AND POST-CONSTRUCTION COLOR-CODED SOIL PLANS

- 11" × 17" sheets suitable, as long as it is readable.
- Submit these plans separate from the drainage area plans.
- A north arrow.
- A scale.
- Name of the soil scientist who performed the survey and date the soil survey took place.
- 2-foot contours (5-foot contours if application is for a gravel pit) as well as other surveyed features.
- Delineation of the soil boundaries and wetland boundaries.
- Delineation of the subcatchment boundaries.
- Soil series symbols (e.g., 26).
- A key or legend identifying each soil series symbol and its associated soil series name (for example: 26 = Windsor).
- The hydrologic soil group color coding (A = Green, B = yellow, C= orange, D=red, Water=blue, and Impervious = gray).

Please note that excavation projects (including gravel pits) have similar requirements to those above, with the following common exceptions or additions:

- Drainage report is not needed if site does not have off-site flow.
- 5-foot contours are allowed rather than 2-foot.
- No Professional Engineer stamp is needed on the plans.
- Add a note to the plans that the applicant must provide NHDES a written update of the project and revised plans documenting the project status every five years from the date of the Alteration of Terrain permit.
- Add reclamation notes.
- A description of the subsurface conditions to the planned depth of excavation, including the elevation of the location of the Seasonal High Water Table (SHWT), as observed and described by a certified soil scientist, or an individual holding a valid permit as a permitted designer as issued by the department's Subsurface Systems Bureau.

For more resources, refer to the Natural Resources Conservation Service's [Vegetating New Hampshire Sand and Gravel Pits](#) publication.



CHEVROLET-CADILLAC
P.O. BOX 473 • 137 MANCHESTER STREET
CONCORD, N.H. 03301

54-7022
2114

CHECK# 23628

MERRIMACK COUNTY SAVINGS BANK

23628

PAY **NINE HUNDRED THIRTEEN DOLLARS AND 00/100**

DATE

AMOUNT

11/14/25

\$913.00

TO THE ORDER OF
TREASURER STATE OF NEW HAMPSHIRE

BANKS CHEVROLET-CADILLAC, LLC

SECURITY FEATURES INCLUDED
DETAILS ON BACK

AUTHORIZED SIGNATURE

⑈023628⑈ ⑆211470225⑆ 3200244600⑈

NAME NUMBER DATE

TREASURER STATE OF NEW HAMPSHIRE

11/14/25

11/14/25 274 913.00 LOT

REMITTANCE ADVICE
DETACH AND RETAIN



CHEVROLET-CADILLAC, LLC.
P.O. BOX 473 • 137 MANCHESTER STREET
CONCORD, N.H. 03301 • PHONE 603/224-4055

CHECK NO.

23628

NET
AMOUNT

\$913.00

Acknowledgement of Receipt

On behalf of the City of Concord, I hereby acknowledge receipt of the Alteration of Terrain Application and site-specific Stormwater Management Plan for the proposed site plan at 234 Airport Road, Concord, New Hampshire, prepared by Wilcox & Barton, Inc. and dated November 19, 2025.

Name and Title

Date

2.0 PROJECT NARRATIVE

2.1 Project Description

The project consists of paving an existing gravel parking area which supports the Banks Chevrolet car dealership. The parking area is located on Tax Map 782Z Lot 8 (project parcel), with a street address of 234 Airport Road in Concord, while the existing dealership it supports is located across the street at 137 Manchester Street in Concord. The parking area is used for employee parking. Site improvements include the paved parking area, lighting, landscaping, and stormwater management systems.

Currently, the use of the existing parcel is for employee parking and vehicle storage for body shop accessory to a principal retail use, the Banks Chevrolet dealership. One portion of this parking area is paved while the other is gravel. There is wooded cover to the rear of the property, adjacent to Sanel Park. The parcel has frontage along both Old Suncook Road and Airport Road and has five driveway locations along Old Suncook Road.

The impervious area of the site is currently 132,930 SF. The project reduces the impervious cover on site by 19,333 SF. The final impervious area on site will be 113,597 SF.

The project area for the purposes of AoT permitting includes land within the City right-of way. Construction activities are expected to disturb approximately 82,600 SF of land and decrease the impervious cover by approximately 24,170 SF to the project property. The project area impervious cover will be 118,110 SF post-construction. The new impervious cover calculation considers the compacted gravel parking as impervious per the Alteration of Terrain regulations, which is why there is an overall decrease of impervious cover. Though the current area of disturbance is below 100,000 SF, the expanded vehicle storage and parking for the dealership occurred in 2020 and therefore necessitates an Alteration of Terrain permit application by being within a ten year period. The proposed stormwater management system for the parking areas consists of one infiltration gallery with an affiliated isolator row, which provides water quality treatment, quantity reduction, and rate control to pre-development levels.

2.2 Site Soils

According to the Natural Resources Conservation Service (NRCS), the on-site soils for the property consist entirely of Windsor loamy sand, which has a Hydrologic Soil Group (HSG) rating of A. On Old Suncook Road, the NRCS soil distinction is considered "Urban Land", which is not designated a specific HSG Rating. The HSG A soils located on-site, and in the report, have an infiltration rate measured at 6.0-20 inches/hour. The proposed location for the subsurface infiltration gallery is situated within Type A soils. Accordingly, the infiltration rate was modeled at 3 inches per hour, incorporating a safety factor of 2.

It was found at the abutting Banks Chevrolet dealership parcel that the on-site soils exceeded the maximum infiltration rate of 10 in/hr (before the factor of safety is implemented), so it is anticipated that the soils on the project parcel will also exceed the maximum rate of 10 in/hr and therefore likely require amendment of on-site soil. For this reason, the supporting civil plan set

reflects amended soil requirement information, if applicable. The requirement for the soil amendment will be confirmed via the confirmatory test pits and on-site infiltration testing, which shall be completed at the start of construction. Test pits and infiltration testing cannot be performed prior to construction due to the existing use of the site and due to the expected necessary depth of the test pits. The test pits for the abutting Banks Chevrolet property were in excess of 13'. This would greatly disturb the existing parking lot and ongoing use of the project parcel, and the site soils are homogeneous.

The project parcel's stormwater management design includes information from the abutting property and from the NRCS soil information. To be conservative, the packaged stormwater management design reflects the lower default design infiltration rate of 3 in/hr (Layout A) but also includes the design option of an amended soil with 4.5 in/hr (Layout B). The secondary design option (with amended soil) is listed in both the Construction Details and Stormwater Management Plan in case the testing proves soil amendment is needed. Refer to Site-Specific Soil Report and Infiltration Feasibility Report for more soil information.

2.3 Pre-Development Watershed

The pre-development watershed consists of the entire project area, which includes the entirety of the parcel to the property boundary lines and some portion of the upland wooded area. The existing project parcel is developed with a gravel parking area for employees and a paved parking area for the sale and display of motor vehicles. Remaining portions of the project parcel are undeveloped with mostly wooded landcover. There are no known wetlands on the project parcel. The parcel also includes some portion of grass and woods located on the eastern part of the property along Airport Road.

The watershed drains to the south toward Old Suncook Road with some natural low points located in the wooded areas. The site's topography directs runoff to three existing dry wells on-site, two existing catch basins on-site, and through the wooded/lawn area on the eastern side of the property. From there, the collected stormwater is conveyed to the existing closed drainage system along Old Suncook Road. As a result, the pre-development watershed has been directed to one point of interest (POI) at the roadway's closed drainage system.

The proposed project extents are within the existing gravel parking lot, which is where the three dry well systems are located. Based on knowledge of the on-site soil, it is understood that the area is capable of fully handling and discarding all influent flow to the three dry wells within the footprints of the systems. For this reason, no runoff from the dry wells is modeled to the downstream point of interest at the off-site roadway. See the pre-development stormwater plan for sub-watershed boundaries and POI locations.

2.4 Post-Development Watershed

The post-development watershed consists of the same area as the pre-development watershed. Post-development cover will consist of paved parking areas, landscaped areas, and naturally vegetated areas. Construction of the project will not change the locations of the POI(s), though the drainage areas to each will change.

The project proposes one stormwater management system that will pre-treat and treat stormwater runoff to remove pollutants and detain peak flows to levels below the pre-development watershed conditions. To the maximum extent feasible, all runoff from the new impervious areas will be collected in the subsurface infiltration gallery. Pre-treatment is provided in the isolator rows at the subsurface infiltration gallery.

POI #1: The POI #1 post-development watershed will include the project parcel and portions of the northern abutting properties including the proposed paved parking area, existing paved parking area, grassed areas, and wooded areas. The proposed parking lot area will eliminate the three existing dry well systems and will include the proposed stormwater management system – one subsurface infiltration gallery. The stormwater management system in POI #1 is centrally located within the proposed parking lot to adequately handle the runoff from the proposed impervious areas to the maximum extent feasible. The treatment system effectively discards all runoff within the footprint of the gallery and therefore does not direct any runoff off the project parcel and to the POI.

The subsurface infiltration gallery is sized to treat the water quality volume – WQV through the storage capacity of the chambers and surrounding stone and is confirmed that the system does not overtop during the 50-year storm event. The system also is checked for the 100-year storm event, which does not overtop the cover stone for the system. The native material beneath the subsurface infiltration gallery may need to be amended, pending confirmatory test pits and infiltration testing, to ensure that the maximum infiltration rate does not exceed the regulated 10 in/hr. If the soil amendment is required, the secondary infiltration gallery design option with amended soils, shall be constructed (Layout B). The alternate layout, Layout B, can be found detailed on sheet C5.3, Construction Details. The drainage system reflects the estimated seasonal high-water table and affiliated infiltration rate in the footprint of the system based on neighboring test pits and NRCS/Site-Specific soil information. These design criteria are reflected in the drainage model. Confirmatory test pits shall be performed at the start of construction due to the necessary depth of the test pit and the homogeneous nature of the on-site soils. Refer to Site-Specific Soil Report and Infiltration Feasibility Report for more information on the estimated seasonal high-water table.

2.5 Schedule

Project construction is planned to commence in Spring 2026 following all applicable state and local permits.

2.6 Points of Interest

There is one point of interest in the hydraulic model. Please see the pre-development and post-development watershed section for descriptions of the points of interest.

2.7 Erosion Sediment Control/Site Stabilization

The methods to be used to control sediment migration and erosion of the site include use of tracking control pads, temporary sedimentation basins, silt fence, landscaping, hydro-seeding, and erosion control matting (if applicable) in accordance with best management practices.

The contractor will be responsible for all temporary erosion and sediment control measures during construction, while the property owner will be ultimately responsible for maintaining all permanent erosion and sediment control measures as may be required.

2.8 Water Quality

During construction activities, silt fence, mulch berms, temporary sedimentation basins, erosion control matting, and seeding/mulching will maintain the quality of stormwater leaving the site. Runoff from disturbed areas shall be directed to depressions to infiltrate into the groundwater and allow for settling of sediment/pollutants. After construction is completed and the site is stabilized, stormwater quality will be maintained by infiltration through the native/amended materials beneath the subsurface infiltration gallery. Pretreatment is provided in the proposed isolator rows before entering the respective treatment system.

2.9 Summary of Results

POI		Peak Discharge				
		2-yr		10-yr	25-yr	50-yr
		Peak Q	Discharged Volume	Peak Q	Peak Q	Peak Q
#1	Pre	3.98 cfs	0.53 ac-ft	5.94 cfs	7.47 cfs	8.91 cfs
	Post	3.73 cfs	0.48 ac-ft	5.56 cfs	6.99 cfs	8.42 cfs

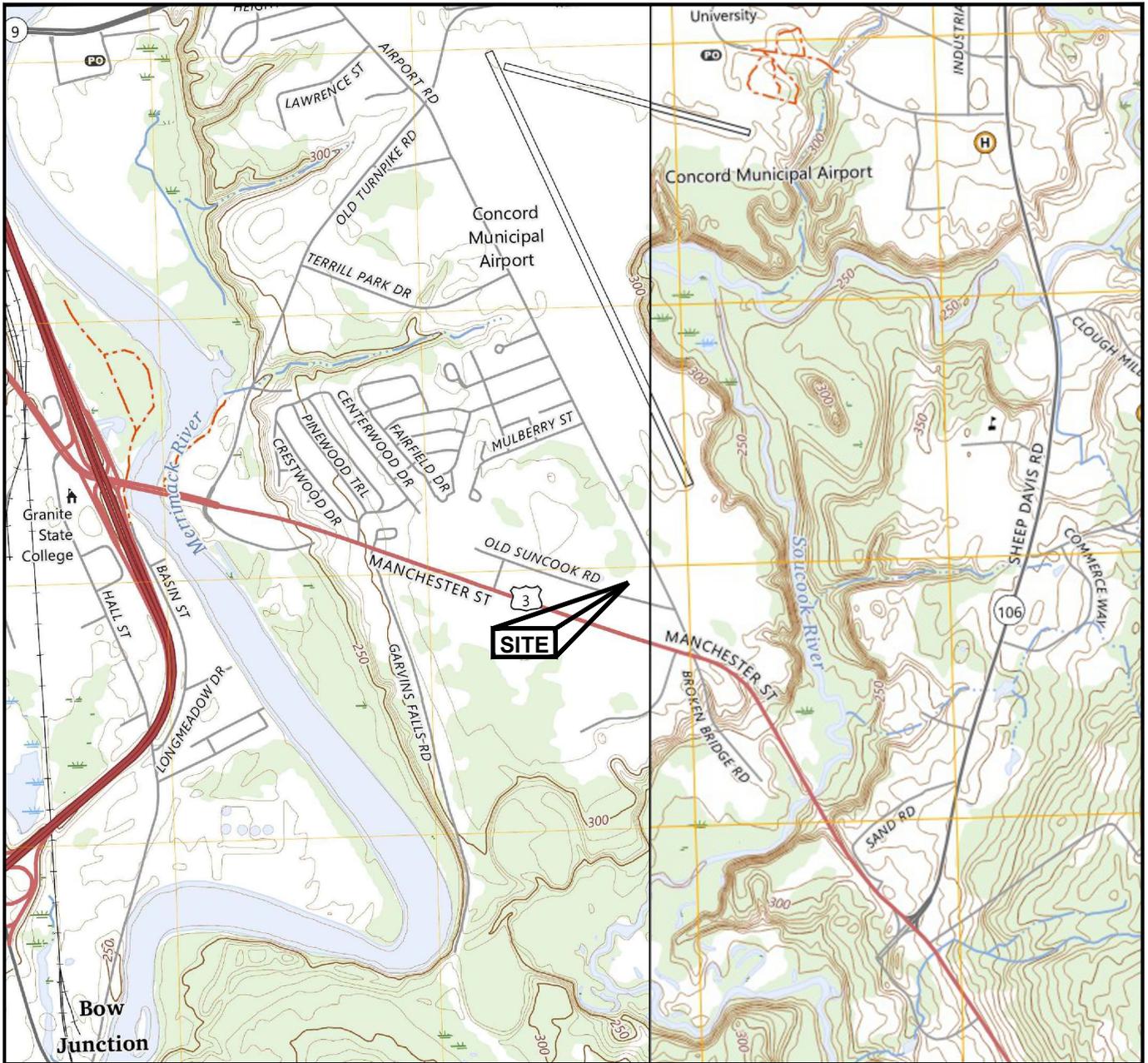
2.10 Conclusions

The preceding table and following calculations indicate that the post-development peak flow rates of the property will be attenuated to a value below the pre-development peak flow in the 2-year, 10-year, 25-year, and 50-year. Stormwater is collected in the proposed subsurface infiltration gallery; and treated by means of infiltration prior to entering the groundwater table.

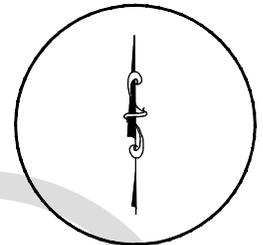
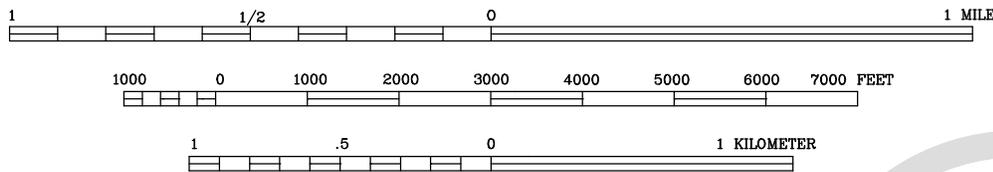
The proposed design meets the Env-Wq 1507.05 Channel Protection Requirement for peak flow rates. The 2-year, 24-hour post-development peak flow rates at all points of interest are less than the 2-year, 24-hour pre-development peak flow rates and/or has not increased over the pre-development volume by more than 0.1 acre-feet. Calculations are included for the 2-year, 10-year, 25-year and 50-year events.

3.0 WEB GIS INFORMATION

- 3.1 USGS Location Map
- 3.2 AoT Screening Layers Map
- 3.3 NHDES Screening Layers Map



SCALE: 1: 24,000



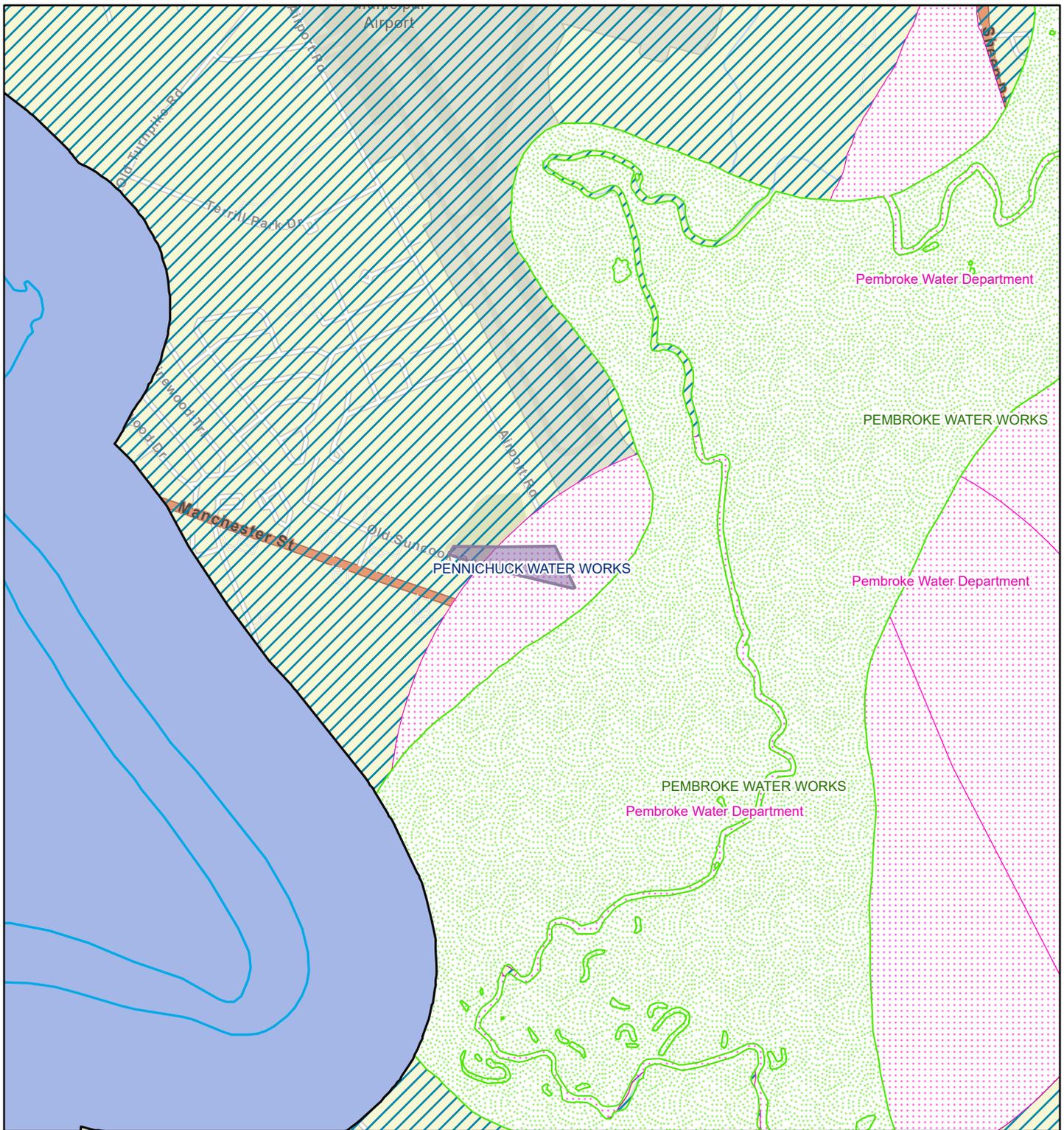
CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

DATE 11/19/2025	SCALE AS SHOWN	FILE BACC0005-LOCATION MAP
APPROVED BY ERL	DRAWN BY RPSB	REVISED
OWNER NAME BANKS CHEVROLET	JOB NUMBER BACC0005	
LOCATION BANKS CHEVROLET PARKING LOT RECONSTRUCTION 234 AIRPORT ROAD CONCORD, NH 03301 MAP 782, BLOCK Z, LOT 8	MAP SOURCE SUNCOOK, NH CONCORD, NH USGS QUAD 2024	

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SITE LOCATION MAP

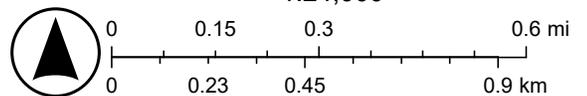
AoT Screening Layers Map



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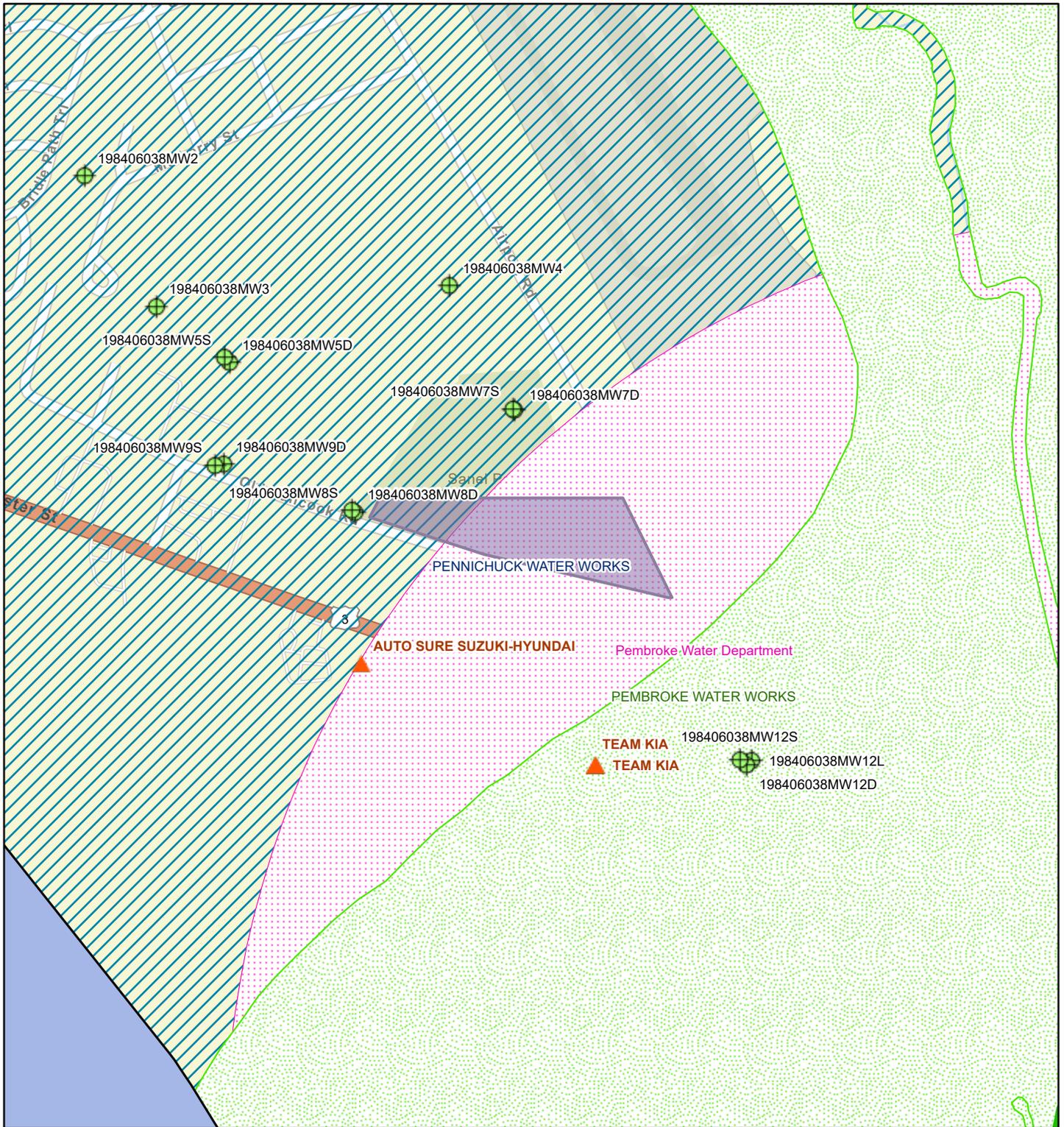
1:24,000

-  Designated Rivers
-  Designated River Corridor
-  Groundwater Classification Areas GA2
-  Groundwater Classification Areas GAA
-  Source Water Protection Areas
-  Wellhead Protection Areas



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

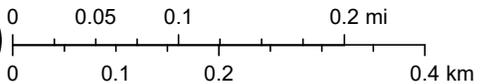
NHDES Screening Layers Map



8/19/2025, 9:59:20 AM

1:10,000

- Sanitary Protection Areas
- Designated River Corridor
- + Environmental Monitoring Sites Secure
- Local Potential Contamination Sources
- Groundwater Classification Areas GA2
- Groundwater Classification Areas GAA
- Source Water Protection Areas
- Wellhead Protection Areas



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

4.0 NH NATURAL HERITAGE BUREAU REVIEW



DataCheck Results Letter
For NHDES Ecological Review

To: Kim Harrington
2 Home Ave
Concord, NH 03301
kharrington@wilcoxandbarton.com

From: Ecological Review Section
NH Department of Environmental Services
Main Contact: Maddie Severance - EcologicalReviews@des.nh.gov

cc: NHFG Review, David Simmons

Date: 08/28/2025 (valid until 08/28/2026)

Re: DataCheck Review by NHDES Ecological Review Section and NH Fish & Game

Permits: MUNICIPAL POR - Concord, NHDES - Alteration of Terrain Permit, USEPA - Stormwater Pollution Prevention

DCT ID: DCT25-2394

Town: Concord
Location: 234 Airport Road

Project Description: The existing gravel parking area at the parcel located at 234 Airport Road in Concord, NH is proposed to be developed with a paved parking area for the display and storage of vehicles for sale. The proposed footprint will be similar but not identical to the existing footprint. The existing gravel area is approximately 65,000 sf.

Next Steps for Applicant:

NHDES's Ecological Review Section has searched the Natural Heritage Bureau's (NHB) database of rare species and exemplary natural communities. Please carefully read the comments below and the consultation requirements on the following page.

Plant and Natural

Community Comments: Please provide proposed plans and representative photos of the proposed impact areas.

Wildlife Comments: Please refer to NHFG consultation requirements below.



DataCheck Results Letter For NHDES Ecological Review

Plant and Natural Community Consultation

If this DataCheck letter includes records of rare plants and/or natural communities/systems, please contact the Ecological Review Section and provide any requested supplementary materials by emailing EcologicalReviews@des.nh.gov.

If this DataCheck letter DOES NOT include any records of rare plants and/or natural communities/systems, no further consultation with the Ecological Review Section regarding rare plants and/or natural communities/systems is required.

Wildlife Consultation

If this DataCheck letter DOES NOT include ANY wildlife species records, then, based on the information submitted, no further consultation with the NH Fish and Game Department (NHFG) pursuant to Fis 1004 is required.

If this DataCheck letter includes a record for a threatened (T) or endangered (E) wildlife species, consultation with the New Hampshire Fish and Game Department under Fis 1004 may be required. To review the Fis 1000 rules (effective February 3, 2022), please go to <https://www.wildlife.nh.gov/wildlife-and-habitat/nongame-and-endangered-species/environmental-review>. All requests for consultation and submittals should be sent via email to NHFGreview@wildlife.nh.gov or can be sent by mail, and must include the DataCheck results letter number and "Fis 1004 consultation request" in the subject line.

If the DataCheck response letter does not include a threatened or endangered wildlife species but includes other wildlife species (e.g., Species of Special Concern), consultation under Fis 1004 is not required; however, some species are protected under other state laws or rules, so coordination with NH Fish & Game is highly recommended or may be required for certain permits. While some permitting processes are exempt from required consultation under Fis 1004 (e.g., *statutory permit by notification, permit by rule, permit by notification, routine roadway registration, docking structure registration, or conditional authorization by rule*), coordination with NH Fish & Game may still be required under the rules governing those specific permitting processes, and it is recommended you contact the applicable permitting agency. For projects not requiring consultation under Fis 1004, but where additional coordination with NH Fish and Game is requested, please email NHFGreview@wildlife.nh.gov, and include the DataCheck results letter number and "review request" in the email subject line.

Contact NH Fish & Game at (603) 271-0467 with questions.

Federal ESA Compliance

This letter does not constitute compliance with the federal Endangered Species Act (ESA). There may be occurrences of federally listed species in New Hampshire that are not included on the NH DataCheck Letter. For compliance with the federal Endangered Species Act (ESA), please visit the US Fish and Wildlife Service's (USFWS) Information for Planning and Consultation website (<https://ipac.ecosphere.fws.gov/>; IPaC) for an official list of federally listed species that may be present in your project area. If a federal agency is involved in your project through funding, permit, or other authorization, coordinate your IPaC results with your point of contact at the agency for further ESA review. If there is no federal agency nexus to your project, and you determine through IPaC, habitat evaluations, etc. that a project may cause take of a federally listed species, we recommend coordinating with the USFWS' New England Field Office (newengland@fws.gov; 603-223-2541).



DataCheck Results Letter
For NHDES Ecological Review

NHB Database Records:

The following record(s) have been documented in the vicinity of the proposed project. Please refer to this list when coordinating.

Invertebrate Species	State¹	Federal	Notes
Frosted Elfin (<i>Collophrys irus</i>)*	E	--	Contact the NH Fish & Game Dept (see above).
Karner Blue Butterfly (<i>Lycaeides melissa samuelis</i>)*	E	E	Contact the NH Fish & Game Dept and the US Fish & Wildlife Service (see above).

Natural Community	State¹	Federal	Notes
Pitch pine - scrub oak woodland: Merrimack Valley variant*	--	--	

Plant species	State¹	Federal	Notes
clasping milkweed (<i>Asclepias amplexicaulis</i>)*	T	--	This species grows in sandplains and disturbed openings, and is sensitive to disturbances that eliminate its habitat.
golden heather (<i>Hudsonia ericoides</i>)*	E	--	Probably sensitive to trampling. Shade-intolerant.
Houghton's umbrella sedge (<i>Cyperus houghtonii</i>)*	E	--	Threats include destruction of natural habitat, fire suppression and/or succession, trampling by hikers, and off-road vehicles. However, since the plants require open habitat, some disturbances (e.g., logging, mowing, and even off-road vehicle use) could actually benefit populations. Site-specific evaluation of conditions will aid in the conservation of this species.
upright false bindweed (<i>Calystegia spithamea ssp. spithamea</i>)	E	--	This species occurs in dry forests, thin woods, sandplains, and disturbed openings. Threats would include development of its habitat or recreational use that directly impacted the plants.
wild lupine (<i>Lupinus perennis ssp. perennis</i>)	T	--	This wildflower grows in extremely dry, sandy openings and is easily identified in the field (see any wildflower guide) between early May and August. It is tolerant of surrounding disturbance and depends upon periodic mowing (or, historically, wildfire) to eliminate trees that would otherwise shade it out. It does not transplant well due to a tap root that can be more than three feet long.

Vertebrate species	State¹	Federal	Notes
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DataCheck Results Letter
For NHDES Ecological Review

Eastern Hognose Snake (<i>Heterodon platirhinos</i>)*	E	--	Contact the NH Fish & Game Dept (see above).
Eastern Meadowlark (<i>Sturnella magna</i>)*	T	--	Contact the NH Fish & Game Dept (see above).
Grasshopper Sparrow (<i>Ammodramus savannarum</i>)*	T	--	Contact the NH Fish & Game Dept (see above).
Northern Black Racer (<i>Coluber constrictor constrictor</i>)*	T	--	Contact the NH Fish & Game Dept (see above).
Northern Leopard Frog (<i>Lithobates pipiens</i>)*	SC	--	Contact the NH Fish & Game Dept (see above).
Spotted Turtle (<i>Clemmys guttata</i>)*	T	--	Contact the NH Fish & Game Dept (see above).
Wood Turtle (<i>Glyptemys insculpta</i>)*	SC	--	Contact the NH Fish & Game Dept (see above).

¹Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list.

An asterisk (*) indicates that the most recent report for that occurrence was 20 or more years ago.

For all animal reviews, refer to 'Wildlife Consultation' section above. For all federally-listed species, refer to the 'Federal ESA Compliance' section above.

Disclaimer: NHB's database can only tell you of known occurrences that have been reported to NHFG/NHB. Known occurrences are based on information gathered by qualified biologists or members of the public, reported to our offices, and verified by NHB/NHFG.

However, many areas have never been surveyed, or have only been surveyed for certain species. Surveys are recommended to determine what species/natural communities are present onsite.



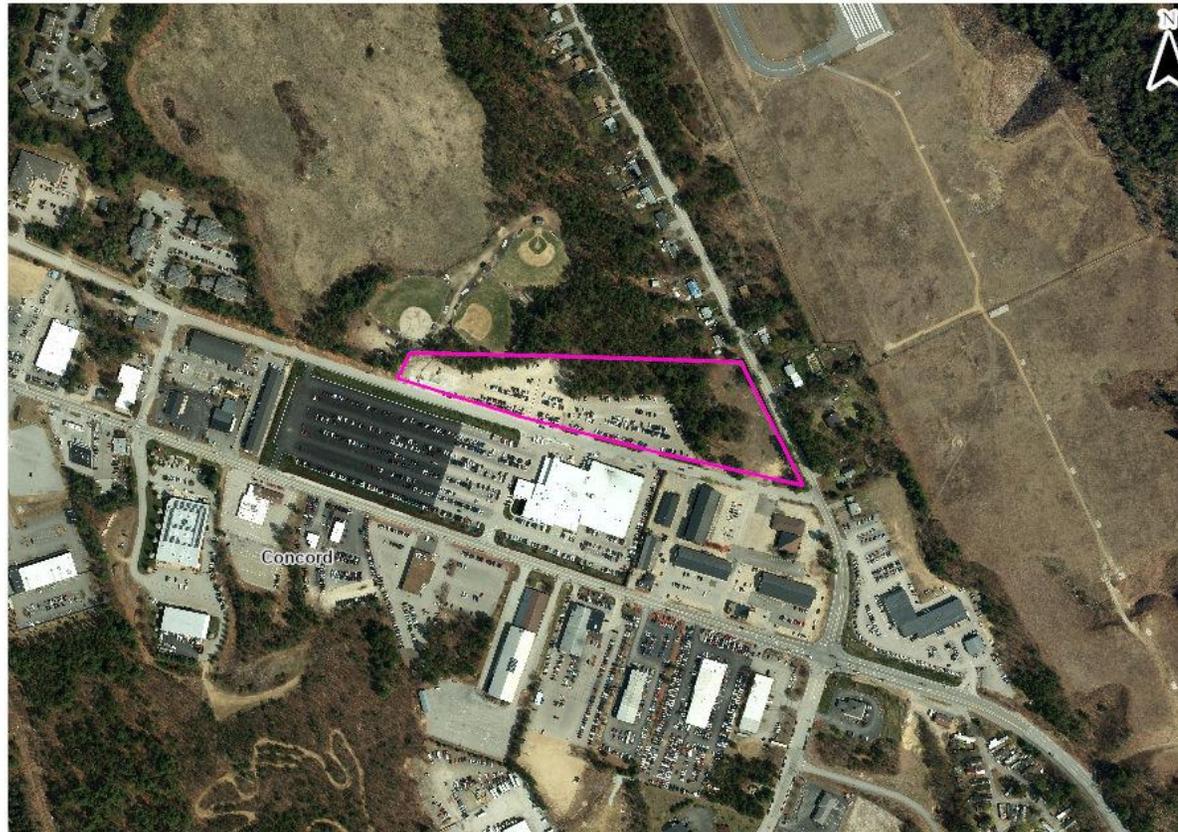
DataCheck Results Letter

For NHDES Ecological Review

Please note: Effective June 10th, 2025, DataCheck letters will no longer include specific locations of rare species and exemplary natural communities. Changes to the map have been made to reflect this update.

Important: The list of rare species and exemplary natural communities that may be impacted by the project is included. Please refer to that list when coordinating.

DCT25-2394



5.0 NRCS SOIL INFORMATION



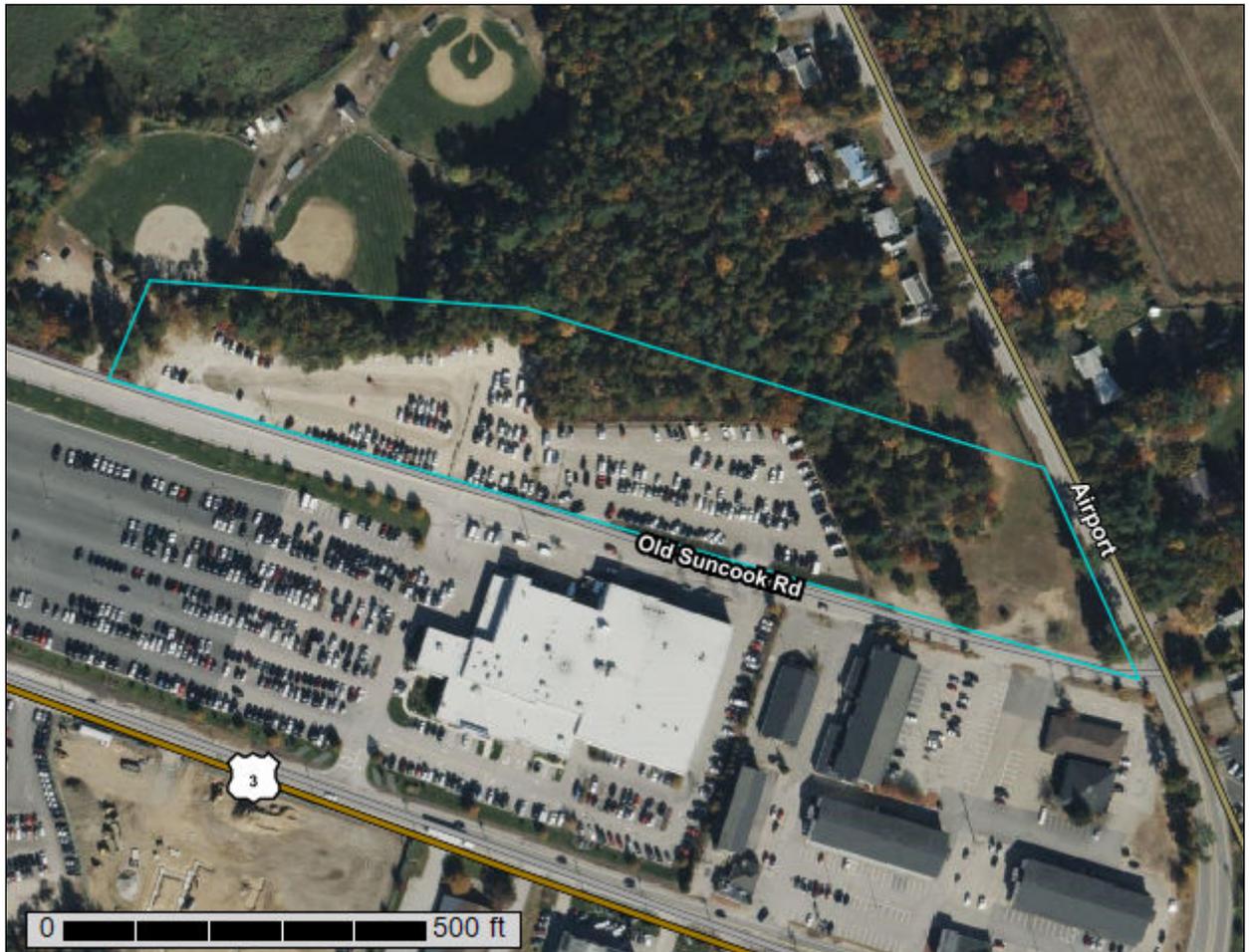
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Merrimack and Belknap Counties, New Hampshire



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

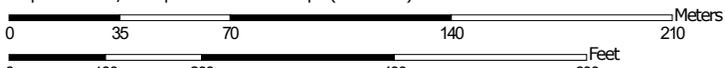
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:2,380 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Merrimack and Belknap Counties, New Hampshire
 Survey Area Data: Version 31, Sep 10, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 6, 2022—Oct 22, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
26A	Windsor loamy sand, 0 to 3 percent slopes	6.2	85.1%
699B	Urban land, 0 to 8 percent slopes	1.1	14.9%
Totals for Area of Interest		7.2	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

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onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Merrimack and Belknap Counties, New Hampshire

26A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkg
Elevation: 0 to 990 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of local importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Outwash plains, outwash terraces, deltas, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Deerfield, loamy sand

Percent of map unit: 10 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, tal
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hinckley, loamy sand

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest,
rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

699B—Urban land, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9dmm
Elevation: 200 to 1,970 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 37 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udipsamments

Percent of map unit: 10 percent

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Landform: Terraces
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Custom Soil Resource Report

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

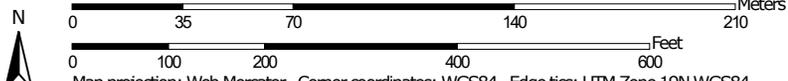
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Soil Map may not be valid at this scale.

Map Scale: 1:2,380 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
 Area of Interest (AOI)

Soils

Soil Rating Polygons

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

Water Features

-  Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

-  Aerial Photography

Soils (continued)

-  C
-  C/D
-  D
-  Not rated or not available

MAP INFORMATION

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Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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Soil Survey Area: Merrimack and Belknap Counties, New Hampshire
 Survey Area Data: Version 31, Sep 10, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 6, 2022—Oct 22, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
26A	Windsor loamy sand, 0 to 3 percent slopes	A	6.2	85.1%
699B	Urban land, 0 to 8 percent slopes		1.1	14.9%
Totals for Area of Interest			7.2	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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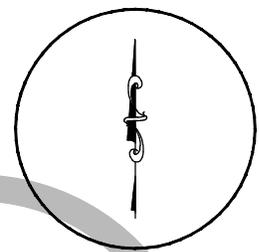
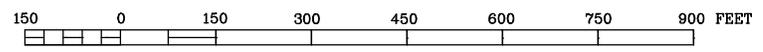
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6.0 AERIAL SITE PHOTOGRAPH



CITY OF CONCORD AERIAL
 IMAGE FROM 2020.
 NOTE: HOUSES ARE NO
 LONGER IN THE
 PROPERTY

SCALE: 1: 3,600



DATE 11/19/2025	SCALE AS SHOWN	FILE BACC0005-LOCATION MAP
APPROVED BY ERL	DRAWN BY RPSB	REVISED
OWNER NAME BANKS CHEVROLET		JOB NUMBER BACC0005
LOCATION BANKS CHEVROLET PARKING LOT RECONSTRUCTION 234 AIRPORT ROAD CONCORD, NH 03301 MAP 782, BLOCK Z, LOT 8		MAP SOURCE CONCORD 2020, NH ARCGIS

Wilcox & Barton INC.
 CIVIL · ENVIRONMENTAL · GEOTECHNICAL

AERIAL MAP

7.0 SITE PHOTOGRAPHS

**EXISTING PHOTOS – BANKS CHEVROLET PARKING LOT RECONSTRUCTION
234 AIRPORT RD, CONCORD, NH**



Figure 1: Western view at western end of property onto Old Suncook Road.



Figure 2: Eastern view of existing gravel parking area.



Figure 3: Property's frontage along Old Suncook Road, facing west.



Figure 4: Property's frontage along Old Suncook Road, facing east.



Figure 5: Northern view at rear of existing paved parking area to remain.



Figure 6: Southern view of existing gravel parking area and dry well location.



Figure 7: Eastern view at gravel parking area extents – facing existing paved parking lot to remain.



Figure 8: Eastern view of adjacent vegetation at gravel parking area, minor tree cutting proposed adjacent to existing gravel parking area.



Figure 9: Grassed area between Old Suncook Road and Airport Road (no disturbance proposed in this area).



Figure 10: Wooded area between Old Suncook Road and Airport Road (no disturbance proposed in this area).



Figure 11: Northwestern view of property's frontage along Airport Road (no disturbance proposed in this area).

8.0 SITE DESIGN CRITERIA

- 8.1 Groundwater recharge volume calculations
- 8.2 BMP calculation worksheets

INFILTRATION PRACTICE CRITERIA (Env-Wq 1508.07)

Type/Node Name: Infiltration Gallery-1 (Layout A)

Enter the type of infiltration practice (such as basin, trench) and the node name in the drainage analysis, if applicable.

yes		Have you reviewed Env-Wq 1508.07(a) to ensure that infiltration is allowed?	← yes
1.28	ac	A = Area draining to the practice	
1.28	ac	A _i = Impervious area draining to the practice	
1.00	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.95	unitless	R _v = Runoff coefficient = 0.05 + (0.9 x I)	
1.22	ac-in	WQV = 1" x R _v x A	
4,414	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1,104	cf	25% x WQV (check calc for sediment forebay volume)	
isolator row			
		Method of pretreatment? (not required for clean or roof runoff)	
	cf	V _{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
14,028	cf	V = Volume ¹ (attach a stage-storage table)	≥ WQV
4,675	sf	A _{SA} = Surface area of the bottom of the pond	
3.00	iph	K _{satDESIGN} = Design infiltration rate ²	
3.8	hours	T _{DRAIN} = Drain time = V / (A _{SA} * I _{DESIGN})	< 72-hrs
318.37	feet	E _{BTM} = Elevation of the bottom of the basin	
315.37	feet	E _{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
315.37	feet	E _{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
3.00	feet	D _{SHWT} = Separation from SHWT	≥ * ³
3.0	feet	D _{ROCK} = Separation from bedrock	≥ * ³
	ft	D _{amend} = Depth of amended soil, if applicable due high infiltration rate	≥ 24"
	ft	D _T = Depth of trench, if trench proposed	4 - 10 ft
yes	Yes/No	If a trench or underground system is proposed, has observation well been provided?	← yes
		If a trench is proposed, does material meet Env-Wq 1508.07(k)(2) requirements. ⁴	← yes
	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
	:1	If a basin is proposed, pond side slopes.	≥ 3:1
320.58	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
322.17	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
322.87	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench? ⁵	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

- Volume below the lowest invert of the outlet structure and excludes forebay volume
- K_{satDESIGN} includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
- 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
- Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
- If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: Note: Isolator Row volume: 1 row of 21 chambers = 4,297 CF, exceeds 25% WQV (complies).

POST-DEVELOPMENT_BACC0005

Prepared by Wilcox & Barton, Inc

HydroCAD® 10.20-7a s/n 08777 © 2025 HydroCAD Software Solutions LLC

Type III 24-hr 50-yr Rainfall=6.19"

Printed 11/13/2025

Stage-Area-Storage for Pond P1: SUBSURFACE INFILTRATION GALLERY-1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
318.37	4,675	0	323.67	6,649	15,524
318.47	4,712	187	323.77	6,686	15,711
318.57	4,750	374	323.87	6,723	15,898
318.67	4,787	561			
318.77	4,824	748			
318.87	4,861	935			
318.97	4,899	1,122			
319.07	4,936	1,309			
319.17	4,973	1,603			
319.27	5,010	2,004			
319.37	5,047	2,403			
319.47	5,085	2,800			
319.57	5,122	3,196			
319.67	5,159	3,590			
319.77	5,196	3,983			
319.87	5,234	4,373			
319.97	5,271	4,762			
320.07	5,308	5,148			
320.17	5,345	5,532			
320.27	5,383	5,914			
320.37	5,420	6,293			
320.47	5,457	6,669			
320.57	5,494	7,042			
320.67	5,532	7,413			
320.77	5,569	7,780			
320.87	5,606	8,143			
320.97	5,643	8,503			
321.07	5,680	8,859			
321.17	5,718	9,210			
321.27	5,755	9,557			
321.37	5,792	9,900			
321.47	5,829	10,237			
321.57	5,867	10,569			
321.67	5,904	10,895			
321.77	5,941	11,214			
321.87	5,978	11,527			
321.97	6,016	11,831			
322.07	6,053	12,128			
322.17	6,090	12,416			
322.27	6,127	12,692			
322.37	6,165	12,956			
322.47	6,202	13,202			
322.57	6,239	13,427			
322.67	6,276	13,636			
322.77	6,314	13,837			
322.87	6,351	14,028			
322.97	6,388	14,215			
323.07	6,425	14,402			
323.17	6,462	14,589			
323.27	6,500	14,776			
323.37	6,537	14,963			
323.47	6,574	15,150			
323.57	6,611	15,337			

POST-DEVELOPMENT_BACC0005

Prepared by Wilcox & Barton, Inc

HydroCAD® 10.20-7a s/n 08777 © 2025 HydroCAD Software Solutions LLC

Type III 24-hr 50-yr Rainfall=6.19"

Printed 11/13/2025

Summary for Pond IR: ISOLATOR ROW CHECK

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	318.37'	1,958 cf	8.42'W x 156.27'L x 5.50'H Field A 7,234 cf Overall - 2,339 cf Embedded = 4,895 cf x 40.0% Voids
#2A	319.12'	2,339 cf	ADS_StormTech MC-3500 d +Cap x 21 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= 14.9 cf x 2 x 1 rows = 29.8 cf
		4,297 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.37'	3.000 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

↑1=Exfiltration (Controls 0.00 cfs)

POST-DEVELOPMENT_BACC0005

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Type III 24-hr 50-yr Rainfall=6.19"

Printed 11/13/2025

Summary for Pond AMH-1: ACCESS MANHOLE-1

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=82)

Inflow Area = 22,601 sf, 100.00% Impervious, Inflow Depth = 5.95" for 50-yr event
 Inflow = 3.17 cfs @ 12.07 hrs, Volume= 11,209 cf
 Outflow = 3.17 cfs @ 12.07 hrs, Volume= 11,202 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.17 cfs @ 12.07 hrs, Volume= 11,202 cf
 Routed to Pond P1 : SUBSURFACE INFILTRATION GALLERY-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.17' @ 13.96 hrs
 Flood Elev= 327.52'

Device	Routing	Invert	Outlet Devices
#1	Primary	319.29'	24.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 319.29' / 319.29' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=320.30' TW=320.38' (Dynamic Tailwater)
 ↑**1=Culvert** (Controls 0.00 cfs)

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Type III 24-hr 50-yr Rainfall=6.19"

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Summary for Pond AMH-2: ACCESS MANHOLE-2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=69)

Inflow Area = 33,148 sf, 100.00% Impervious, Inflow Depth = 5.95" for 50-yr event
 Inflow = 4.65 cfs @ 12.07 hrs, Volume= 16,440 cf
 Outflow = 4.65 cfs @ 12.07 hrs, Volume= 16,437 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.65 cfs @ 12.07 hrs, Volume= 16,437 cf
 Routed to Pond P1 : SUBSURFACE INFILTRATION GALLERY-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.17' @ 13.96 hrs
 Flood Elev= 326.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	319.29'	24.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 319.29' / 319.29' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=2.45 cfs @ 12.07 hrs HW=320.47' TW=320.38' (Dynamic Tailwater)
 ↑**1=Culvert** (Outlet Controls 2.45 cfs @ 1.83 fps)

INFILTRATION PRACTICE CRITERIA (Env-Wq 1508.07)

Type/Node Name: Amended Soil Gallery-1 (Layout B)

Enter the type of infiltration practice (such as basin, trench) and the node name in the drainage analysis, if applicable.

yes		Have you reviewed Env-Wq 1508.07(a) to ensure that infiltration is allowed?	← yes
1.28	ac	A = Area draining to the practice	
1.28	ac	A _i = Impervious area draining to the practice	
1.00	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.95	unitless	R _v = Runoff coefficient = 0.05 + (0.9 x I)	
1.22	ac-in	WQV = 1" x R _v x A	
4,414	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1,104	cf	25% x WQV (check calc for sediment forebay volume)	
isolator row			
		Method of pretreatment? (not required for clean or roof runoff)	
	cf	V _{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
12,728	cf	V = Volume ¹ (attach a stage-storage table)	≥ WQV
4,246	sf	A _{SA} = Surface area of the bottom of the pond	
3.00	iph	K _{satDESIGN} = Design infiltration rate ²	
4.2	hours	T _{DRAIN} = Drain time = V / (A _{SA} * I _{DESIGN})	< 72-hrs
318.37	feet	E _{BTM} = Elevation of the bottom of the basin	
315.37	feet	E _{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
315.37	feet	E _{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
3.00	feet	D _{SHWT} = Separation from SHWT	≥ * ³
3.0	feet	D _{ROCK} = Separation from bedrock	≥ * ³
	ft	D _{amend} = Depth of amended soil, if applicable due high infiltration rate	≥ 24"
	ft	D _T = Depth of trench, if trench proposed	4 - 10 ft
yes	Yes/No	If a trench or underground system is proposed, has observation well been provided?	← yes
		If a trench is proposed, does material meet Env-Wq 1508.07(k)(2) requirements. ⁴	← yes
	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
	:1	If a basin is proposed, pond side slopes.	≥ 3:1
320.51	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
321.99	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
322.87	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench? ⁵	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

- Volume below the lowest invert of the outlet structure and excludes forebay volume
- K_{satDESIGN} includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
- 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
- Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
- If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: Note: Isolator Row volume: 1 row of 19 chambers = 3,899 CF, exceeds 25% WQV (complies).

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Type III 24-hr 50-yr Rainfall=6.19"

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Stage-Area-Storage for Pond add/alt: AMENDED SOIL - GALLERY-1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
318.37	4,246	0	323.67	6,068	14,087
318.47	4,280	170	323.77	6,102	14,257
318.57	4,315	340	323.87	6,136	14,427
318.67	4,349	510			
318.77	4,384	679			
318.87	4,418	849			
318.97	4,452	1,019			
319.07	4,487	1,189			
319.17	4,521	1,456			
319.27	4,555	1,819			
319.37	4,590	2,181			
319.47	4,624	2,542			
319.57	4,659	2,901			
319.67	4,693	3,258			
319.77	4,727	3,614			
319.87	4,762	3,968			
319.97	4,796	4,321			
320.07	4,830	4,671			
320.17	4,865	5,019			
320.27	4,899	5,366			
320.37	4,933	5,709			
320.47	4,968	6,051			
320.57	5,002	6,390			
320.67	5,037	6,725			
320.77	5,071	7,058			
320.87	5,105	7,388			
320.97	5,140	7,714			
321.07	5,174	8,037			
321.17	5,208	8,356			
321.27	5,243	8,671			
321.37	5,277	8,982			
321.47	5,312	9,288			
321.57	5,346	9,589			
321.67	5,380	9,884			
321.77	5,415	10,174			
321.87	5,449	10,458			
321.97	5,483	10,734			
322.07	5,518	11,003			
322.17	5,552	11,264			
322.27	5,586	11,515			
322.37	5,621	11,755			
322.47	5,655	11,978			
322.57	5,690	12,182			
322.67	5,724	12,372			
322.77	5,758	12,554			
322.87	5,793	12,728			
322.97	5,827	12,898			
323.07	5,861	13,068			
323.17	5,896	13,238			
323.27	5,930	13,408			
323.37	5,965	13,577			
323.47	5,999	13,747			
323.57	6,033	13,917			

POST-DEVELOPMENT_BACC0005

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Type III 24-hr 50-yr Rainfall=6.19"

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Summary for Pond IR: ISOLATOR ROW CHECK

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	318.37'	1,781 cf	8.42'W x 141.93'L x 5.50'H Field A 6,570 cf Overall - 2,119 cf Embedded = 4,451 cf x 40.0% Voids
#2A	319.12'	2,119 cf	ADS_StormTech MC-3500 d +Cap x 19 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= 14.9 cf x 2 x 1 rows = 29.8 cf
		3,899 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.37'	3.000 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

↑1=Exfiltration (Controls 0.00 cfs)

9.0 HYDRAULIC CALCULATIONS

- 9.1 Extreme Precipitations
- 9.2 Pre-Development Stormwater Plan – SW.1
- 9.3 Post-Development Stormwater Plan – SW.2
- 9.4 Pre-development Conditions
 - 9.4.1 Drainage Diagram
 - 9.4.2 Area Listing
 - 9.4.3 Soil Listing
 - 9.4.4 2-yr Node Listing
 - 9.4.5 10-yr Node Listing
 - 9.4.6 25-yr Node Listing
 - 9.4.7 50-yr Node Listing
 - 9.4.8 10-yr Storm Full Summary
- 9.5 Post-Development Conditions
 - 9.5.1 Drainage Diagram
 - 9.5.2 Area Listing
 - 9.5.3 Soil Listing
 - 9.5.4 2-yr Node Listing
 - 9.5.5 10-yr Node Listing
 - 9.5.6 25-yr Node Listing
 - 9.5.7 50-yr Node Listing
 - 9.5.8 10-yr Storm Full Summary
 - 9.5.9 Infiltration Gallery-1 Secondary Analysis – Amended Soil (Layout B)

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point	
Smoothing State	Yes
Location	
Latitude	43.189 degrees North
Longitude	71.5 degrees West
Elevation	90 feet
Date/Time	Mon Jul 28 2025 13:15:37 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day
1yr	0.25	0.39	0.48	0.64	0.79	1.00	1yr	0.69	0.98	1.16	1.47	1.86	2.37	2.58	1yr	2.09	2.48	2.90	3.59	4.13
2yr	0.31	0.48	0.60	0.79	1.00	1.25	2yr	0.86	1.15	1.45	1.81	2.26	2.82	3.16	2yr	2.50	3.04	3.52	4.20	4.80
5yr	0.37	0.58	0.73	0.98	1.25	1.58	5yr	1.08	1.44	1.83	2.29	2.84	3.53	4.01	5yr	3.12	3.85	4.45	5.23	5.92
10yr	0.42	0.66	0.84	1.14	1.48	1.89	10yr	1.28	1.71	2.19	2.74	3.39	4.17	4.80	10yr	3.69	4.62	5.32	6.17	6.94
25yr	0.50	0.79	1.01	1.39	1.85	2.38	25yr	1.59	2.15	2.77	3.46	4.27	5.22	6.10	25yr	4.62	5.87	6.74	7.69	8.58
50yr	0.57	0.91	1.17	1.63	2.19	2.84	50yr	1.89	2.55	3.31	4.13	5.09	6.19	7.32	50yr	5.48	7.04	8.07	9.08	10.06
100yr	0.64	1.04	1.35	1.91	2.60	3.39	100yr	2.24	3.02	3.97	4.94	6.06	7.34	8.78	100yr	6.49	8.45	9.66	10.73	11.82
200yr	0.74	1.21	1.57	2.24	3.09	4.04	200yr	2.66	3.59	4.73	5.90	7.21	8.70	10.55	200yr	7.70	10.14	11.56	12.69	13.88
500yr	0.89	1.46	1.91	2.77	3.87	5.11	500yr	3.34	4.52	5.99	7.45	9.09	10.92	13.44	500yr	9.66	12.92	14.69	15.85	17.18

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day
1yr	0.21	0.32	0.39	0.52	0.64	0.88	1yr	0.55	0.86	1.06	1.37	1.59	2.04	2.44	1yr	1.81	2.35	2.67	3.31	3.88
2yr	0.30	0.47	0.58	0.78	0.96	1.15	2yr	0.83	1.12	1.31	1.73	2.19	2.75	3.06	2yr	2.44	2.95	3.42	4.09	4.68
5yr	0.35	0.53	0.66	0.91	1.16	1.37	5yr	1.00	1.34	1.54	2.00	2.56	3.31	3.72	5yr	2.93	3.58	4.15	4.90	5.57
10yr	0.38	0.59	0.73	1.02	1.32	1.56	10yr	1.14	1.52	1.75	2.25	2.87	3.80	4.32	10yr	3.37	4.16	4.80	5.61	6.38
25yr	0.44	0.67	0.84	1.19	1.57	1.82	25yr	1.36	1.78	2.07	2.62	3.35	4.56	5.25	25yr	4.04	5.05	5.78	6.73	7.63
50yr	0.49	0.74	0.92	1.33	1.79	2.04	50yr	1.54	2.00	2.36	2.95	3.77	5.24	6.09	50yr	4.64	5.85	6.64	7.70	8.75
100yr	0.55	0.83	1.04	1.50	2.06	2.32	100yr	1.77	2.26	2.70	3.32	4.24	6.02	7.06	100yr	5.32	6.79	7.64	8.83	10.02
200yr	0.61	0.92	1.16	1.68	2.35	2.59	200yr	2.02	2.54	3.07	3.73	4.78	6.92	8.19	200yr	6.12	7.88	8.76	10.14	11.47
500yr	0.71	1.06	1.36	1.97	2.81	3.03	500yr	2.42	2.96	3.66	4.37	5.61	8.30	9.95	500yr	7.35	9.57	10.45	12.19	13.77

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day
1yr	0.29	0.44	0.54	0.73	0.90	1.08	1yr	0.77	1.05	1.19	1.58	1.99	2.49	2.75	1yr	2.21	2.64	3.14	3.81	4.34
2yr	0.33	0.50	0.62	0.84	1.03	1.24	2yr	0.89	1.21	1.39	1.83	2.32	2.91	3.25	2yr	2.57	3.13	3.64	4.32	4.94
5yr	0.40	0.62	0.77	1.06	1.35	1.57	5yr	1.17	1.53	1.78	2.29	2.91	3.74	4.30	5yr	3.31	4.14	4.75	5.54	6.28
10yr	0.48	0.74	0.92	1.29	1.66	1.90	10yr	1.44	1.86	2.15	2.72	3.47	4.55	5.32	10yr	4.03	5.12	5.87	6.70	7.58
25yr	0.62	0.94	1.17	1.67	2.20	2.47	25yr	1.90	2.42	2.77	3.41	4.36	5.89	7.06	25yr	5.22	6.79	7.73	8.61	9.66
50yr	0.73	1.12	1.39	2.00	2.69	3.02	50yr	2.32	2.95	3.33	4.07	5.18	7.17	8.74	50yr	6.35	8.40	9.53	10.43	11.63
100yr	0.89	1.34	1.68	2.43	3.33	3.68	100yr	2.88	3.60	4.03	4.84	6.17	8.75	10.84	100yr	7.74	10.42	11.79	12.63	14.00
200yr	1.06	1.60	2.03	2.94	4.10	4.49	200yr	3.53	4.39	4.86	5.77	7.36	10.65	13.42	200yr	9.42	12.90	14.61	15.31	16.84
500yr	1.37	2.03	2.62	3.80	5.40	5.86	500yr	4.66	5.73	6.25	7.29	9.30	13.84	17.85	500yr	12.25	17.16	19.40	19.75	21.52



REVISION HISTORY

1.

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OWNER

**DAVAL REALTY
ASSOCIATES LLC /
BANKS CHEVROLET**

**137 MANCHESTER ST
CONCORD, NH 03301**

**BANKS CHEVROLET
PARKING LOT
RECONSTRUCTION**

**234 AIRPORT ROAD
CONCORD, NH 03301**

MBLU: 782/Z/8

DRAWING TITLE

**PRE-DEVELOPMENT
WATERSHED PLAN**

SCALE

1" = 50'

DATE

11/19/2025

DRAFTED BY

KAD

CHECKED BY

ERL

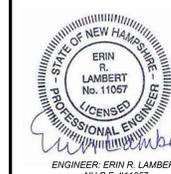
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ERL

PROJECT NO.

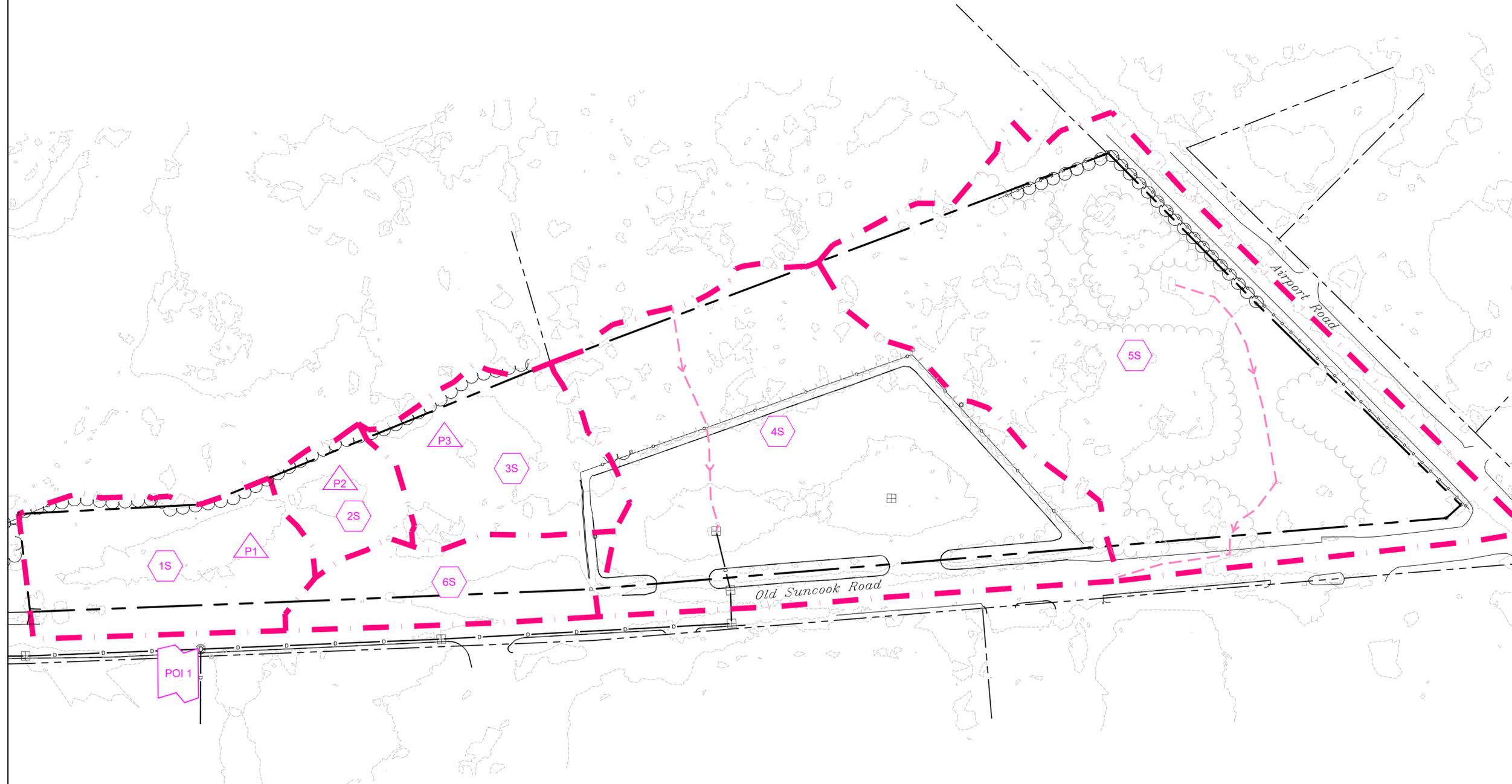
BACC0005

SHEET NO.



SW1

01 OF 02



STORMWATER PLAN LEGEND

-  SUBCATCHMENT NODE
-  POND NODE
-  REACH NODE
-  POINT OF INTEREST NODE
-  PRE-DEVELOPMENT SUBWATERSHED BOUNDARY
-  PRE-DEVELOPMENT SUBWATERSHED TIME OF CONCENTRATION

GRAPHIC SCALE



(IN FEET)
1 inch = 50 ft.

REVISION HISTORY

NO.	DATE	DESCRIPTION

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OWNER

DAVAL REALTY ASSOCIATES LLC / BANKS CHEVROLET

**137 MANCHESTER ST
CONCORD, NH 03301**

**BANKS CHEVROLET
PARKING LOT
RECONSTRUCTION**

**234 AIRPORT ROAD
CONCORD, NH 03301**

MBLU: 782/Z/8

DRAWING TITLE
**POST-DEVELOPMENT
WATERSHED PLAN**

SCALE: 1" = 50' DATE: 11/19/2025

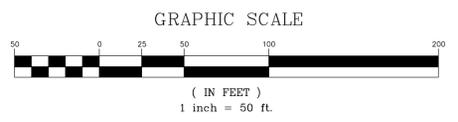
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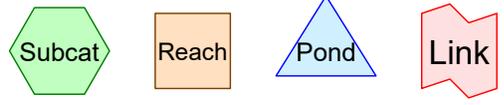
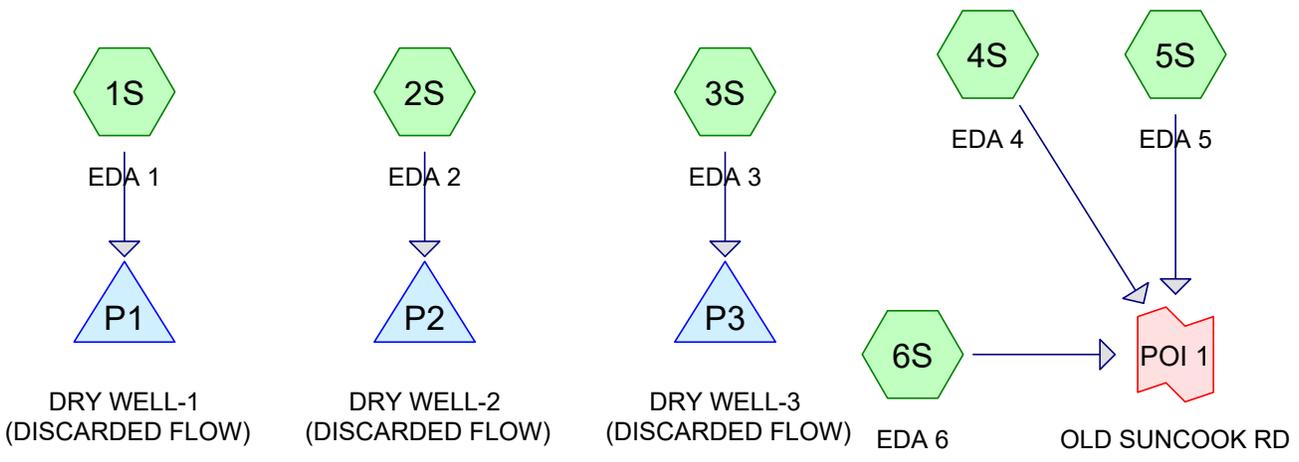
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STORMWATER PLAN LEGEND

- SUBCATCHMENT NODE
- POND NODE
- REACH NODE
- POINT OF INTEREST NODE
- PRE-DEVELOPMENT SUBWATERSHED BOUNDARY
- PRE-DEVELOPMENT SUBWATERSHED TIME OF CONCENTRATION





Routing Diagram for PRE-DEVELOPMENT_BACC0005
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Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	2.82	2

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
67,655	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S, 5S, 6S)
995	98	EXISTING BUILDING (5S)
73,475	98	EXISTING COMPACTED GRAVEL (1S, 2S, 3S, 6S)
102,974	98	EXISTING PAVEMENT (1S, 3S, 4S, 5S, 6S)
129,932	30	Woods, Good, HSG A (1S, 2S, 3S, 4S, 5S)
375,031	64	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
197,587	HSG A	1S, 2S, 3S, 4S, 5S, 6S
0	HSG B	
0	HSG C	
0	HSG D	
177,444	Other	1S, 2S, 3S, 4S, 5S, 6S
375,031		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
67,655	0	0	0	0	67,655	>75% Grass cover, Good
0	0	0	0	995	995	EXISTING BUILDING
0	0	0	0	73,475	73,475	EXISTING COMPACTED GRAVEL
0	0	0	0	102,974	102,974	EXISTING PAVEMENT
129,932	0	0	0	0	129,932	Woods, Good
197,587	0	0	0	177,444	375,031	TOTAL AREA

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Type III 24-hr 2-yr Rainfall=2.82"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EDA 1	Runoff Area=35,720 sf 94.49% Impervious Runoff Depth=2.45" Tc=5.0 min CN=WQ Runoff=2.13 cfs 7,282 cf
Subcatchment 2S: EDA 2	Runoff Area=12,068 sf 91.36% Impervious Runoff Depth=2.37" Tc=5.0 min CN=WQ Runoff=0.69 cfs 2,379 cf
Subcatchment 3S: EDA 3	Runoff Area=30,665 sf 82.03% Impervious Runoff Depth=2.12" Tc=5.0 min CN=WQ Runoff=1.59 cfs 5,427 cf
Subcatchment 4S: EDA 4	Runoff Area=120,594 sf 56.40% Impervious Runoff Depth=1.46" Flow Length=222' Tc=20.3 min CN=WQ Runoff=2.88 cfs 14,674 cf
Subcatchment 5S: EDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.29" Flow Length=310' Tc=30.7 min CN=WQ Runoff=0.61 cfs 3,692 cf
Subcatchment 6S: EDA 6	Runoff Area=23,138 sf 96.77% Impervious Runoff Depth=2.51" Tc=5.0 min CN=WQ Runoff=1.41 cfs 4,831 cf
Pond P1: DRY WELL-1 (DISCARDED FLOW)	Inflow=2.13 cfs 7,282 cf Primary=2.13 cfs 7,282 cf
Pond P2: DRY WELL-2 (DISCARDED FLOW)	Inflow=0.69 cfs 2,379 cf Primary=0.69 cfs 2,379 cf
Pond P3: DRY WELL-3 (DISCARDED FLOW)	Inflow=1.59 cfs 5,427 cf Primary=1.59 cfs 5,427 cf
Link POI 1: OLD SUNCOOK RD	Inflow=3.98 cfs 23,197 cf Primary=3.98 cfs 23,197 cf

Total Runoff Area = 375,031 sf Runoff Volume = 38,284 cf Average Runoff Depth = 1.23"
52.69% Pervious = 197,587 sf 47.31% Impervious = 177,444 sf

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type III 24-hr		Default	24.00	1	4.17	2

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Type III 24-hr 10-yr Rainfall=4.17"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EDA 1	Runoff Area=35,720 sf 94.49% Impervious Runoff Depth=3.72" Tc=5.0 min CN=WQ Runoff=3.17 cfs 11,073 cf
Subcatchment 2S: EDA 2	Runoff Area=12,068 sf 91.36% Impervious Runoff Depth=3.60" Tc=5.0 min CN=WQ Runoff=1.04 cfs 3,618 cf
Subcatchment 3S: EDA 3	Runoff Area=30,665 sf 82.03% Impervious Runoff Depth=3.23" Tc=5.0 min CN=WQ Runoff=2.37 cfs 8,262 cf
Subcatchment 4S: EDA 4	Runoff Area=120,594 sf 56.40% Impervious Runoff Depth=2.23" Flow Length=222' Tc=20.3 min CN=WQ Runoff=4.30 cfs 22,380 cf
Subcatchment 5S: EDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.46" Flow Length=310' Tc=30.7 min CN=WQ Runoff=0.91 cfs 5,871 cf
Subcatchment 6S: EDA 6	Runoff Area=23,138 sf 96.77% Impervious Runoff Depth=3.81" Tc=5.0 min CN=WQ Runoff=2.11 cfs 7,346 cf
Pond P1: DRY WELL-1 (DISCARDED FLOW)	Inflow=3.17 cfs 11,073 cf Primary=3.17 cfs 11,073 cf
Pond P2: DRY WELL-2 (DISCARDED FLOW)	Inflow=1.04 cfs 3,618 cf Primary=1.04 cfs 3,618 cf
Pond P3: DRY WELL-3 (DISCARDED FLOW)	Inflow=2.37 cfs 8,262 cf Primary=2.37 cfs 8,262 cf
Link POI 1: OLD SUNCOOK RD	Inflow=5.94 cfs 35,596 cf Primary=5.94 cfs 35,596 cf

Total Runoff Area = 375,031 sf Runoff Volume = 58,549 cf Average Runoff Depth = 1.87"
52.69% Pervious = 197,587 sf 47.31% Impervious = 177,444 sf

Summary for Subcatchment 1S: EDA 1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.17 cfs @ 12.07 hrs, Volume= 11,073 cf, Depth= 3.72"
 Routed to Pond P1 : DRY WELL-1 (DISCARDED FLOW)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

	Area (sf)	CN	Description
*	9,905	98	EXISTING PAVEMENT
*	23,847	98	EXISTING COMPACTED GRAVEL
	1,118	39	>75% Grass cover, Good, HSG A
	850	30	Woods, Good, HSG A
	35,720		Weighted Average
	1,968		5.51% Pervious Area
	33,752		94.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 2S: EDA 2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.04 cfs @ 12.07 hrs, Volume= 3,618 cf, Depth= 3.60"
 Routed to Pond P2 : DRY WELL-2 (DISCARDED FLOW)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

	Area (sf)	CN	Description
*	11,025	98	EXISTING COMPACTED GRAVEL
	548	39	>75% Grass cover, Good, HSG A
	495	30	Woods, Good, HSG A
	12,068		Weighted Average
	1,043		8.64% Pervious Area
	11,025		91.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 3S: EDA 3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.37 cfs @ 12.07 hrs, Volume= 8,262 cf, Depth= 3.23"
 Routed to Pond P3 : DRY WELL-3 (DISCARDED FLOW)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 1,762	98	EXISTING PAVEMENT
* 23,391	98	EXISTING COMPACTED GRAVEL
2,717	39	>75% Grass cover, Good, HSG A
2,795	30	Woods, Good, HSG A
30,665		Weighted Average
5,512		17.97% Pervious Area
25,153		82.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 4S: EDA 4

Runoff = 4.30 cfs @ 12.27 hrs, Volume= 22,380 cf, Depth= 2.23"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 68,012	98	EXISTING PAVEMENT
14,576	39	>75% Grass cover, Good, HSG A
38,006	30	Woods, Good, HSG A
120,594		Weighted Average
52,582		43.60% Pervious Area
68,012		56.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.82"
2.3	70	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	12	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.5	90	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
20.3	222	Total			

Summary for Subcatchment 5S: EDA 5

Runoff = 0.91 cfs @ 12.40 hrs, Volume= 5,871 cf, Depth= 0.46"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 16,117	98	EXISTING PAVEMENT
* 995	98	EXISTING BUILDING
47,948	39	>75% Grass cover, Good, HSG A
87,786	30	Woods, Good, HSG A
152,846		Weighted Average
135,734		88.80% Pervious Area
17,112		11.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	50	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.82"
8.7	260	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
30.7	310	Total			

Summary for Subcatchment 6S: EDA 6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.11 cfs @ 12.07 hrs, Volume= 7,346 cf, Depth= 3.81"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 7,178	98	EXISTING PAVEMENT
* 15,212	98	EXISTING COMPACTED GRAVEL
748	39	>75% Grass cover, Good, HSG A
23,138		Weighted Average
748		3.23% Pervious Area
22,390		96.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond P1: DRY WELL-1 (DISCARDED FLOW)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	35,720 sf, 94.49% Impervious,	Inflow Depth = 3.72"	for 10-yr event
Inflow =	3.17 cfs @ 12.07 hrs,	Volume=	11,073 cf
Primary =	3.17 cfs @ 12.07 hrs,	Volume=	11,073 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond P2: DRY WELL-2 (DISCARDED FLOW)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	12,068 sf, 91.36% Impervious,	Inflow Depth = 3.60"	for 10-yr event
Inflow =	1.04 cfs @ 12.07 hrs,	Volume=	3,618 cf
Primary =	1.04 cfs @ 12.07 hrs,	Volume=	3,618 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond P3: DRY WELL-3 (DISCARDED FLOW)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	30,665 sf, 82.03% Impervious,	Inflow Depth = 3.23"	for 10-yr event
Inflow =	2.37 cfs @ 12.07 hrs,	Volume=	8,262 cf
Primary =	2.37 cfs @ 12.07 hrs,	Volume=	8,262 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link POI 1: OLD SUNCOOK RD

Inflow Area =	296,578 sf, 36.25% Impervious,	Inflow Depth = 1.44"	for 10-yr event
Inflow =	5.94 cfs @ 12.26 hrs,	Volume=	35,596 cf
Primary =	5.94 cfs @ 12.26 hrs,	Volume=	35,596 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-yr	Type III 24-hr		Default	24.00	1	5.22	2

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Type III 24-hr 25-yr Rainfall=5.22"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EDA 1	Runoff Area=35,720 sf 94.49% Impervious Runoff Depth=4.72" Tc=5.0 min CN=WQ Runoff=3.98 cfs 14,039 cf
Subcatchment 2S: EDA 2	Runoff Area=12,068 sf 91.36% Impervious Runoff Depth=4.56" Tc=5.0 min CN=WQ Runoff=1.30 cfs 4,590 cf
Subcatchment 3S: EDA 3	Runoff Area=30,665 sf 82.03% Impervious Runoff Depth=4.11" Tc=5.0 min CN=WQ Runoff=2.97 cfs 10,503 cf
Subcatchment 4S: EDA 4	Runoff Area=120,594 sf 56.40% Impervious Runoff Depth=2.84" Flow Length=222' Tc=20.3 min CN=WQ Runoff=5.40 cfs 28,581 cf
Subcatchment 5S: EDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.64" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.14 cfs 8,185 cf
Subcatchment 6S: EDA 6	Runoff Area=23,138 sf 96.77% Impervious Runoff Depth=4.83" Tc=5.0 min CN=WQ Runoff=2.64 cfs 9,313 cf
Pond P1: DRY WELL-1 (DISCARDED FLOW)	Inflow=3.98 cfs 14,039 cf Primary=3.98 cfs 14,039 cf
Pond P2: DRY WELL-2 (DISCARDED FLOW)	Inflow=1.30 cfs 4,590 cf Primary=1.30 cfs 4,590 cf
Pond P3: DRY WELL-3 (DISCARDED FLOW)	Inflow=2.97 cfs 10,503 cf Primary=2.97 cfs 10,503 cf
Link POI 1: OLD SUNCOOK RD	Inflow=7.47 cfs 46,079 cf Primary=7.47 cfs 46,079 cf

Total Runoff Area = 375,031 sf Runoff Volume = 75,211 cf Average Runoff Depth = 2.41"
52.69% Pervious = 197,587 sf 47.31% Impervious = 177,444 sf

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	50-yr	Type III 24-hr		Default	24.00	1	6.19	2

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Type III 24-hr 50-yr Rainfall=6.19"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EDA 1	Runoff Area=35,720 sf 94.49% Impervious Runoff Depth=5.64" Tc=5.0 min CN=WQ Runoff=4.73 cfs 16,793 cf
Subcatchment 2S: EDA 2	Runoff Area=12,068 sf 91.36% Impervious Runoff Depth=5.46" Tc=5.0 min CN=WQ Runoff=1.55 cfs 5,495 cf
Subcatchment 3S: EDA 3	Runoff Area=30,665 sf 82.03% Impervious Runoff Depth=4.93" Tc=5.0 min CN=WQ Runoff=3.53 cfs 12,610 cf
Subcatchment 4S: EDA 4	Runoff Area=120,594 sf 56.40% Impervious Runoff Depth=3.45" Flow Length=222' Tc=20.3 min CN=WQ Runoff=6.44 cfs 34,637 cf
Subcatchment 5S: EDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.88" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.44 cfs 11,173 cf
Subcatchment 6S: EDA 6	Runoff Area=23,138 sf 96.77% Impervious Runoff Depth=5.78" Tc=5.0 min CN=WQ Runoff=3.14 cfs 11,136 cf
Pond P1: DRY WELL-1 (DISCARDED FLOW)	Inflow=4.73 cfs 16,793 cf Primary=4.73 cfs 16,793 cf
Pond P2: DRY WELL-2 (DISCARDED FLOW)	Inflow=1.55 cfs 5,495 cf Primary=1.55 cfs 5,495 cf
Pond P3: DRY WELL-3 (DISCARDED FLOW)	Inflow=3.53 cfs 12,610 cf Primary=3.53 cfs 12,610 cf
Link POI 1: OLD SUNCOOK RD	Inflow=8.91 cfs 56,945 cf Primary=8.91 cfs 56,945 cf

Total Runoff Area = 375,031 sf Runoff Volume = 91,844 cf Average Runoff Depth = 2.94"
52.69% Pervious = 197,587 sf 47.31% Impervious = 177,444 sf

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-yr	Type III 24-hr		Default	24.00	1	7.34	2

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Type III 24-hr 100-yr Rainfall=7.34"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EDA 1 Runoff Area=35,720 sf 94.49% Impervious Runoff Depth=6.74"
Tc=5.0 min CN=WQ Runoff=5.63 cfs 20,074 cf

Subcatchment 2S: EDA 2 Runoff Area=12,068 sf 91.36% Impervious Runoff Depth=6.54"
Tc=5.0 min CN=WQ Runoff=1.84 cfs 6,576 cf

Subcatchment 3S: EDA 3 Runoff Area=30,665 sf 82.03% Impervious Runoff Depth=5.93"
Tc=5.0 min CN=WQ Runoff=4.21 cfs 15,150 cf

Subcatchment 4S: EDA 4 Runoff Area=120,594 sf 56.40% Impervious Runoff Depth=4.20"
Flow Length=222' Tc=20.3 min CN=WQ Runoff=7.72 cfs 42,200 cf

Subcatchment 5S: EDA 5 Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=1.23"
Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.93 cfs 15,706 cf

Subcatchment 6S: EDA 6 Runoff Area=23,138 sf 96.77% Impervious Runoff Depth=6.90"
Tc=5.0 min CN=WQ Runoff=3.73 cfs 13,304 cf

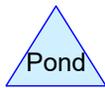
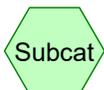
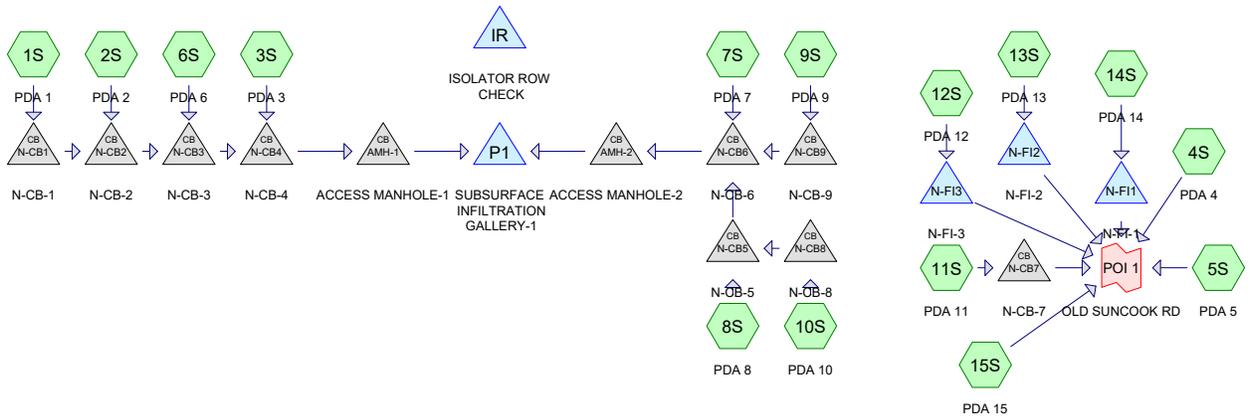
Pond P1: DRY WELL-1 (DISCARDED FLOW) Inflow=5.63 cfs 20,074 cf
Primary=5.63 cfs 20,074 cf

Pond P2: DRY WELL-2 (DISCARDED FLOW) Inflow=1.84 cfs 6,576 cf
Primary=1.84 cfs 6,576 cf

Pond P3: DRY WELL-3 (DISCARDED FLOW) Inflow=4.21 cfs 15,150 cf
Primary=4.21 cfs 15,150 cf

Link POI 1: OLD SUNCOOK RD Inflow=10.77 cfs 71,210 cf
Primary=10.77 cfs 71,210 cf

Total Runoff Area = 375,031 sf Runoff Volume = 113,011 cf Average Runoff Depth = 3.62"
52.69% Pervious = 197,587 sf 47.31% Impervious = 177,444 sf



Routing Diagram for POST-DEVELOPMENT_BACC005
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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	2.82	2

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
94,229	39	>75% Grass cover, Good, HSG A (4S, 5S, 11S, 12S, 13S, 14S, 15S)
995	98	EXISTING BUILDING (5S)
96,535	98	EXISTING PAVEMENT (4S, 5S, 11S, 15S)
55,749	98	PROPOSED PARKING LOT (1S, 2S, 3S, 6S, 7S, 8S, 9S, 10S)
127,523	30	Woods, Good, HSG A (4S, 5S, 12S, 13S, 14S)
375,031	60	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
221,752	HSG A	4S, 5S, 11S, 12S, 13S, 14S, 15S
0	HSG B	
0	HSG C	
0	HSG D	
153,279	Other	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 15S
375,031		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
94,229	0	0	0	0	94,229	>75% Grass cover, Good
0	0	0	0	995	995	EXISTING BUILDING
0	0	0	0	96,535	96,535	EXISTING PAVEMENT
0	0	0	0	55,749	55,749	PROPOSED PARKING LOT
127,523	0	0	0	0	127,523	Woods, Good
221,752	0	0	0	153,279	375,031	TOTAL AREA

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	AMH-1	319.29	319.29	4.0	0.0000	0.012	0.0	24.0	0.0	
2	AMH-2	319.29	319.29	4.0	0.0000	0.012	0.0	24.0	0.0	
3	N-CB1	323.63	322.82	162.0	0.0050	0.012	0.0	12.0	0.0	
4	N-CB2	322.72	322.50	45.0	0.0049	0.012	0.0	12.0	0.0	
5	N-CB3	322.40	322.14	53.0	0.0049	0.012	0.0	12.0	0.0	
6	N-CB4	321.89	321.87	4.0	0.0050	0.012	0.0	15.0	0.0	
7	N-CB5	322.17	321.90	55.0	0.0049	0.012	0.0	12.0	0.0	
8	N-CB6	321.40	321.37	4.0	0.0075	0.012	0.0	18.0	0.0	
9	N-CB7	322.70	322.40	27.0	0.0111	0.012	0.0	12.0	0.0	
10	N-CB8	322.50	322.27	45.0	0.0051	0.012	0.0	12.0	0.0	
11	N-CB9	322.41	322.19	45.0	0.0049	0.012	0.0	12.0	0.0	

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Type III 24-hr 2-yr Rainfall=2.82"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.35 cfs 1,197 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.35 cfs 1,192 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.56 cfs 1,905 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=1.47" Flow Length=222' Tc=20.3 min CN=WQ Runoff=2.88 cfs 14,674 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.29" Flow Length=310' Tc=30.7 min CN=WQ Runoff=0.61 cfs 3,692 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.17 cfs 583 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.78 cfs 2,667 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.19 cfs 665 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.97 cfs 3,314 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=2.59" Tc=5.0 min CN=98 Runoff=0.15 cfs 506 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=1.27" Tc=5.0 min CN=WQ Runoff=0.60 cfs 2,059 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=WQ Runoff=0.00 cfs 0 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=WQ Runoff=0.00 cfs 0 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=WQ Runoff=0.00 cfs 0 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=0.90" Tc=5.0 min CN=WQ Runoff=0.18 cfs 618 cf
Pond AMH-1: ACCESS MANHOLE-1	Peak Elev=319.92' Inflow=1.42 cfs 4,876 cf 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=1.42 cfs 4,876 cf

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Type III 24-hr 2-yr Rainfall=2.82"

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Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=320.06' Inflow=2.09 cfs 7,152 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=2.09 cfs 7,152 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=323.97' Inflow=0.35 cfs 1,197 cf
12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' Outflow=0.35 cfs 1,197 cf

Pond N-CB2: N-CB-2 Peak Elev=323.23' Inflow=0.70 cfs 2,388 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=0.70 cfs 2,388 cf

Pond N-CB3: N-CB-3 Peak Elev=322.96' Inflow=0.87 cfs 2,971 cf
12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' Outflow=0.87 cfs 2,971 cf

Pond N-CB4: N-CB-4 Peak Elev=322.61' Inflow=1.42 cfs 4,876 cf
15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' Outflow=1.42 cfs 4,876 cf

Pond N-CB5: N-CB-5 Peak Elev=322.51' Inflow=0.34 cfs 1,171 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' Outflow=0.34 cfs 1,171 cf

Pond N-CB6: N-CB-6 Peak Elev=322.22' Inflow=2.09 cfs 7,152 cf
18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' Outflow=2.09 cfs 7,152 cf

Pond N-CB7: N-CB-7 Peak Elev=323.10' Inflow=0.60 cfs 2,059 cf
12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' Outflow=0.60 cfs 2,059 cf

Pond N-CB8: N-CB-8 Peak Elev=322.72' Inflow=0.15 cfs 506 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' Outflow=0.15 cfs 506 cf

Pond N-CB9: N-CB-9 Peak Elev=323.00' Inflow=0.97 cfs 3,314 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=0.97 cfs 3,314 cf

Pond N-FI1: N-FI-1 Peak Elev=322.15' Storage=0 cf Inflow=0.00 cfs 0 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Pond N-FI2: N-FI-2 Peak Elev=322.35' Storage=0 cf Inflow=0.00 cfs 0 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Pond N-FI3: N-FI-3 Peak Elev=322.45' Storage=0 cf Inflow=0.00 cfs 0 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Pond P1: SUBSURFACE INFILTRATION Peak Elev=319.78' Storage=4,017 cf Inflow=3.51 cfs 12,028 cf
Outflow=0.36 cfs 12,050 cf

Link POI 1: OLD SUNCOOK RD Inflow=3.73 cfs 21,043 cf
Primary=3.73 cfs 21,043 cf

Total Runoff Area = 375,031 sf Runoff Volume = 33,071 cf Average Runoff Depth = 1.06"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type III 24-hr		Default	24.00	1	4.17	2

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Type III 24-hr 10-yr Rainfall=4.17"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.52 cfs 1,818 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.52 cfs 1,811 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.83 cfs 2,895 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=2.24" Flow Length=222' Tc=20.3 min CN=WQ Runoff=4.30 cfs 22,380 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.46" Flow Length=310' Tc=30.7 min CN=WQ Runoff=0.91 cfs 5,871 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.25 cfs 886 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=1.16 cfs 4,053 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.29 cfs 1,011 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=1.44 cfs 5,036 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.22 cfs 769 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=1.96" Tc=5.0 min CN=WQ Runoff=0.90 cfs 3,183 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.06" Tc=5.0 min CN=WQ Runoff=0.00 cfs 21 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.06" Tc=5.0 min CN=WQ Runoff=0.00 cfs 29 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.05" Tc=5.0 min CN=WQ Runoff=0.00 cfs 39 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=1.42" Tc=5.0 min CN=WQ Runoff=0.27 cfs 968 cf
Pond AMH-1: ACCESS MANHOLE-1	Peak Elev=320.58' Inflow=2.13 cfs 7,411 cf 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=2.13 cfs 7,411 cf

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Type III 24-hr 10-yr Rainfall=4.17"

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Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=320.58' Inflow=3.12 cfs 10,869 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' /' Outflow=3.12 cfs 10,869 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.05' Inflow=0.52 cfs 1,818 cf
12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' /' Outflow=0.52 cfs 1,818 cf

Pond N-CB2: N-CB-2 Peak Elev=323.37' Inflow=1.04 cfs 3,630 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' /' Outflow=1.04 cfs 3,630 cf

Pond N-CB3: N-CB-3 Peak Elev=323.13' Inflow=1.29 cfs 4,516 cf
12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' /' Outflow=1.29 cfs 4,516 cf

Pond N-CB4: N-CB-4 Peak Elev=322.79' Inflow=2.13 cfs 7,411 cf
15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' /' Outflow=2.13 cfs 7,411 cf

Pond N-CB5: N-CB-5 Peak Elev=322.63' Inflow=0.51 cfs 1,780 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' /' Outflow=0.51 cfs 1,780 cf

Pond N-CB6: N-CB-6 Peak Elev=322.42' Inflow=3.12 cfs 10,869 cf
18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' /' Outflow=3.12 cfs 10,869 cf

Pond N-CB7: N-CB-7 Peak Elev=323.20' Inflow=0.90 cfs 3,183 cf
12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' /' Outflow=0.90 cfs 3,183 cf

Pond N-CB8: N-CB-8 Peak Elev=322.78' Inflow=0.22 cfs 769 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' /' Outflow=0.22 cfs 769 cf

Pond N-CB9: N-CB-9 Peak Elev=323.16' Inflow=1.44 cfs 5,036 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' /' Outflow=1.44 cfs 5,036 cf

Pond N-FI1: N-FI-1 Peak Elev=322.15' Storage=0 cf Inflow=0.00 cfs 39 cf
Discarded=0.00 cfs 39 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 39 cf

Pond N-FI2: N-FI-2 Peak Elev=322.35' Storage=0 cf Inflow=0.00 cfs 29 cf
Discarded=0.00 cfs 29 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 29 cf

Pond N-FI3: N-FI-3 Peak Elev=322.45' Storage=0 cf Inflow=0.00 cfs 21 cf
Discarded=0.00 cfs 21 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 21 cf

Pond P1: SUBSURFACE INFILTRATION Peak Elev=320.58' Storage=7,071 cf Inflow=5.24 cfs 18,280 cf
Outflow=0.38 cfs 18,284 cf

Link POI 1: OLD SUNCOOK RD Inflow=5.56 cfs 32,401 cf
Primary=5.56 cfs 32,401 cf

Total Runoff Area = 375,031 sf Runoff Volume = 50,770 cf Average Runoff Depth = 1.62"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

Summary for Subcatchment 1S: PDA 1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf, Depth= 3.93"
 Routed to Pond N-CB1 : N-CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 5,546	98	PROPOSED PARKING LOT
5,546		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 2S: PDA 2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 1,811 cf, Depth= 3.93"
 Routed to Pond N-CB2 : N-CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 5,524	98	PROPOSED PARKING LOT
5,524		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 3S: PDA 3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.83 cfs @ 12.07 hrs, Volume= 2,895 cf, Depth= 3.93"
 Routed to Pond N-CB4 : N-CB-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

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Type III 24-hr 10-yr Rainfall=4.17"

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Area (sf)	CN	Description
* 8,829	98	PROPOSED PARKING LOT
8,829		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 4S: PDA 4

Runoff = 4.30 cfs @ 12.27 hrs, Volume= 22,380 cf, Depth= 2.24"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 68,012	98	EXISTING PAVEMENT
14,576	39	>75% Grass cover, Good, HSG A
37,280	30	Woods, Good, HSG A
119,868		Weighted Average
51,856		43.26% Pervious Area
68,012		56.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.82"
2.3	70	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	12	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.5	90	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
20.3	222	Total			

Summary for Subcatchment 5S: PDA 5

Runoff = 0.91 cfs @ 12.40 hrs, Volume= 5,871 cf, Depth= 0.46"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

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Type III 24-hr 10-yr Rainfall=4.17"

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	Area (sf)	CN	Description
*	16,117	98	EXISTING PAVEMENT
*	995	98	EXISTING BUILDING
	47,948	39	>75% Grass cover, Good, HSG A
	87,786	30	Woods, Good, HSG A
	152,846		Weighted Average
	135,734		88.80% Pervious Area
	17,112		11.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	50	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.82"
8.7	260	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
30.7	310	Total			

Summary for Subcatchment 6S: PDA 6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.25 cfs @ 12.07 hrs, Volume= 886 cf, Depth= 3.93"
Routed to Pond N-CB3 : N-CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

	Area (sf)	CN	Description
*	2,702	98	PROPOSED PARKING LOT
	2,702		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 7S: PDA 7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.16 cfs @ 12.07 hrs, Volume= 4,053 cf, Depth= 3.93"
Routed to Pond N-CB6 : N-CB-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

	Area (sf)	CN	Description
*	12,362	98	PROPOSED PARKING LOT
	12,362		100.00% Impervious Area

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Type III 24-hr 10-yr Rainfall=4.17"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 8S: PDA 8

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 1,011 cf, Depth= 3.93"
Routed to Pond N-CB5 : N-CB-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 3,084	98	PROPOSED PARKING LOT
3,084		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 9S: PDA 9

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf, Depth= 3.93"
Routed to Pond N-CB9 : N-CB-9

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 15,358	98	PROPOSED PARKING LOT
15,358		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 10S: PDA 10

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.22 cfs @ 12.07 hrs, Volume= 769 cf, Depth= 3.93"
Routed to Pond N-CB8 : N-CB-8

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

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Type III 24-hr 10-yr Rainfall=4.17"

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Area (sf)	CN	Description
* 2,344	98	PROPOSED PARKING LOT
2,344		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 11S: PDA 11

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf, Depth= 1.96"
Routed to Pond N-CB7 : N-CB-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 9,543	98	EXISTING PAVEMENT
9,948	39	>75% Grass cover, Good, HSG A
19,491		Weighted Average
9,948		51.04% Pervious Area
9,543		48.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 12S: PDA 12

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.00 cfs @ 15.20 hrs, Volume= 21 cf, Depth= 0.06"
Routed to Pond N-FI3 : N-FI-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
376	30	Woods, Good, HSG A
3,900	39	>75% Grass cover, Good, HSG A
4,276		Weighted Average
4,276		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 13S: PDA 13

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.00 cfs @ 15.20 hrs, Volume= 29 cf, Depth= 0.06"
 Routed to Pond N-FI2 : N-FI-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
765	30	Woods, Good, HSG A
5,405	39	>75% Grass cover, Good, HSG A
6,170		Weighted Average
6,170		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 14S: PDA 14

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.00 cfs @ 15.20 hrs, Volume= 39 cf, Depth= 0.05"
 Routed to Pond N-FI1 : N-FI-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
1,316	30	Woods, Good, HSG A
7,118	39	>75% Grass cover, Good, HSG A
8,434		Weighted Average
8,434		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 15S: PDA 15

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.27 cfs @ 12.07 hrs, Volume= 968 cf, Depth= 1.42"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

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Type III 24-hr 10-yr Rainfall=4.17"

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Area (sf)	CN	Description
* 2,863	98	EXISTING PAVEMENT
5,334	39	>75% Grass cover, Good, HSG A
8,197		Weighted Average
5,334		65.07% Pervious Area
2,863		34.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond AMH-1: ACCESS MANHOLE-1

Inflow Area = 22,601 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Outflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Routed to Pond P1 : SUBSURFACE INFILTRATION GALLERY-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 320.58' @ 13.21 hrs
 Flood Elev= 327.52'

Device #	Routing	Invert	Outlet Devices
#1	Primary	319.29'	24.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 319.29' / 319.29' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=2.05 cfs @ 12.07 hrs HW=320.05' TW=319.65' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 2.05 cfs @ 2.78 fps)

Summary for Pond AMH-2: ACCESS MANHOLE-2

Inflow Area = 33,148 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Outflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Routed to Pond P1 : SUBSURFACE INFILTRATION GALLERY-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 320.58' @ 13.21 hrs
 Flood Elev= 326.60'

Device #	Routing	Invert	Outlet Devices
#1	Primary	319.29'	24.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 319.29' / 319.29' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=3.00 cfs @ 12.07 hrs HW=320.22' TW=319.65' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 3.00 cfs @ 3.09 fps)

Summary for Pond IR: ISOLATOR ROW CHECK

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	318.37'	1,958 cf	8.42'W x 156.27'L x 5.50'H Field A 7,234 cf Overall - 2,339 cf Embedded = 4,895 cf x 40.0% Voids
#2A	319.12'	2,339 cf	ADS_StormTech MC-3500 d +Cap x 21 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= 14.9 cf x 2 x 1 rows = 29.8 cf
		4,297 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.37'	3.000 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

↑1=Exfiltration (Controls 0.00 cfs)

Summary for Pond N-CB1: N-CB-1

Inflow Area = 5,546 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf
 Outflow = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf
 Routed to Pond N-CB2 : N-CB-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 324.05' @ 12.08 hrs
 Flood Elev= 327.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	323.63'	12.0" Round Culvert L= 162.0' Ke= 0.500 Inlet / Outlet Invert= 323.63' / 322.82' S= 0.0050 ' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.48 cfs @ 12.07 hrs HW=324.04' TW=323.35' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 0.48 cfs @ 2.30 fps)

Summary for Pond N-CB2: N-CB-2

Inflow Area = 11,070 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 1.04 cfs @ 12.07 hrs, Volume= 3,630 cf
 Outflow = 1.04 cfs @ 12.07 hrs, Volume= 3,630 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.04 cfs @ 12.07 hrs, Volume= 3,630 cf
 Routed to Pond N-CB3 : N-CB-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

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Peak Elev= 323.37' @ 12.10 hrs

Flood Elev= 327.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.72'	12.0" Round Culvert L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 322.72' / 322.50' S= 0.0049 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.87 cfs @ 12.07 hrs HW=323.35' TW=323.10' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 0.87 cfs @ 2.39 fps)

Summary for Pond N-CB3: N-CB-3

Inflow Area = 13,772 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 1.29 cfs @ 12.07 hrs, Volume= 4,516 cf
 Outflow = 1.29 cfs @ 12.07 hrs, Volume= 4,516 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.29 cfs @ 12.07 hrs, Volume= 4,516 cf
 Routed to Pond N-CB4 : N-CB-4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 323.13' @ 12.09 hrs

Flood Elev= 327.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.40'	12.0" Round Culvert L= 53.0' Ke= 0.500 Inlet / Outlet Invert= 322.40' / 322.14' S= 0.0049 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.15 cfs @ 12.07 hrs HW=323.10' TW=322.77' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 1.15 cfs @ 2.74 fps)

Summary for Pond N-CB4: N-CB-4

Inflow Area = 22,601 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Outflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Routed to Pond AMH-1 : ACCESS MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 322.79' @ 12.07 hrs

Flood Elev= 327.34'

Device	Routing	Invert	Outlet Devices
#1	Primary	321.89'	15.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 321.89' / 321.87' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=2.05 cfs @ 12.07 hrs HW=322.77' TW=320.05' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 2.05 cfs @ 3.13 fps)

Summary for Pond N-CB5: N-CB-5

Inflow Area = 5,428 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 0.51 cfs @ 12.07 hrs, Volume= 1,780 cf
 Outflow = 0.51 cfs @ 12.07 hrs, Volume= 1,780 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.51 cfs @ 12.07 hrs, Volume= 1,780 cf
 Routed to Pond N-CB6 : N-CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.63' @ 12.10 hrs
 Flood Elev= 326.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.17'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 322.17' / 321.90' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.41 cfs @ 12.07 hrs HW=322.60' TW=322.40' (Dynamic Tailwater)
 ↑**1=Culvert** (Outlet Controls 0.41 cfs @ 1.86 fps)

Summary for Pond N-CB6: N-CB-6

Inflow Area = 33,148 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Outflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Routed to Pond AMH-2 : ACCESS MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.42' @ 12.07 hrs
 Flood Elev= 326.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	321.40'	18.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 321.40' / 321.37' S= 0.0075 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.00 cfs @ 12.07 hrs HW=322.40' TW=320.22' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 3.00 cfs @ 3.40 fps)

Summary for Pond N-CB7: N-CB-7

Inflow Area = 19,491 sf, 48.96% Impervious, Inflow Depth = 1.96" for 10-yr event
 Inflow = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf
 Outflow = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

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Peak Elev= 323.20' @ 12.07 hrs

Flood Elev= 326.68'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.70'	12.0" Round Culvert L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 322.70' / 322.40' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.86 cfs @ 12.07 hrs HW=323.19' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 0.86 cfs @ 3.32 fps)

Summary for Pond N-CB8: N-CB-8

Inflow Area = 2,344 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 0.22 cfs @ 12.07 hrs, Volume= 769 cf
 Outflow = 0.22 cfs @ 12.07 hrs, Volume= 769 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.22 cfs @ 12.07 hrs, Volume= 769 cf
 Routed to Pond N-CB5 : N-CB-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 322.78' @ 12.10 hrs

Flood Elev= 326.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	12.0" Round Culvert L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.27' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.18 cfs @ 12.07 hrs HW=322.78' TW=322.60' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 0.18 cfs @ 1.56 fps)

Summary for Pond N-CB9: N-CB-9

Inflow Area = 15,358 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf
 Outflow = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf
 Routed to Pond N-CB6 : N-CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 323.16' @ 12.07 hrs

Flood Elev= 326.41'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.41'	12.0" Round Culvert L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 322.41' / 322.19' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.39 cfs @ 12.07 hrs HW=323.14' TW=322.40' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 1.39 cfs @ 3.15 fps)

Summary for Pond N-FI1: N-FI-1

Inflow Area = 8,434 sf, 0.00% Impervious, Inflow Depth = 0.05" for 10-yr event
 Inflow = 0.00 cfs @ 15.20 hrs, Volume= 39 cf
 Outflow = 0.00 cfs @ 15.20 hrs, Volume= 39 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 15.20 hrs, Volume= 39 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.15' @ 0.00 hrs Surf.Area= 86 sf Storage= 0 cf
 Flood Elev= 326.90' Surf.Area= 86 sf Storage= 71 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,094.5 - 1,094.5)

Volume	Invert	Avail.Storage	Storage Description
#1	322.15'	67 cf	4.00'W x 10.75'L x 2.00'H Prismaoid x 2 172 cf Overall - 4 cf Embedded = 168 cf x 40.0% Voids
#2	322.90'	4 cf	6.0" Round Pipe Storage x 2 Inside #1 L= 10.7'
		71 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	322.15'	3.000 in/hr Exfiltration over Wetted area
#2	Primary	323.90'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.00 cfs @ 15.20 hrs HW=322.15' (Free Discharge)
 ↑1=Exfiltration (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=322.15' TW=0.00' (Dynamic Tailwater)
 ↑2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond N-FI2: N-FI-2

[92] Warning: Device #2 is above defined storage

Inflow Area = 6,170 sf, 0.00% Impervious, Inflow Depth = 0.06" for 10-yr event
 Inflow = 0.00 cfs @ 15.20 hrs, Volume= 29 cf
 Outflow = 0.00 cfs @ 15.20 hrs, Volume= 29 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 15.20 hrs, Volume= 29 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.35' @ 0.00 hrs Surf.Area= 86 sf Storage= 0 cf
 Flood Elev= 327.09' Surf.Area= 86 sf Storage= 71 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,094.5 - 1,094.5)

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Volume	Invert	Avail.Storage	Storage Description
#1	322.35'	67 cf	4.00'W x 10.75'L x 2.00'H Prismaoid x 2 172 cf Overall - 4 cf Embedded = 168 cf x 40.0% Voids
#2	323.10'	4 cf	6.0" Round Pipe Storage x 2 Inside #1 L= 10.7'
		71 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	322.35'	3.000 in/hr Exfiltration over Wetted area
#2	Primary	324.35'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.00 cfs @ 15.20 hrs HW=322.35' (Free Discharge)
 ↑1=Exfiltration (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=322.35' TW=0.00' (Dynamic Tailwater)
 ↑2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond N-FI3: N-FI-3

[92] Warning: Device #2 is above defined storage

Inflow Area = 4,276 sf, 0.00% Impervious, Inflow Depth = 0.06" for 10-yr event
 Inflow = 0.00 cfs @ 15.20 hrs, Volume= 21 cf
 Outflow = 0.00 cfs @ 15.20 hrs, Volume= 21 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 15.20 hrs, Volume= 21 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.45' @ 0.00 hrs Surf.Area= 86 sf Storage= 0 cf
 Flood Elev= 327.24' Surf.Area= 86 sf Storage= 71 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,094.5 - 1,094.5)

Volume	Invert	Avail.Storage	Storage Description
#1	322.45'	67 cf	4.00'W x 10.75'L x 2.00'H Prismaoid x 2 172 cf Overall - 4 cf Embedded = 168 cf x 40.0% Voids
#2	323.20'	4 cf	6.0" Round Pipe Storage x 2 Inside #1 L= 10.7'
		71 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	322.45'	3.000 in/hr Exfiltration over Wetted area
#2	Primary	324.45'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.00 cfs @ 15.20 hrs HW=322.45' (Free Discharge)
 ↑1=Exfiltration (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=322.45' TW=0.00' (Dynamic Tailwater)
 ↑2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P1: SUBSURFACE INFILTRATION GALLERY-1

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=21)

[80] Warning: Exceeded Pond AMH-1 by 0.07' @ 12.20 hrs (1.34 cfs 3,832 cf)

[80] Warning: Exceeded Pond AMH-2 by 0.05' @ 12.35 hrs (1.60 cfs 3,334 cf)

Inflow Area = 55,749 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 5.24 cfs @ 12.07 hrs, Volume= 18,280 cf
 Outflow = 0.38 cfs @ 13.16 hrs, Volume= 18,284 cf, Atten= 93%, Lag= 65.3 min
 Discarded = 0.38 cfs @ 13.16 hrs, Volume= 18,284 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 320.58' @ 13.16 hrs Surf.Area= 4,675 sf Storage= 7,071 cf
 Flood Elev= 323.87' Surf.Area= 4,675 sf Storage= 15,898 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 143.0 min (893.3 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	318.37'	6,543 cf	29.92'W x 156.27'L x 5.50'H Field A 25,713 cf Overall - 9,355 cf Embedded = 16,358 cf x 40.0% Voids
#2A	319.12'	9,355 cf	ADS_StormTech MC-3500 d +Cap x 84 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 84 Chambers in 4 Rows Cap Storage= 14.9 cf x 2 x 4 rows = 119.2 cf
		15,898 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.37'	3.000 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.38 cfs @ 13.16 hrs HW=320.58' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.38 cfs)

Summary for Link POI 1: OLD SUNCOOK RD

Inflow Area = 319,282 sf, 30.55% Impervious, Inflow Depth = 1.22" for 10-yr event
 Inflow = 5.56 cfs @ 12.27 hrs, Volume= 32,401 cf
 Primary = 5.56 cfs @ 12.27 hrs, Volume= 32,401 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-yr	Type III 24-hr		Default	24.00	1	5.22	2

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Type III 24-hr 25-yr Rainfall=5.22"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=0.65 cfs 2,303 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=0.65 cfs 2,294 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=1.04 cfs 3,666 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=2.86" Flow Length=222' Tc=20.3 min CN=WQ Runoff=5.40 cfs 28,581 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.64" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.14 cfs 8,185 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=0.32 cfs 1,122 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=1.46 cfs 5,133 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=0.36 cfs 1,281 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=1.81 cfs 6,377 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=4.98" Tc=5.0 min CN=98 Runoff=0.28 cfs 973 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=2.57" Tc=5.0 min CN=WQ Runoff=1.13 cfs 4,167 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.23" Tc=5.0 min CN=WQ Runoff=0.01 cfs 81 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.22" Tc=5.0 min CN=WQ Runoff=0.01 cfs 112 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.21" Tc=5.0 min CN=WQ Runoff=0.01 cfs 148 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=1.90" Tc=5.0 min CN=WQ Runoff=0.34 cfs 1,299 cf
Pond AMH-1: ACCESS MANHOLE-1	Peak Elev=321.33' Inflow=2.67 cfs 9,385 cf 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=2.67 cfs 9,389 cf

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Type III 24-hr 25-yr Rainfall=5.22"

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Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=321.33' Inflow=3.91 cfs 13,764 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' /' Outflow=3.91 cfs 13,768 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.11' Inflow=0.65 cfs 2,303 cf
12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' /' Outflow=0.65 cfs 2,303 cf

Pond N-CB2: N-CB-2 Peak Elev=323.48' Inflow=1.31 cfs 4,597 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' /' Outflow=1.31 cfs 4,597 cf

Pond N-CB3: N-CB-3 Peak Elev=323.25' Inflow=1.63 cfs 5,719 cf
12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' /' Outflow=1.63 cfs 5,719 cf

Pond N-CB4: N-CB-4 Peak Elev=322.92' Inflow=2.67 cfs 9,385 cf
15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' /' Outflow=2.67 cfs 9,385 cf

Pond N-CB5: N-CB-5 Peak Elev=322.73' Inflow=0.64 cfs 2,254 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' /' Outflow=0.64 cfs 2,254 cf

Pond N-CB6: N-CB-6 Peak Elev=322.57' Inflow=3.91 cfs 13,764 cf
18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' /' Outflow=3.91 cfs 13,764 cf

Pond N-CB7: N-CB-7 Peak Elev=323.27' Inflow=1.13 cfs 4,167 cf
12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' /' Outflow=1.13 cfs 4,167 cf

Pond N-CB8: N-CB-8 Peak Elev=322.84' Inflow=0.28 cfs 973 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' /' Outflow=0.28 cfs 973 cf

Pond N-CB9: N-CB-9 Peak Elev=323.28' Inflow=1.81 cfs 6,377 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' /' Outflow=1.81 cfs 6,377 cf

Pond N-FI1: N-FI-1 Peak Elev=322.25' Storage=3 cf Inflow=0.01 cfs 148 cf
Discarded=0.01 cfs 148 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 148 cf

Pond N-FI2: N-FI-2 Peak Elev=322.38' Storage=1 cf Inflow=0.01 cfs 112 cf
Discarded=0.01 cfs 112 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 112 cf

Pond N-FI3: N-FI-3 Peak Elev=322.45' Storage=0 cf Inflow=0.01 cfs 81 cf
Discarded=0.01 cfs 81 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 81 cf

Pond P1: SUBSURFACE INFILTRATION Peak Elev=321.33' Storage=9,762 cf Inflow=6.58 cfs 23,157 cf
Outflow=0.40 cfs 23,184 cf

Link POI 1: OLD SUNCOOK RD Inflow=6.99 cfs 42,232 cf
Primary=6.99 cfs 42,232 cf

Total Runoff Area = 375,031 sf Runoff Volume = 65,721 cf Average Runoff Depth = 2.10"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	50-yr	Type III 24-hr		Default	24.00	1	6.19	2

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Type III 24-hr 50-yr Rainfall=6.19"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.78 cfs 2,751 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.77 cfs 2,740 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=1.24 cfs 4,379 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=3.47" Flow Length=222' Tc=20.3 min CN=WQ Runoff=6.44 cfs 34,631 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.88" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.44 cfs 11,173 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.38 cfs 1,340 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=1.73 cfs 6,131 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.43 cfs 1,530 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=2.15 cfs 7,617 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.33 cfs 1,163 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=3.17" Tc=5.0 min CN=WQ Runoff=1.35 cfs 5,149 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.47" Tc=5.0 min CN=WQ Runoff=0.02 cfs 166 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.45" Tc=5.0 min CN=WQ Runoff=0.03 cfs 232 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.44" Tc=5.0 min CN=WQ Runoff=0.03 cfs 308 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=2.40" Tc=5.0 min CN=WQ Runoff=0.41 cfs 1,643 cf
Pond AMH-1: ACCESS MANHOLE-1	Peak Elev=322.17' Inflow=3.17 cfs 11,209 cf 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=3.17 cfs 11,195 cf

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Type III 24-hr 50-yr Rainfall=6.19"

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Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=322.17' Inflow=4.65 cfs 16,440 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' /' Outflow=4.65 cfs 16,440 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.17' Inflow=0.78 cfs 2,751 cf
12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' /' Outflow=0.78 cfs 2,751 cf

Pond N-CB2: N-CB-2 Peak Elev=323.58' Inflow=1.55 cfs 5,490 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' /' Outflow=1.55 cfs 5,490 cf

Pond N-CB3: N-CB-3 Peak Elev=323.37' Inflow=1.93 cfs 6,831 cf
12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' /' Outflow=1.93 cfs 6,831 cf

Pond N-CB4: N-CB-4 Peak Elev=323.03' Inflow=3.17 cfs 11,209 cf
15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' /' Outflow=3.17 cfs 11,209 cf

Pond N-CB5: N-CB-5 Peak Elev=322.83' Inflow=0.76 cfs 2,692 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' /' Outflow=0.76 cfs 2,692 cf

Pond N-CB6: N-CB-6 Peak Elev=322.70' Inflow=4.65 cfs 16,440 cf
18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' /' Outflow=4.65 cfs 16,440 cf

Pond N-CB7: N-CB-7 Peak Elev=323.34' Inflow=1.35 cfs 5,149 cf
12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' /' Outflow=1.35 cfs 5,149 cf

Pond N-CB8: N-CB-8 Peak Elev=322.91' Inflow=0.33 cfs 1,163 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' /' Outflow=0.33 cfs 1,163 cf

Pond N-CB9: N-CB-9 Peak Elev=323.39' Inflow=2.15 cfs 7,617 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' /' Outflow=2.15 cfs 7,617 cf

Pond N-FI1: N-FI-1 Peak Elev=323.45' Storage=47 cf Inflow=0.03 cfs 308 cf
Discarded=0.01 cfs 308 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 308 cf

Pond N-FI2: N-FI-2 Peak Elev=323.20' Storage=29 cf Inflow=0.03 cfs 232 cf
Discarded=0.01 cfs 232 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 232 cf

Pond N-FI3: N-FI-3 Peak Elev=322.93' Storage=17 cf Inflow=0.02 cfs 166 cf
Discarded=0.01 cfs 166 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 166 cf

Pond P1: SUBSURFACE INFILTRATION Peak Elev=322.17' Storage=12,426 cf Inflow=7.82 cfs 27,635 cf
Outflow=0.42 cfs 27,639 cf

Link POI 1: OLD SUNCOOK RD Inflow=8.42 cfs 52,595 cf
Primary=8.42 cfs 52,595 cf

Total Runoff Area = 375,031 sf Runoff Volume = 80,950 cf Average Runoff Depth = 2.59"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-yr	Type III 24-hr		Default	24.00	1	7.34	2

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Type III 24-hr 100-yr Rainfall=7.34"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.92 cfs 3,282 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.92 cfs 3,269 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=1.47 cfs 5,224 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=4.22" Flow Length=222' Tc=20.3 min CN=WQ Runoff=7.72 cfs 42,183 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=1.23" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.93 cfs 15,706 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.45 cfs 1,599 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=2.06 cfs 7,315 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.51 cfs 1,825 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=2.56 cfs 9,088 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.39 cfs 1,387 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=3.93" Tc=5.0 min CN=WQ Runoff=1.68 cfs 6,388 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.84" Tc=5.0 min CN=WQ Runoff=0.05 cfs 299 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.82" Tc=5.0 min CN=WQ Runoff=0.07 cfs 420 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.80" Tc=5.0 min CN=WQ Runoff=0.10 cfs 560 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=3.06" Tc=5.0 min CN=WQ Runoff=0.53 cfs 2,091 cf
Pond AMH-1: ACCESS MANHOLE-1	Peak Elev=323.75' Inflow=3.76 cfs 13,373 cf 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=3.76 cfs 13,356 cf

POST-DEVELOPMENT_BACC0005

Type III 24-hr 100-yr Rainfall=7.34"

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Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=323.75' Inflow=5.52 cfs 19,614 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=5.52 cfs 19,614 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.23' Inflow=0.92 cfs 3,282 cf
12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' Outflow=0.92 cfs 3,282 cf

Pond N-CB2: N-CB-2 Peak Elev=323.75' Inflow=1.84 cfs 6,550 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=1.84 cfs 6,550 cf

Pond N-CB3: N-CB-3 Peak Elev=323.75' Inflow=2.29 cfs 8,149 cf
12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' Outflow=2.29 cfs 8,149 cf

Pond N-CB4: N-CB-4 Peak Elev=323.75' Inflow=3.76 cfs 13,373 cf
15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' Outflow=3.76 cfs 13,373 cf

Pond N-CB5: N-CB-5 Peak Elev=323.75' Inflow=0.90 cfs 3,212 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' Outflow=0.90 cfs 3,212 cf

Pond N-CB6: N-CB-6 Peak Elev=323.75' Inflow=5.52 cfs 19,614 cf
18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' Outflow=5.52 cfs 19,614 cf

Pond N-CB7: N-CB-7 Peak Elev=323.44' Inflow=1.68 cfs 6,388 cf
12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' Outflow=1.68 cfs 6,388 cf

Pond N-CB8: N-CB-8 Peak Elev=323.75' Inflow=0.39 cfs 1,387 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' Outflow=0.39 cfs 1,387 cf

Pond N-CB9: N-CB-9 Peak Elev=323.75' Inflow=2.56 cfs 9,088 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=2.56 cfs 9,088 cf

Pond N-FI1: N-FI-1 Peak Elev=323.97' Storage=65 cf Inflow=0.10 cfs 560 cf
Discarded=0.01 cfs 442 cf Primary=0.06 cfs 119 cf Outflow=0.08 cfs 560 cf

Pond N-FI2: N-FI-2 Peak Elev=324.41' Storage=71 cf Inflow=0.07 cfs 420 cf
Discarded=0.01 cfs 392 cf Primary=0.05 cfs 28 cf Outflow=0.06 cfs 420 cf

Pond N-FI3: N-FI-3 Peak Elev=324.11' Storage=60 cf Inflow=0.05 cfs 299 cf
Discarded=0.01 cfs 299 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 299 cf

Pond P1: SUBSURFACE INFILTRATION Peak Elev=323.75' Storage=15,676 cf Inflow=9.28 cfs 32,970 cf
Outflow=0.46 cfs 32,994 cf

Link POI 1: OLD SUNCOOK RD Inflow=10.29 cfs 66,514 cf
Primary=10.29 cfs 66,514 cf

Total Runoff Area = 375,031 sf Runoff Volume = 100,635 cf Average Runoff Depth = 3.22"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

POST-DEVELOPMENT_AMENDED SOIL_BACC0005

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type III 24-hr		Default	24.00	1	4.17	2

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.52 cfs 1,818 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.52 cfs 1,811 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.83 cfs 2,895 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=2.24" Flow Length=222' Tc=20.3 min CN=WQ Runoff=4.30 cfs 22,380 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.46" Flow Length=310' Tc=30.7 min CN=WQ Runoff=0.91 cfs 5,871 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.25 cfs 886 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=1.16 cfs 4,053 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.29 cfs 1,011 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=1.44 cfs 5,036 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=3.93" Tc=5.0 min CN=98 Runoff=0.22 cfs 769 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=1.96" Tc=5.0 min CN=WQ Runoff=0.90 cfs 3,183 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.06" Tc=5.0 min CN=WQ Runoff=0.00 cfs 21 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.06" Tc=5.0 min CN=WQ Runoff=0.00 cfs 29 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.05" Tc=5.0 min CN=WQ Runoff=0.00 cfs 39 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=1.42" Tc=5.0 min CN=WQ Runoff=0.27 cfs 968 cf
Pond add/alt: AMENDED SOIL - GALLERY-1	Peak Elev=320.51' Storage=6,179 cf Inflow=5.24 cfs 18,280 cf Outflow=0.52 cfs 18,300 cf

Pond AMH-1: ACCESS MANHOLE-1 Peak Elev=320.51' Inflow=2.13 cfs 7,411 cf
 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 '/' Outflow=2.13 cfs 7,411 cf

Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=320.51' Inflow=3.12 cfs 10,869 cf
 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 '/' Outflow=3.12 cfs 10,869 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
 Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.05' Inflow=0.52 cfs 1,818 cf
 12.0" Round Culvert n=0.012 L=162.0' S=0.0050 '/' Outflow=0.52 cfs 1,818 cf

Pond N-CB2: N-CB-2 Peak Elev=323.37' Inflow=1.04 cfs 3,630 cf
 12.0" Round Culvert n=0.012 L=45.0' S=0.0049 '/' Outflow=1.04 cfs 3,630 cf

Pond N-CB3: N-CB-3 Peak Elev=323.13' Inflow=1.29 cfs 4,516 cf
 12.0" Round Culvert n=0.012 L=53.0' S=0.0049 '/' Outflow=1.29 cfs 4,516 cf

Pond N-CB4: N-CB-4 Peak Elev=322.79' Inflow=2.13 cfs 7,411 cf
 15.0" Round Culvert n=0.012 L=4.0' S=0.0050 '/' Outflow=2.13 cfs 7,411 cf

Pond N-CB5: N-CB-5 Peak Elev=322.63' Inflow=0.51 cfs 1,780 cf
 12.0" Round Culvert n=0.012 L=55.0' S=0.0049 '/' Outflow=0.51 cfs 1,780 cf

Pond N-CB6: N-CB-6 Peak Elev=322.42' Inflow=3.12 cfs 10,869 cf
 18.0" Round Culvert n=0.012 L=4.0' S=0.0075 '/' Outflow=3.12 cfs 10,869 cf

Pond N-CB7: N-CB-7 Peak Elev=323.20' Inflow=0.90 cfs 3,183 cf
 12.0" Round Culvert n=0.012 L=27.0' S=0.0111 '/' Outflow=0.90 cfs 3,183 cf

Pond N-CB8: N-CB-8 Peak Elev=322.78' Inflow=0.22 cfs 769 cf
 12.0" Round Culvert n=0.012 L=45.0' S=0.0051 '/' Outflow=0.22 cfs 769 cf

Pond N-CB9: N-CB-9 Peak Elev=323.16' Inflow=1.44 cfs 5,036 cf
 12.0" Round Culvert n=0.012 L=45.0' S=0.0049 '/' Outflow=1.44 cfs 5,036 cf

Pond N-FI1: N-FI-1 Peak Elev=322.15' Storage=0 cf Inflow=0.00 cfs 39 cf
 Discarded=0.00 cfs 39 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 39 cf

Pond N-FI2: N-FI-2 Peak Elev=322.35' Storage=0 cf Inflow=0.00 cfs 29 cf
 Discarded=0.00 cfs 29 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 29 cf

Pond N-FI3: N-FI-3 Peak Elev=322.45' Storage=0 cf Inflow=0.00 cfs 21 cf
 Discarded=0.00 cfs 21 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 21 cf

Link POI 1: OLD SUNCOOK RD Inflow=5.56 cfs 32,401 cf
 Primary=5.56 cfs 32,401 cf

Total Runoff Area = 375,031 sf Runoff Volume = 50,770 cf Average Runoff Depth = 1.62"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

Summary for Subcatchment 1S: PDA 1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf, Depth= 3.93"
 Routed to Pond N-CB1 : N-CB-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 5,546	98	PROPOSED PARKING LOT
5,546		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 2S: PDA 2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 1,811 cf, Depth= 3.93"
 Routed to Pond N-CB2 : N-CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 5,524	98	PROPOSED PARKING LOT
5,524		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 3S: PDA 3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.83 cfs @ 12.07 hrs, Volume= 2,895 cf, Depth= 3.93"
 Routed to Pond N-CB4 : N-CB-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 8,829	98	PROPOSED PARKING LOT
8,829		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 4S: PDA 4

Runoff = 4.30 cfs @ 12.27 hrs, Volume= 22,380 cf, Depth= 2.24"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 68,012	98	EXISTING PAVEMENT
14,576	39	>75% Grass cover, Good, HSG A
37,280	30	Woods, Good, HSG A
119,868		Weighted Average
51,856		43.26% Pervious Area
68,012		56.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.82"
2.3	70	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	12	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.5	90	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
20.3	222	Total			

Summary for Subcatchment 5S: PDA 5

Runoff = 0.91 cfs @ 12.40 hrs, Volume= 5,871 cf, Depth= 0.46"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 16,117	98	EXISTING PAVEMENT
* 995	98	EXISTING BUILDING
47,948	39	>75% Grass cover, Good, HSG A
87,786	30	Woods, Good, HSG A
152,846		Weighted Average
135,734		88.80% Pervious Area
17,112		11.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	50	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.82"
8.7	260	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
30.7	310	Total			

Summary for Subcatchment 6S: PDA 6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.25 cfs @ 12.07 hrs, Volume= 886 cf, Depth= 3.93"
 Routed to Pond N-CB3 : N-CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 2,702	98	PROPOSED PARKING LOT
2,702		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 7S: PDA 7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.16 cfs @ 12.07 hrs, Volume= 4,053 cf, Depth= 3.93"
 Routed to Pond N-CB6 : N-CB-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 12,362	98	PROPOSED PARKING LOT
12,362		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 8S: PDA 8

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 1,011 cf, Depth= 3.93"
 Routed to Pond N-CB5 : N-CB-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 3,084	98	PROPOSED PARKING LOT
3,084		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 9S: PDA 9

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf, Depth= 3.93"
 Routed to Pond N-CB9 : N-CB-9

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 15,358	98	PROPOSED PARKING LOT
15,358		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 10S: PDA 10

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.22 cfs @ 12.07 hrs, Volume= 769 cf, Depth= 3.93"
 Routed to Pond N-CB8 : N-CB-8

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 2,344	98	PROPOSED PARKING LOT
2,344		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 11S: PDA 11

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf, Depth= 1.96"
 Routed to Pond N-CB7 : N-CB-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 9,543	98	EXISTING PAVEMENT
9,948	39	>75% Grass cover, Good, HSG A
19,491		Weighted Average
9,948		51.04% Pervious Area
9,543		48.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 12S: PDA 12

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.00 cfs @ 15.20 hrs, Volume= 21 cf, Depth= 0.06"
 Routed to Pond N-FI3 : N-FI-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
376	30	Woods, Good, HSG A
3,900	39	>75% Grass cover, Good, HSG A
4,276		Weighted Average
4,276		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 13S: PDA 13

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.00 cfs @ 15.20 hrs, Volume= 29 cf, Depth= 0.06"
 Routed to Pond N-FI2 : N-FI-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
765	30	Woods, Good, HSG A
5,405	39	>75% Grass cover, Good, HSG A
6,170		Weighted Average
6,170		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 14S: PDA 14

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.00 cfs @ 15.20 hrs, Volume= 39 cf, Depth= 0.05"
 Routed to Pond N-FI1 : N-FI-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
1,316	30	Woods, Good, HSG A
7,118	39	>75% Grass cover, Good, HSG A
8,434		Weighted Average
8,434		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 15S: PDA 15

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.27 cfs @ 12.07 hrs, Volume= 968 cf, Depth= 1.42"
 Routed to Link POI 1 : OLD SUNCOOK RD

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=4.17"

Area (sf)	CN	Description
* 2,863	98	EXISTING PAVEMENT
5,334	39	>75% Grass cover, Good, HSG A
8,197		Weighted Average
5,334		65.07% Pervious Area
2,863		34.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Pond add/alt: AMENDED SOIL - GALLERY-1

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=54)
 [80] Warning: Exceeded Pond AMH-1 by 0.07' @ 12.20 hrs (1.35 cfs 2,810 cf)
 [80] Warning: Exceeded Pond AMH-2 by 0.05' @ 12.30 hrs (1.45 cfs 2,329 cf)

Inflow Area = 55,749 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 5.24 cfs @ 12.07 hrs, Volume= 18,280 cf
 Outflow = 0.52 cfs @ 12.82 hrs, Volume= 18,300 cf, Atten= 90%, Lag= 44.9 min
 Discarded = 0.52 cfs @ 12.82 hrs, Volume= 18,300 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 320.51' @ 12.82 hrs Surf.Area= 4,246 sf Storage= 6,179 cf
 Flood Elev= 323.87' Surf.Area= 4,246 sf Storage= 14,427 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 82.7 min (833.0 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	318.37'	5,951 cf	29.92'W x 141.93'L x 5.50'H Field A 23,353 cf Overall - 8,476 cf Embedded = 14,878 cf x 40.0% Voids
#2A	319.12'	8,476 cf	ADS_StormTech MC-3500 d +Cap x 76 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 76 Chambers in 4 Rows Cap Storage= 14.9 cf x 2 x 4 rows = 119.2 cf
		14,427 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.37'	4.500 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.52 cfs @ 12.82 hrs HW=320.51' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.52 cfs)

Summary for Pond AMH-1: ACCESS MANHOLE-1

Inflow Area = 22,601 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Outflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Routed to Pond add/alt : AMENDED SOIL - GALLERY-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 320.51' @ 12.87 hrs
 Flood Elev= 327.52'

Device	Routing	Invert	Outlet Devices
#1	Primary	319.29'	24.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 319.29' / 319.29' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=2.05 cfs @ 12.07 hrs HW=320.05' TW=319.62' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 2.05 cfs @ 2.78 fps)

Summary for Pond AMH-2: ACCESS MANHOLE-2

Inflow Area = 33,148 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Outflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Routed to Pond add/alt : AMENDED SOIL - GALLERY-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 320.51' @ 12.86 hrs
 Flood Elev= 326.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	319.29'	24.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 319.29' / 319.29' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=3.00 cfs @ 12.07 hrs HW=320.22' TW=319.62' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 3.00 cfs @ 3.09 fps)

Summary for Pond IR: ISOLATOR ROW CHECK

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	318.37'	1,781 cf	8.42'W x 141.93'L x 5.50'H Field A 6,570 cf Overall - 2,119 cf Embedded = 4,451 cf x 40.0% Voids
#2A	319.12'	2,119 cf	ADS_StormTech MC-3500 d +Cap x 19 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap

Cap Storage= 14.9 cf x 2 x 1 rows = 29.8 cf
 3,899 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	318.37'	3.000 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
 ↑1=Exfiltration (Controls 0.00 cfs)

Summary for Pond N-CB1: N-CB-1

Inflow Area = 5,546 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf
 Outflow = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.52 cfs @ 12.07 hrs, Volume= 1,818 cf
 Routed to Pond N-CB2 : N-CB-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 324.05' @ 12.08 hrs
 Flood Elev= 327.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	323.63'	12.0" Round Culvert L= 162.0' Ke= 0.500 Inlet / Outlet Invert= 323.63' / 322.82' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.48 cfs @ 12.07 hrs HW=324.04' TW=323.35' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 0.48 cfs @ 2.30 fps)

Summary for Pond N-CB2: N-CB-2

Inflow Area = 11,070 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 1.04 cfs @ 12.07 hrs, Volume= 3,630 cf
 Outflow = 1.04 cfs @ 12.07 hrs, Volume= 3,630 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.04 cfs @ 12.07 hrs, Volume= 3,630 cf
 Routed to Pond N-CB3 : N-CB-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 323.37' @ 12.10 hrs
 Flood Elev= 327.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.72'	12.0" Round Culvert L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 322.72' / 322.50' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.87 cfs @ 12.07 hrs HW=323.35' TW=323.10' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 0.87 cfs @ 2.39 fps)

Summary for Pond N-CB3: N-CB-3

Inflow Area = 13,772 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 1.29 cfs @ 12.07 hrs, Volume= 4,516 cf
 Outflow = 1.29 cfs @ 12.07 hrs, Volume= 4,516 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.29 cfs @ 12.07 hrs, Volume= 4,516 cf
 Routed to Pond N-CB4 : N-CB-4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 323.13' @ 12.09 hrs
 Flood Elev= 327.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.40'	12.0" Round Culvert L= 53.0' Ke= 0.500 Inlet / Outlet Invert= 322.40' / 322.14' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.15 cfs @ 12.07 hrs HW=323.10' TW=322.77' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 1.15 cfs @ 2.74 fps)

Summary for Pond N-CB4: N-CB-4

Inflow Area = 22,601 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Outflow = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.13 cfs @ 12.07 hrs, Volume= 7,411 cf
 Routed to Pond AMH-1 : ACCESS MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.79' @ 12.07 hrs
 Flood Elev= 327.34'

Device	Routing	Invert	Outlet Devices
#1	Primary	321.89'	15.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 321.89' / 321.87' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=2.05 cfs @ 12.07 hrs HW=322.77' TW=320.05' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 2.05 cfs @ 3.13 fps)

Summary for Pond N-CB5: N-CB-5

Inflow Area = 5,428 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 0.51 cfs @ 12.07 hrs, Volume= 1,780 cf
 Outflow = 0.51 cfs @ 12.07 hrs, Volume= 1,780 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.51 cfs @ 12.07 hrs, Volume= 1,780 cf
 Routed to Pond N-CB6 : N-CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 322.63' @ 12.10 hrs
 Flood Elev= 326.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.17'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 322.17' / 321.90' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.41 cfs @ 12.07 hrs HW=322.60' TW=322.40' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 0.41 cfs @ 1.86 fps)

Summary for Pond N-CB6: N-CB-6

Inflow Area = 33,148 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Outflow = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.12 cfs @ 12.07 hrs, Volume= 10,869 cf
 Routed to Pond AMH-2 : ACCESS MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.42' @ 12.07 hrs
 Flood Elev= 326.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	321.40'	18.0" Round Culvert L= 4.0' Ke= 0.500 Inlet / Outlet Invert= 321.40' / 321.37' S= 0.0075 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.00 cfs @ 12.07 hrs HW=322.40' TW=320.22' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 3.00 cfs @ 3.40 fps)

Summary for Pond N-CB7: N-CB-7

Inflow Area = 19,491 sf, 48.96% Impervious, Inflow Depth = 1.96" for 10-yr event
 Inflow = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf
 Outflow = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.90 cfs @ 12.07 hrs, Volume= 3,183 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 323.20' @ 12.07 hrs
 Flood Elev= 326.68'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.70'	12.0" Round Culvert L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 322.70' / 322.40' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.86 cfs @ 12.07 hrs HW=323.19' TW=0.00' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 0.86 cfs @ 3.32 fps)

Summary for Pond N-CB8: N-CB-8

Inflow Area = 2,344 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 0.22 cfs @ 12.07 hrs, Volume= 769 cf
 Outflow = 0.22 cfs @ 12.07 hrs, Volume= 769 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.22 cfs @ 12.07 hrs, Volume= 769 cf
 Routed to Pond N-CB5 : N-CB-5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.78' @ 12.10 hrs
 Flood Elev= 326.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	12.0" Round Culvert L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.27' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.18 cfs @ 12.07 hrs HW=322.78' TW=322.60' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 0.18 cfs @ 1.56 fps)

Summary for Pond N-CB9: N-CB-9

Inflow Area = 15,358 sf, 100.00% Impervious, Inflow Depth = 3.93" for 10-yr event
 Inflow = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf
 Outflow = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.07 hrs, Volume= 5,036 cf
 Routed to Pond N-CB6 : N-CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 323.16' @ 12.07 hrs
 Flood Elev= 326.41'

Device	Routing	Invert	Outlet Devices
#1	Primary	322.41'	12.0" Round Culvert L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 322.41' / 322.19' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.39 cfs @ 12.07 hrs HW=323.14' TW=322.40' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 1.39 cfs @ 3.15 fps)

Summary for Pond N-FI1: N-FI-1

Inflow Area = 8,434 sf, 0.00% Impervious, Inflow Depth = 0.05" for 10-yr event
 Inflow = 0.00 cfs @ 15.20 hrs, Volume= 39 cf
 Outflow = 0.00 cfs @ 15.20 hrs, Volume= 39 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 15.20 hrs, Volume= 39 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Peak Elev= 322.15' @ 0.00 hrs Surf.Area= 86 sf Storage= 0 cf
 Flood Elev= 326.90' Surf.Area= 86 sf Storage= 71 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,094.5 - 1,094.5)

Volume	Invert	Avail.Storage	Storage Description
#1	322.15'	67 cf	4.00'W x 10.75'L x 2.00'H Prismaoid x 2 172 cf Overall - 4 cf Embedded = 168 cf x 40.0% Voids
#2	322.90'	4 cf	6.0" Round Pipe Storage x 2 Inside #1 L= 10.7'
		71 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	322.15'	3.000 in/hr Exfiltration over Wetted area
#2	Primary	323.90'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.00 cfs @ 15.20 hrs HW=322.15' (Free Discharge)
 ↑1=Exfiltration (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=322.15' TW=0.00' (Dynamic Tailwater)
 ↑2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond N-FI2: N-FI-2

[92] Warning: Device #2 is above defined storage

Inflow Area = 6,170 sf, 0.00% Impervious, Inflow Depth = 0.06" for 10-yr event
 Inflow = 0.00 cfs @ 15.20 hrs, Volume= 29 cf
 Outflow = 0.00 cfs @ 15.20 hrs, Volume= 29 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 15.20 hrs, Volume= 29 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.35' @ 0.00 hrs Surf.Area= 86 sf Storage= 0 cf
 Flood Elev= 327.09' Surf.Area= 86 sf Storage= 71 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,094.5 - 1,094.5)

Volume	Invert	Avail.Storage	Storage Description
#1	322.35'	67 cf	4.00'W x 10.75'L x 2.00'H Prismaoid x 2 172 cf Overall - 4 cf Embedded = 168 cf x 40.0% Voids
#2	323.10'	4 cf	6.0" Round Pipe Storage x 2 Inside #1 L= 10.7'
		71 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	322.35'	3.000 in/hr Exfiltration over Wetted area
#2	Primary	324.35'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.00 cfs @ 15.20 hrs HW=322.35' (Free Discharge)
 ↑1=Exfiltration (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=322.35' TW=0.00' (Dynamic Tailwater)
 ↑2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond N-FI3: N-FI-3

[92] Warning: Device #2 is above defined storage

Inflow Area = 4,276 sf, 0.00% Impervious, Inflow Depth = 0.06" for 10-yr event
 Inflow = 0.00 cfs @ 15.20 hrs, Volume= 21 cf
 Outflow = 0.00 cfs @ 15.20 hrs, Volume= 21 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 15.20 hrs, Volume= 21 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link POI 1 : OLD SUNCOOK RD

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 322.45' @ 0.00 hrs Surf.Area= 86 sf Storage= 0 cf
 Flood Elev= 327.24' Surf.Area= 86 sf Storage= 71 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,094.5 - 1,094.5)

Volume	Invert	Avail.Storage	Storage Description
#1	322.45'	67 cf	4.00'W x 10.75'L x 2.00'H Prismaoid x 2 172 cf Overall - 4 cf Embedded = 168 cf x 40.0% Voids
#2	323.20'	4 cf	6.0" Round Pipe Storage x 2 Inside #1 L= 10.7'
		71 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	322.45'	3.000 in/hr Exfiltration over Wetted area
#2	Primary	324.45'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.00 cfs @ 15.20 hrs HW=322.45' (Free Discharge)
 ↑1=Exfiltration (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=322.45' TW=0.00' (Dynamic Tailwater)
 ↑2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link POI 1: OLD SUNCOOK RD

Inflow Area = 319,282 sf, 30.55% Impervious, Inflow Depth = 1.22" for 10-yr event
 Inflow = 5.56 cfs @ 12.27 hrs, Volume= 32,401 cf
 Primary = 5.56 cfs @ 12.27 hrs, Volume= 32,401 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

POST-DEVELOPMENT_AMENDED SOIL_BACC0005

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	50-yr	Type III 24-hr		Default	24.00	1	6.19	2

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.78 cfs 2,751 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.77 cfs 2,740 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=1.24 cfs 4,379 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=3.47" Flow Length=222' Tc=20.3 min CN=WQ Runoff=6.44 cfs 34,631 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=0.88" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.44 cfs 11,173 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.38 cfs 1,340 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=1.73 cfs 6,131 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.43 cfs 1,530 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=2.15 cfs 7,617 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=5.95" Tc=5.0 min CN=98 Runoff=0.33 cfs 1,163 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=3.17" Tc=5.0 min CN=WQ Runoff=1.35 cfs 5,149 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.47" Tc=5.0 min CN=WQ Runoff=0.02 cfs 166 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.45" Tc=5.0 min CN=WQ Runoff=0.03 cfs 232 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.44" Tc=5.0 min CN=WQ Runoff=0.03 cfs 308 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=2.40" Tc=5.0 min CN=WQ Runoff=0.41 cfs 1,643 cf
Pond add/alt: AMENDED SOIL -	Peak Elev=321.99' Storage=10,782 cf Inflow=7.82 cfs 27,645 cf Outflow=0.57 cfs 27,673 cf

Pond AMH-1: ACCESS MANHOLE-1 Peak Elev=321.99' Inflow=3.17 cfs 11,209 cf
 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=3.17 cfs 11,204 cf

Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=321.99' Inflow=4.65 cfs 16,440 cf
 24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=4.65 cfs 16,440 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
 Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.17' Inflow=0.78 cfs 2,751 cf
 12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' Outflow=0.78 cfs 2,751 cf

Pond N-CB2: N-CB-2 Peak Elev=323.58' Inflow=1.55 cfs 5,490 cf
 12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=1.55 cfs 5,490 cf

Pond N-CB3: N-CB-3 Peak Elev=323.37' Inflow=1.93 cfs 6,831 cf
 12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' Outflow=1.93 cfs 6,831 cf

Pond N-CB4: N-CB-4 Peak Elev=323.03' Inflow=3.17 cfs 11,209 cf
 15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' Outflow=3.17 cfs 11,209 cf

Pond N-CB5: N-CB-5 Peak Elev=322.83' Inflow=0.76 cfs 2,692 cf
 12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' Outflow=0.76 cfs 2,692 cf

Pond N-CB6: N-CB-6 Peak Elev=322.70' Inflow=4.65 cfs 16,440 cf
 18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' Outflow=4.65 cfs 16,440 cf

Pond N-CB7: N-CB-7 Peak Elev=323.34' Inflow=1.35 cfs 5,149 cf
 12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' Outflow=1.35 cfs 5,149 cf

Pond N-CB8: N-CB-8 Peak Elev=322.91' Inflow=0.33 cfs 1,163 cf
 12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' Outflow=0.33 cfs 1,163 cf

Pond N-CB9: N-CB-9 Peak Elev=323.39' Inflow=2.15 cfs 7,617 cf
 12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=2.15 cfs 7,617 cf

Pond N-FI1: N-FI-1 Peak Elev=323.45' Storage=47 cf Inflow=0.03 cfs 308 cf
 Discarded=0.01 cfs 308 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 308 cf

Pond N-FI2: N-FI-2 Peak Elev=323.20' Storage=29 cf Inflow=0.03 cfs 232 cf
 Discarded=0.01 cfs 232 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 232 cf

Pond N-FI3: N-FI-3 Peak Elev=322.93' Storage=17 cf Inflow=0.02 cfs 166 cf
 Discarded=0.01 cfs 166 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 166 cf

Link POI 1: OLD SUNCOOK RD Inflow=8.42 cfs 52,595 cf
 Primary=8.42 cfs 52,595 cf

Total Runoff Area = 375,031 sf Runoff Volume = 80,950 cf Average Runoff Depth = 2.59"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

POST-DEVELOPMENT_AMENDED SOIL_BACC0005

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-yr	Type III 24-hr		Default	24.00	1	7.34	2

POST-DEVELOPMENT_AMENDED SOIL_BACC0005 Type III 24-hr 100-yr Rainfall=7.34"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: PDA 1	Runoff Area=5,546 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.92 cfs 3,282 cf
Subcatchment 2S: PDA 2	Runoff Area=5,524 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.92 cfs 3,269 cf
Subcatchment 3S: PDA 3	Runoff Area=8,829 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=1.47 cfs 5,224 cf
Subcatchment 4S: PDA 4	Runoff Area=119,868 sf 56.74% Impervious Runoff Depth=4.22" Flow Length=222' Tc=20.3 min CN=WQ Runoff=7.72 cfs 42,183 cf
Subcatchment 5S: PDA 5	Runoff Area=152,846 sf 11.20% Impervious Runoff Depth=1.23" Flow Length=310' Tc=30.7 min CN=WQ Runoff=1.93 cfs 15,706 cf
Subcatchment 6S: PDA 6	Runoff Area=2,702 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.45 cfs 1,599 cf
Subcatchment 7S: PDA 7	Runoff Area=12,362 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=2.06 cfs 7,315 cf
Subcatchment 8S: PDA 8	Runoff Area=3,084 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.51 cfs 1,825 cf
Subcatchment 9S: PDA 9	Runoff Area=15,358 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=2.56 cfs 9,088 cf
Subcatchment 10S: PDA 10	Runoff Area=2,344 sf 100.00% Impervious Runoff Depth=7.10" Tc=5.0 min CN=98 Runoff=0.39 cfs 1,387 cf
Subcatchment 11S: PDA 11	Runoff Area=19,491 sf 48.96% Impervious Runoff Depth=3.93" Tc=5.0 min CN=WQ Runoff=1.68 cfs 6,388 cf
Subcatchment 12S: PDA 12	Runoff Area=4,276 sf 0.00% Impervious Runoff Depth=0.84" Tc=5.0 min CN=WQ Runoff=0.05 cfs 299 cf
Subcatchment 13S: PDA 13	Runoff Area=6,170 sf 0.00% Impervious Runoff Depth=0.82" Tc=5.0 min CN=WQ Runoff=0.07 cfs 420 cf
Subcatchment 14S: PDA 14	Runoff Area=8,434 sf 0.00% Impervious Runoff Depth=0.80" Tc=5.0 min CN=WQ Runoff=0.10 cfs 560 cf
Subcatchment 15S: PDA 15	Runoff Area=8,197 sf 34.93% Impervious Runoff Depth=3.06" Tc=5.0 min CN=WQ Runoff=0.53 cfs 2,091 cf
Pond add/alt: AMENDED SOIL -	Peak Elev=323.39' Storage=13,617 cf Inflow=9.28 cfs 32,982 cf Outflow=0.62 cfs 32,986 cf

Pond AMH-1: ACCESS MANHOLE-1 Peak Elev=323.39' Inflow=3.76 cfs 13,373 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=3.76 cfs 13,368 cf

Pond AMH-2: ACCESS MANHOLE-2 Peak Elev=323.39' Inflow=5.52 cfs 19,614 cf
24.0" Round Culvert n=0.012 L=4.0' S=0.0000 ' Outflow=5.52 cfs 19,614 cf

Pond IR: ISOLATOR ROW CHECK Peak Elev=0.00' Storage=0 cf
Discarded=0.00 cfs 0 cf

Pond N-CB1: N-CB-1 Peak Elev=324.23' Inflow=0.92 cfs 3,282 cf
12.0" Round Culvert n=0.012 L=162.0' S=0.0050 ' Outflow=0.92 cfs 3,282 cf

Pond N-CB2: N-CB-2 Peak Elev=323.71' Inflow=1.84 cfs 6,550 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=1.84 cfs 6,550 cf

Pond N-CB3: N-CB-3 Peak Elev=323.52' Inflow=2.29 cfs 8,149 cf
12.0" Round Culvert n=0.012 L=53.0' S=0.0049 ' Outflow=2.29 cfs 8,149 cf

Pond N-CB4: N-CB-4 Peak Elev=323.40' Inflow=3.76 cfs 13,373 cf
15.0" Round Culvert n=0.012 L=4.0' S=0.0050 ' Outflow=3.76 cfs 13,373 cf

Pond N-CB5: N-CB-5 Peak Elev=323.40' Inflow=0.90 cfs 3,212 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0049 ' Outflow=0.90 cfs 3,212 cf

Pond N-CB6: N-CB-6 Peak Elev=323.40' Inflow=5.52 cfs 19,614 cf
18.0" Round Culvert n=0.012 L=4.0' S=0.0075 ' Outflow=5.52 cfs 19,614 cf

Pond N-CB7: N-CB-7 Peak Elev=323.44' Inflow=1.68 cfs 6,388 cf
12.0" Round Culvert n=0.012 L=27.0' S=0.0111 ' Outflow=1.68 cfs 6,388 cf

Pond N-CB8: N-CB-8 Peak Elev=323.40' Inflow=0.39 cfs 1,387 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0051 ' Outflow=0.39 cfs 1,387 cf

Pond N-CB9: N-CB-9 Peak Elev=323.52' Inflow=2.56 cfs 9,088 cf
12.0" Round Culvert n=0.012 L=45.0' S=0.0049 ' Outflow=2.56 cfs 9,088 cf

Pond N-FI1: N-FI-1 Peak Elev=323.97' Storage=65 cf Inflow=0.10 cfs 560 cf
Discarded=0.01 cfs 442 cf Primary=0.06 cfs 119 cf Outflow=0.08 cfs 560 cf

Pond N-FI2: N-FI-2 Peak Elev=324.41' Storage=71 cf Inflow=0.07 cfs 420 cf
Discarded=0.01 cfs 392 cf Primary=0.05 cfs 28 cf Outflow=0.06 cfs 420 cf

Pond N-FI3: N-FI-3 Peak Elev=324.11' Storage=60 cf Inflow=0.05 cfs 299 cf
Discarded=0.01 cfs 299 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 299 cf

Link POI 1: OLD SUNCOOK RD Inflow=10.29 cfs 66,514 cf
Primary=10.29 cfs 66,514 cf

Total Runoff Area = 375,031 sf Runoff Volume = 100,635 cf Average Runoff Depth = 3.22"
59.13% Pervious = 221,752 sf 40.87% Impervious = 153,279 sf

10.0 SITE-SPECIFIC SOIL REPORT

TES ENVIRONMENTAL CONSULTANTS, L.L.C.

*Environmental Planning and Permitting
Soil and Wetlands Investigation*

SITE-SPECIFIC
SOIL SURVEY REPORT

performed at

Daval Realty Associates, LLC and
Banks Chevrolet-Cadillac Property
Tax Map/Block 782/Z, Lot 8
234 Airport Road
Concord, NH

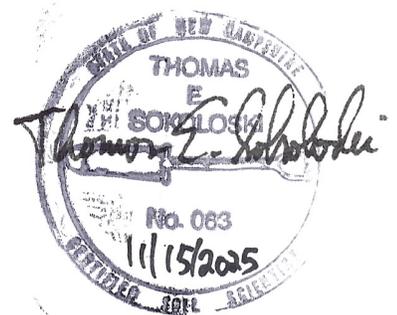
prepared for

Wilcox & Barton, Inc.
2 Home Avenue
Concord, NH 03301

TES Project # 25-0044

1494 Route 3A, Unit 1
Bow, NH 03304
(603) 856-8925

tom@tesenviro.comcastbiz.net



November 15, 2025

Ms. Erin Lambert, PE, LEED AP
Wilcox & Barton, Inc.
2 Home Avenue
Concord, NH 03301

RE: Site Specific Soil Map – Daval Realty Associates, LLC/Banks Chevrolet-Cadillac Property
Tax Map/Block 782/Z, Lot 8
234 Airport Road, Concord, New Hampshire

Dear Ms. Lambert:

On November 14, 2025 I performed field work on the above-referenced property at 234 Airport Road in Concord, New Hampshire for a Site Specific Soil Survey as you requested. The Site Specific Soil Survey comprised the entire 7.08-acre parcel which was depicted on an existing conditions plan provided by your office (survey by Holden Engineering & Surveying, Inc.). This plan had a scale of 1" = 40' and 2-foot contour intervals (the entire parcel is nearly level). This soil survey was prepared to support a New Hampshire Alteration of Terrain permit application for a planned expansion of and improvements to existing automobile parking areas on the site.

The subject parcel is bounded by Airport Road to the east, Old Suncook Road to the south, residential properties along Airport Road, office buildings off Old Suncook Road to the west, and forest and athletic fields to the north. Concord Airport is located to the east of Airport Road.

This Soil Survey was completed utilizing SSSNNE Special Publication No. 3, Version 7.0, "Site-Specific Soil Mapping Standards for New Hampshire and Vermont", July 2021. The soil legend used for this soil map conforms to the New Hampshire State-Wide Numerical Soils Legend, Issue #10 (January 2011) established and maintained by the Natural Resources Conservation Service.

Field work for this soil survey included the examination of many soil profiles via hand dug test pits and auger borings taken at intervals sufficient to delineate the boundaries between soil map units. No New Hampshire Wetlands Bureau jurisdictional wetlands were observed to be present on or adjacent to the survey area. Readily-identifiable property boundaries and markers, utility poles, fences, pavement, catch basins, tree lines, jersey barrier walls, and other development features on and adjacent to the site were utilized for locational control for the soil survey.

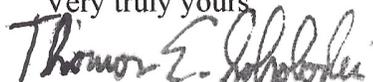
The Soil Survey of Merrimack and Belknap Counties, New Hampshire (USDA – Natural Resource Conservation Service) was reviewed (via Web Soil Survey) prior to site work for reference. This publication indicates that the soils across almost the entire mapping area consist of Windsor loamy sand (26A), with Urban Land (699B) in a narrow strip along Old Suncook Road. Windsor loamy sand is a sandy, excessively drained soil formed in glaciofluvial deposits. The Urban Land map unit depicts mostly developed soils (paved and/or buildings) without specifying underlying soil types, however, for this site, it may be safely concluded that the soils underlying the site pavement consists of the natural substrata of Windsor loamy sand, as all

undisturbed soils surrounding the property are indicated as such or similar but disturbed soils. No other soils were observed during the Site Specific Soil Survey.

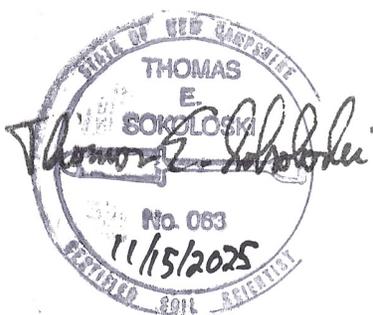
The following report includes a Site Specific Soil Map Key with Hydrologic Soil Groups and attached soil unit descriptions. The general soil conditions on the site consist of nearly level, sandy glacial outwash deposits, approximately half of which (the western half) has been developed as automobile parking areas, either paved with asphalt or having a man-made gravel surface. Mature, mostly evergreen forest exists to the north and east of a central asphalt-paved parking area extending north from Old Suncook Road, and a smaller area of maintained grassland exists along the Airport Road lot frontage.

If you have any questions regarding the soils on this site and the accompanying report, please contact our office.

Very truly yours



Thomas E. Sokoloski
Certified Soil Scientist #063



SITE SPECIFIC SOIL MAP UNIT KEY

Symbol*	Map Unit	Slope Class	Drainage Class	HISS Symbol	Hydro. Soil Group
26B	Windsor loamy sand	0-8%	Excessively	111BH	A
400B/abaaa	Udorthents, sandy	0-8%	Excessively	161BH	A
400B/hbhaa	Udorthents, sandy	0-8%	Undeterminable**	761BH	A

* Refer to accompanying report for 5-unit supplemental symbol explanation.

** Assumed to be excessively drained as in adjacent unpaved soils.

This detailed Site-Specific Soil Map, prepared on November 14, 2025 by Thomas E. Sokoloski, Certified Soil Scientist #063 of TES Environmental Consultants, L.L.C. in Bow, New Hampshire, conforms to the standards of SSSNNE Publication No. 3, Version 7.0, "Site-Specific Soil Mapping Standards for New Hampshire and Vermont", July 2021. This map has been prepared to comply with soil mapping requirements of RSA 485 A: 17 and NHDES Env-Wq 1500, Alteration of Terrain. See accompanying report for methodology, map symbol legend, and interpretations. Use of the map symbol denominators for disturbed or altered soils, where given, is at the discretion of the Certified Soil Scientist.

This map product is within the technical standards of the National Cooperative Soil Survey. It is a special purpose product, intended for use in support of a New Hampshire Alteration Terrain permit application. It was produced by a certified Soil Scientist, and is not a product of the USDA Natural Resources Conservation Service. There is a narrative report that accompanies this map.

Supplemental Symbols

The five components of the Disturbed Soil Mapping Unit Supplement are as follows:

Symbol 1: Drainage Class

- a-Excessively Well Drained
- b-Somewhat Excessively Drained
- c-Well Drained
- d-Moderately Well Drained
- e-Somewhat Poorly Drained
- f-Poorly Drained
- g-Very Poorly Drained
- h-Not Determined

Symbol 2 -: Parent Material (of naturally formed soil only, if present)

- a-No natural soil within 60"
- b-Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel)
- c-Glacial Till Material (active ice)
- d-Glaciolacustrine very fine sand and silt deposits (glacial lakes)
- e-Loamy/sandy over silt/clay deposits
- f-Marine Silt and clay deposits (ocean waters)
- g-Alluvial Deposits (floodplains)
- h-Organic Materials-Fresh water Bogs, etc
- i- Organic Materials-Tidal Marsh

Symbol 3: Restrictive/Impervious Layers

- a-None
- b-Bouldery surface with more than 15% of the surface covered with boulders
- c-Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface such as hardpan, platy structure or clayey texture with consistence of at least firm, i.e. more than 20 newtons. For other examples of soil characteristics that qualify for restrictive layer, see "Soil Manual for Site evaluations in NH" 2nd Ed., page 3-17, figure 2-14
- d-Bedrock in the soil profile 0-20 inches
- e-Bedrock in the soil profile 20-60 inches
- f-Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types
- g-Subject to Flooding
- h –man-made impervious surface including pavement, concrete, or built-up surfaces (i.e. buildings) with no morphological restrictive layer within control section

Symbol 4 Estimated Ksat* (most restrictive layer excluding symbol 3h above).

- a- High
 - b-Moderate
 - c-Low
 - d-Not determined
- *See "Guidelines for Ksat Class Placement" in Chapter 3 of the Soil Survey Manual, USDA

Symbol 5: Hydrologic Soil Group*

- a-Group A
- b-Group B
- c-Group C
- d-Group D
- e-Not determined

*excluding man-made impervious/restrictive layers

SITE SPECIFIC SOIL MAP UNIT DESCRIPTIONS

Map Unit Symbol: 26
Map Unit Name: Windsor loamy sand
Landscape Settings: Outwash plains and terraces
Surface Features: None
Drainage Class: Excessively
Parent Material: Sandy glaciofluvial deposits (outwash)
Complex: Yes () No (X)

Nature of Dissimilar Inclusions, Locations and Estimated Percent:

None.

Additional Notes:

Typical observed soil profile description:

<u>Depth</u>	<u>Horizon</u>	<u>Color</u>	<u>Texture</u>	<u>Structure</u>	<u>Consistency</u>	<u>Redox</u>	<u>Notes</u>
0-10"	A	10YR 3/2	Sandy loam	Granular	Very friable	None	
10-22"	Bw1	10YR 5/6	Sandy loam*	Blocky	Friable	None	
22-40"+	Bw2	10YR 5/6	Grav. loamy sand	Single grain	Loose	None	

*The Bw1 horizon in some areas was loamy sand.

Tax Map/Block 482/Z, Lot 8. Undisturbed upland evergreen forest, north-central and eastern portions of mapping area, and maintained grassland, eastern side of parcel. SHWT > 40".

Thomas E. Sokoloski 11/14/2025

SITE SPECIFIC SOIL MAP UNIT DESCRIPTIONS

Map Unit Symbol: 400B/abaaa
 Map Unit Name: Udorthents, sandy
 Landscape Settings: Excavated, regraded or filled land surfaces
 Surface Features: Fill or regraded soil; parking or landscaped areas
 Drainage Class: Excessively
 Parent Material: Sandy glaciofluvial deposits (outwash)
 Complex: Yes () No (X)

Nature of Dissimilar Inclusions, Locations and Estimated Percent:

Small, narrow areas of disturbed soils without the placed gravel surface exist in the area surrounding the asphalt-paved parking area in the south-central portion of the parcel along Old Suncook Road and small areas of landscaping or turnouts along Old Suncook Road.

Additional Notes:

Typical observed soil profile description:

<u>Depth</u>	<u>Horizon</u>	<u>Color</u>	<u>Texture</u>	<u>Structure</u>	<u>Consistency</u>	<u>Redox</u>	<u>Notes</u>
0-10"	F	2.5Y 5/1	Gravel	Single grain	Friable	None	Packed fill
10-24"	Bw1	10YR 5/6	Sandy loam	Blocky	Friable	None	
24-40"+	Bw2	10YR 5/6	Grav. loamy sand	Single grain	Loose	None	

Tax Map/Block 482/Z, Lot 8. Soils altered by regrading, and filling; car parking area in western portion of site, and other locations of disturbed soils across mapping area; SHWT > 40".

Thomas E. Sokoloski 11/14/2025

SITE SPECIFIC SOIL MAP UNIT DESCRIPTIONS

Map Unit Symbol: 400B/hbhaa

Map Unit Name: Udorthents, sandy

Landscape Settings: Developed land surfaces

Surface Features: Asphalt pavement - impervious surfaces

Drainage Class: Undeterminable (assumed to be excessively drained as are adjacent soils)

Parent Material: Sandy glaciofluvial deposits (outwash)

Complex: Yes () No (X)

Nature of Dissimilar Inclusions, Locations and Estimated Percent:

None.

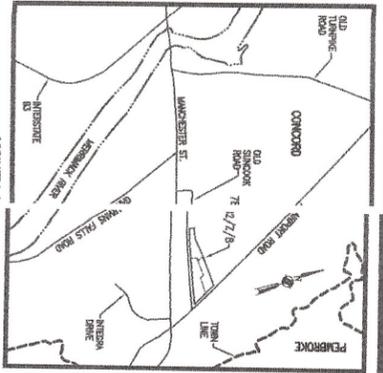
Additional Notes:

Soil profile not observed due to pavement. All surrounding, undeveloped soils known to have subsoils and substrata consisting of glaciofluvial sand and gravel.

Tax Map/Block 482/Z, Lot 8. Developed soils at a car-parking area in south-central portion of parcel along Old Suncook Road with impervious surface of asphalt; SHWT > 40", assumed.

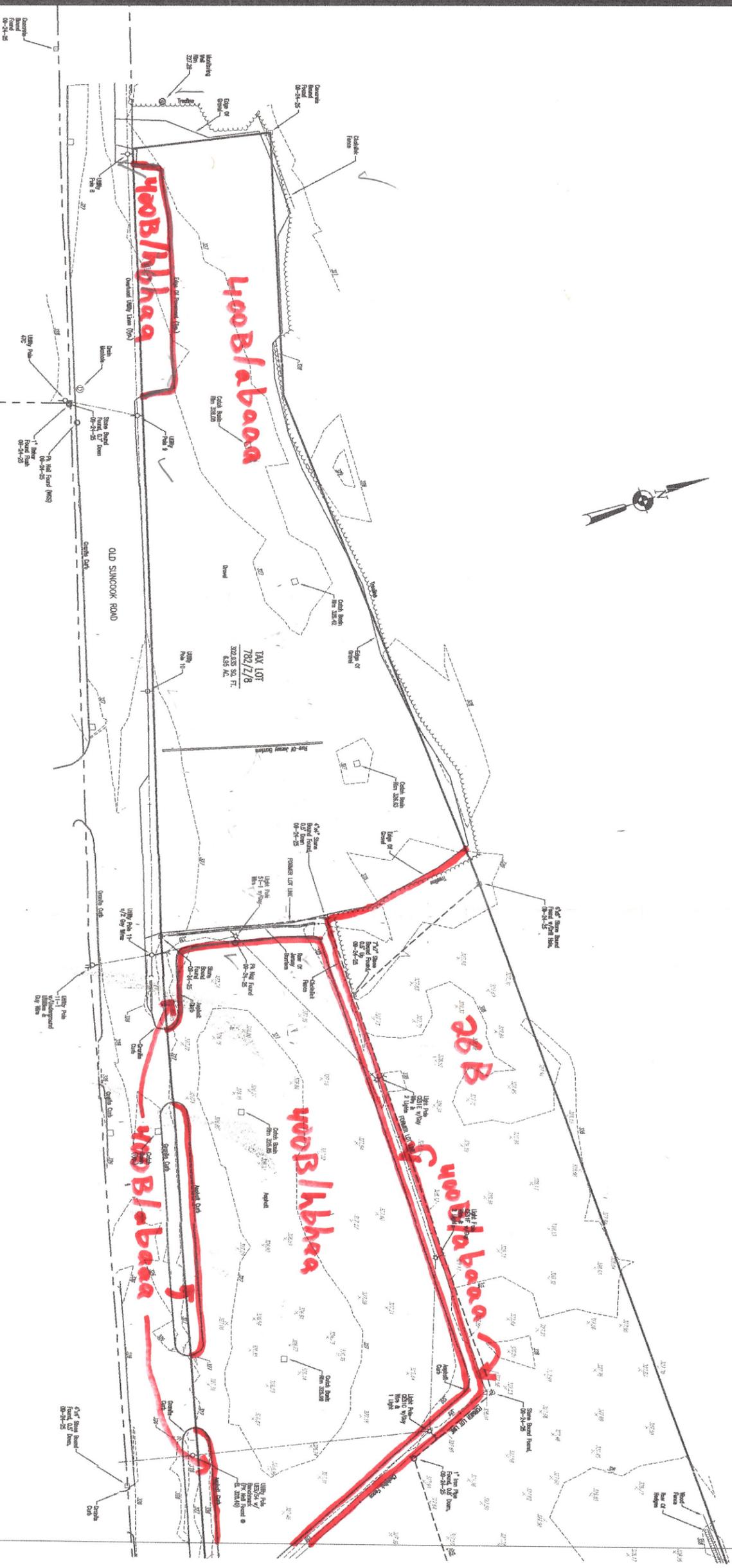
Thomas E. Sokoloski

11/14/2025



- PLAN REFERENCES:**
1. OLD SUNCOOK ROAD RIGHT OF WAY ASSET MAP DATED MAY 1973 BY CITY OF CONCORD, NEW HAMPSHIRE ENGINEERING DIVISION, FILE NO. 1973
 2. LAND TO BE LEASED OF CONCORD LITTLE LEAGUE DATED MARCH 1974 BY CITY OF CONCORD, NEW HAMPSHIRE ENGINEERING DIVISION, FILE NO. 1974
 3. STATE REALTY CO., INC., TRACTS 4371-4 & 4481-4 DATED APRIL, 1959 BY CH. ROBERTS, CITY OF CONCORD FILE N. 1, 1099

- NOTES:**
1. INTERFERE THIS SHEET AS CITY OF CONCORD TAX LOT 7827/8 OWNED BY DANIEL WHEAT (PERSONAL), 107 WASHINGTON ST., CONCORD, NH 03301.
 2. LEASING REFERENCE SET NOTICE OF LOT 12 INSOLIDATION BOOK 2741 PAGE 515 AS RECORDED AT THE MERRIMACK COUNTY REGISTERY OF DEEDS.
 3. AREA OF PARKED 30X35 SQUARE FEET OR LESS AREAS.
 4. THIS SURVEY WAS AN ACTUAL ON THE GROUND TOPOGRAPHIC SURVEY FOR THE PURPOSE OF DETERMINING DISTANCE - THE CONDITIONS ON THE SUBJECT PROPERTY.
 5. THE HORIZONTAL SURVEY SYSTEM IS REFERRED TO THE NH STATE PLANE COORDINATE SYSTEM AND THE VERTICAL SURVEY SYSTEM IS REFERRED TO NAD 1983 DATUM.



HOLDEN ENGINEERING & SURVEYING, Inc.

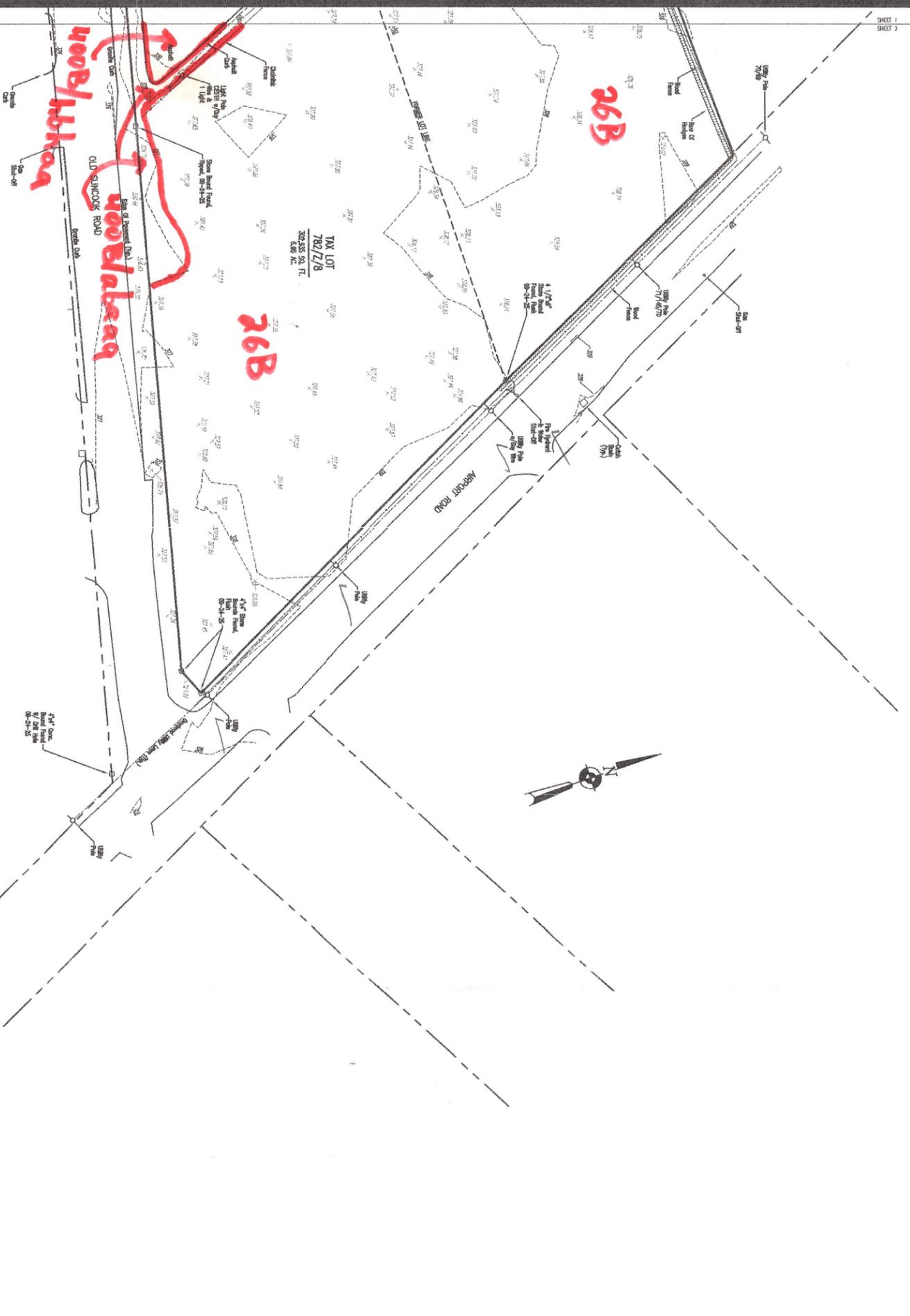
59 Old Suncook Road - 4th Fl.
 P.O. Box 487 Concord, NH 03302
 (603) 252-4448
 3 Computer Aids
 Concord, NH 03301
 (603) 725-2289

EXISTING CONDITIONS PLAN
BANKS CHEVROLET - CADILLAC
 CONCORD, NH

Date	Revisions	By	Check	Page	Date
					10-16-25
					1-40
					Dr. By: DS CK By: LR
					Job No. 2520435
					Sheet no 1 of 2

SCALE: 1"=40'

40 0 40 80 120



HOLDEN ENGINEERING & SURVEYING, Inc.

99 Old Sincor Road - LR #1
 PO Box 400 Concord, NH 03302
 (603) 252-4419
 1 Dandolena Drive
 Concord, NH 03301
 (603) 472-2013

EXISTING CONDITIONS PLAN
BANKS CHEVROLET - CADILLAC
 CONCORD, NH

Date:	Revisions Description	Dr. Ck By	Book	Page	Date:
					10-16-25
					Scale: 1"=40'
					Dr. By DS CK By: LR
					Job No. 2520435
					Sheet no 2 of 2



REVISION HISTORY

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OWNER
DAVAL REALTY ASSOCIATES LLC / BANKS CHEVROLET
137 MANCHESTER ST CONCORD, NH 03301

SITE
BANKS CHEVROLET PARKING LOT RECONSTRUCTION
234 AIRPORT ROAD CONCORD, NH 03301

MBLU: 782/Z/8
DRAWING TITLE
PRE-DEVELOPMENT SOILS MAP

SCALE 1" = 40' DATE 11/19/2025

DRAFTED BY KAD CHECKED BY ERL PROJECT MGR ERL PROJECT NO. BACC0005

STATE OF NEW HAMPSHIRE
ERIN R. LAMBERT
No. 11057
LICENSED PROFESSIONAL ENGINEER
Erin R. Lambert
ENGINEER: ERIN R. LAMBERT
NH P.E. #11057

SM1

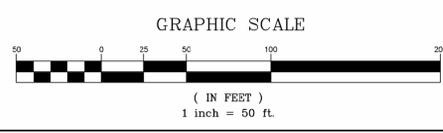
SHEET NO.
01 OF 02



- SSSNNE SOIL MAP LEGEND**
- HYDROLOGIC GROUP A
 - IMPERVIOUS COVER
 - SOIL TYPE BOUNDARY
- STORMWATER PLAN LEGEND**
- SUBCATCHMENT NODE
 - POINT OF INTEREST NODE
 - SUBWATERSHED BOUNDARY

PLAN NOTES:

- EXISTING CONDITIONS, TOPOGRAPHICAL INFORMATION, NORTH ORIENTATION, AND COORDINATE VALUES DEPICTED ON THESE DRAWINGS ARE BASED ON PLANS TITLED "EXISTING CONDITIONS PLAN - BANKS CHEVROLET-CADILLAC - CONCORD, NH" PREPARED FOR BANKS CHEVROLET, DATED OCTOBER 16, 2025, PROVIDED TO WILCOX & BARTON, INC. BY HOLDEN ENGINEERING & SURVEYING, INC.



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OWNER

**DAVAL REALTY
ASSOCIATES LLC /
BANKS CHEVROLET**

**137 MANCHESTER ST
CONCORD, NH 03301**

**BANKS CHEVROLET
PARKING LOT
RECONSTRUCTION**

**234 AIRPORT ROAD
CONCORD, NH 03301**

MBLU: 782/Z/8

DRAWING TITLE

**POST-DEVELOPMENT
SOILS MAP**

SCALE

1" = 40'

DATE

11/19/2025

DRAFTED BY

KAD

CHECKED BY

ERL

PROJECT MGR

ERL

PROJECT NO.

BACC0005

SHEET NO.

SM2

02 OF 02



SSSNNE SOIL MAP LEGEND

- HYDROLOGIC GROUP A
- IMPERVIOUS COVER
- SOIL TYPE BOUNDARY

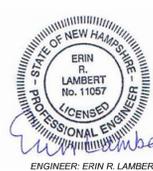
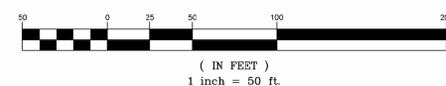
STORMWATER PLAN LEGEND

- SUBCATCHMENT NODE
- POINT OF INTEREST NODE
- SUBWATERSHED BOUNDARY

PLAN NOTES:

1. EXISTING CONDITIONS, TOPOGRAPHICAL INFORMATION, NORTH ORIENTATION, AND COORDINATE VALUES DEPICTED ON THESE DRAWINGS ARE BASED ON PLANS TITLED "EXISTING CONDITIONS PLAN - BANKS CHEVROLET-CADILLAC - CONCORD, NH" PREPARED FOR BANKS CHEVROLET, DATED OCTOBER 16, 2025, PROVIDED TO WILCOX & BARTON, INC. BY HOLDEN ENGINEERING & SURVEYING, INC.

GRAPHIC SCALE



ENGINEER: ERIN R. LAMBERT
NH P.E. #11057

11.0 INFILTRATION FEASIBILITY REPORT

Wilcox & Barton INC.

CIVIL • ENVIRONMENTAL • GEOTECHNICAL

INFILTRATION FEASIBILITY REPORT

for

Banks Chevrolet Parking Lot Reconstruction
234 Airport Road
Concord, NH 03301

Prepared for:

Banks Chevrolet
C/O Fred Booth
137 Manchester Street
Concord, NH 03301

Prepared by:

Wilcox & Barton, Inc.
2 Home Ave.
Concord, New Hampshire 03301
Contact: Erin R. Lambert, PE, (603) 369-4190 x527



Wilcox & Barton, Inc.
Project No.: BACC0005

November 19, 2025

1.0 LOCATION OF THE PRACTICE.....3
2.0 EXISTING TOPOGRAPHY AT THE LOCATION OF THE PRACTICES3
3.0 TEST PIT LOCATIONS.....3
4.0 SEASONAL HIGH WATER (SHWT) AND BEDROCK ELEVATIONS3
5.0 PROFILE DESCRIPTION AND SOILS.....4
6.0 SUMMARY OF DATA USED TO DETERMINE THE INFILTRATION RATE.....4



1.0 LOCATION OF THE PRACTICE

This project proposes multiple systems that require infiltration to function properly. The systems are identified on the plans as Infiltration Gallery-1, Field Inlet-1, Field Inlet-2, and Field Inlet-3. Currently the project area is served by three dry wells that manage a portion of the runoff through infiltration. The eastern portion of the project is proposed to be maintained, will not be disturbed, and will remain paved with two catch basin locations directing flow to the closed drainage system at Old Suncook Road.

Infiltration Gallery-1: This gallery is in the central area of the proposed redeveloped parking lot. The gallery captures runoff from the proposed parking lot area via catch basins. In total, the system collects drainage runoff from 1.28 acres of influent area, consisting of all impervious surfaces. Please see Grading & Drainage Plans for more information on the infiltration gallery-1 location.

Field Inlets-1-3: Field Inlets 1–3 are located on the northern side of the property within the grassed landscaped areas. Each inlet consists of a field inlet directed to two 6-inch perforated pipes embedded in a stone trench. These systems are not intended for stormwater treatment but rather to collect runoff from the rear landscaped areas of the project site for disconnecting stormwater runoff. Please see Grading & Drainage Plans for more information on the field inlet's location.

2.0 EXISTING TOPOGRAPHY AT THE LOCATION OF THE PRACTICES

The current topography of the infiltration practice areas is situated on mostly disturbed/developed land with existing compacted gravel and paved areas, characterized by gradual slopes ranging from 0.5% to 5% towards the southern property boundary line. The site's existing vegetation in this area includes wooded and grassed areas surrounding the existing development, supported by well-draining soils.

3.0 TEST PIT LOCATIONS

Confirmatory test pits will be performed at the start of construction at the location of the infiltration treatment system, Infiltration Gallery-1. Test pit logs will be submitted to the City of Concord and NHDES Alteration of Terrain Bureau to confirm the design criteria as required. Please see the Site-Specific Soil Survey Report for more information.

4.0 SEASONAL HIGH WATER (SHWT) AND BEDROCK ELEVATIONS

The on-site soils indicate well-draining soil around the infiltration practices, with SHWT observed at depths of 80" and greater. The soil information is enclosed here to the NHDES Alteration of Terrain Bureau to verify the minimum separation of 3-feet from the bottom of the infiltration system to the elevation of seasonal high water and bedrock. Test pit logs will be submitted to the City of Concord and NHDES Alteration of Terrain Bureau to supplement the soil information.

5.0 PROFILE DESCRIPTION AND SOILS

Please refer to “Site-Specific Soil Survey Report”.

6.0 SUMMARY OF DATA USED TO DETERMINE THE INFILTRATION RATE

The project area includes hydrologic soil group (HSG) ‘A’ soils near the proposed infiltration practices with default Ksat values ranging from 6 to 20 in/hr at both high and low soil horizons. For modeling purposes, an infiltration rate of 3 in/hr was used, incorporating a factor of safety of 2. Previous testing conducted at the adjacent Banks Chevrolet dealership parcel reflected infiltration rates exceeding the maximum allowable rate of 10 in/hr (prior to applying the factor of safety). Based on this information, similar soil conditions are anticipated on the project site, which may require on-site soil amendment at the treatment system location. The civil plan set has been prepared to reflect these potential amendment requirements, which are detailed via Layout B in the Construction Details. Confirmatory test pits and on-site infiltration rate testing will be performed prior to construction, and the results will be submitted to the NHDES Alteration of Terrain Bureau to verify the assumed design infiltration rate and affiliated infiltration gallery configuration. Both gallery configurations (Layout A and Layout B) require impermeable liners be installed at all sidewalls of Infiltration Gallery-1 due to soils being HSG A, as reflected in sheet C5.3, Construction Details.



REGISTRATION AND NOTIFICATION FORM FOR STORMWATER INFILTRATION TO GROUNDWATER (5H1) Groundwater Discharge Program



RSA/Rule: RSA 485-A:6, VII; 485:3, X; Env-Wq 402

Applicant Information

Name: Banks Chevrolet/Daval Realty Associates LLC		Daytime Phone: 603-229-4004	
Mailing Address: 137 Manchester Street			
City: Concord		State: NH	ZIP: 03301
Contact Person Name: Fred Booth		Email: fred.booth@banksautos.com	
Contact Person Phone Number: 603-229-4004		Fax Number:	

Facility Information

Name: Banks Chevrolet Parking Lot Reconstruction			
Address: 234 Airport Road			
City: Concord		State: NH	ZIP: 03301
Property Tax Map: 782 Block Z		Lot Number: 8	
Latitude & Longitude of discharge point(s): 43.190, -71.503			

Facility Owner Information (complete only if different than applicant)

Owner Name:		Daytime Phone:	
Mailing Address:			
City/Town:		State:	ZIP:
Contact Person Name:		Email:	
Contact Person Phone Number:		Fax Number:	

Property Owner (complete only if different then Applicant)

Name:		Daytime Phone:	
Mailing Address:			
City:		State:	ZIP:
Contact Person Name:		Email:	
Contact Person Phone Number:		Fax Number:	

Facility Operator's Information (complete only if different than applicant)

Facility Operator Name:		Daytime Phone:	
Mailing Address:			
City:		State:	ZIP:

Complete this form if you are using a drywell or other subsurface infiltration structures to recharge stormwater to the ground or groundwater. If a completed Underground Injection Control (UIC) registration form was submitted to the Alteration of Terrain Bureau for this project, then one is not required to be sent directly to the Drinking Water and Groundwater Bureau (DWGB).

UICProgramNH@des.nh.gov or phone (603) 271-2858

PO Box 95, Concord, NH 03302-0095

www.des.nh.gov

REGISTRATION AND NOTIFICATION FORM FOR STORMWATER INFILTRATION TO GROUNDWATER (attach additional sheets, as necessary, for responses to questions below)

Please provide a complete description of the facility including historic uses, any former contamination and/or ongoing remedial action at the site.

The project involves paving an existing gravel parking area to be used for employee parking at 234 Airport Road in Concord to support the Banks Chevrolet Car Dealership located across Old Suncook Road. The redevelopment of the gravel parking area results in an overall decrease of impervious cover to the site that will be transitioned to landscaped areas (24,170 SF). Supporting infrastructure including stormwater improvements, lighting, and landscaping are proposed. There are no known former contamination and no ongoing remedial action at the site.

Please provide information concerning the location of the infiltration activity, include Locus map (i.e. USGS map).

One subsurface infiltration gallery is proposed on-site to collect runoff from the redeveloped parking lot area. The location of the subsurface infiltration gallery is within the existing development and is centrally located in the proposed parking lot area. Minimal tree clearing (approximately 3,600 SF) is proposed at the rear of the project area to allow space for the northeastern corner of the parking lot. The overall impervious cover to the site is decreased in the proposed redevelopment conditions by 24,170 SF. Please see the attached Grading & Drainage Plan for reference.

Please describe the pretreatment system, if any, and capacity of the system.

Pretreatment of stormwater is provided in the isolator row of the subsurface infiltration gallery. The practice is sized to accommodate the necessary Water Quality Volume from the contributing drainage area. The practice is designed to control the 50-year storm event to match pre-development drainage conditions and is designed to not overtop during the 100-year storm event.

Please describe the materials and products used for the subsurface infiltration structure (i.e., pipe and stone leachfield, plastic chamber units, concrete drywell, etc.).

The proposed subsurface infiltration gallery is an ADS Stormtech MC-3500 system. The system includes the Stormtech chamber (45" high chamber), ADS geosynthetic non-woven geotextile fabric, and crushed stone surrounding the chamber system. Please see attached Construction Details for more information on the ADS Stormtech MC-3500 system.

Please describe the disposal method and location. Include a site plan showing: the infiltration structure, any other on-site infiltration structures, dimensions, depth to groundwater (if known), adjacent septic system(s), and drinking water source(s).

The proposed subsurface infiltration gallery is designed to fully infiltrate the runoff within the gallery footprint. No outlet is included in the proposed gallery; the system is designed to not overtop the chambers and stone cover during the 100-year storm event. Refer to plans accompanying the Alteration of Terrain Permit application.

Please provide information concerning methods and schedule for periodic inspection and/or maintenance.

Refer to the Inspection & Maintenance Manual for the requirements for the practice.

Applicant/Owner Certification Statement and Signature

By signing this application, the signer certifies that the information contained in or otherwise submitted with this application is true, complete and not misleading to the best of the signer's knowledge and belief.

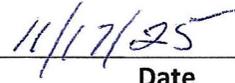
By signing this application, the signer understands that submission of false, incomplete or misleading information is grounds for:

- Denying the application;
- Revoking any application that is granted based on the information; and
- If the signer is acting as or on behalf of a listed engineer as defined in Env-C 502.10, debarring the listed engineer from the roster.

By signing the application, the signer and applicant agree to comply with all applicable rules and conditions of this permit and to not discharge to the holding tank(s) until written permission from the department has been received.



Signature of Facility Owner or Contact



Date

12.0 INSPECTION AND MAINTENANCE MANUAL

Wilcox & Barton INC.

CIVIL • ENVIRONMENTAL • GEOTECHNICAL

INSPECTION AND MAINTENANCE MANUAL

for

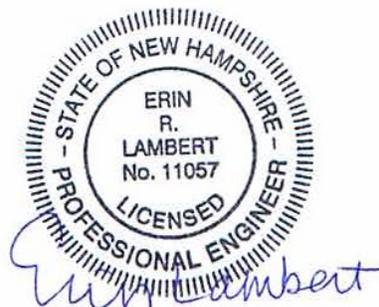
Banks Chevrolet Parking Lot Reconstruction
234 Airport Road
Concord, NH 03301

Prepared for:

Banks Chevrolet
C/O Fred Booth
137 Manchester Street
Concord, NH 03301

Prepared by:

Wilcox & Barton, Inc.
2 Home Ave.
Concord, New Hampshire 03301
Contact: Erin R. Lambert, PE, (603) 369-4190 x527



Wilcox & Barton, Inc.
Project No.: BACC0005

November 19, 2025

INSPECTION AND MAINTENANCE PROCEDURES

RESPONSIBLE PARTIES

Inspection/Maintenance/Record Keeping:

Applicant - Developer of Banks Chevrolet:

Banks Chevrolet
C/O Fred Booth
137 Manchester Street
Concord, NH 03301
(603) 229-4004
Fred.Booth@banksautos.com

INSPECTION SCHEDULE

Catch Basins / Access Manholes	Each catch basin/access manhole will be inspected when the system is installed and prior to directing stormwater to it. Structure inverts will be measured and documented at this time as a baseline reference for future inspections. Catch basins will be inspected every three months (minimum) and after major storm events exceeding 2.5 inches in a 24-hour period. Inspection results will be recorded using the Inspection Forms included at the end of this document.
Infiltration Gallery	The infiltration gallery will be inspected when the system is installed and prior to directing storm water to it. The isolator row will be inspected via the inspection port annually (minimum). If, upon visual inspection, it is found that sediment has accumulated, a stadia rod will be inserted to determine the depth of sediment. Inlet/outlet structures and manifolds will be inspected annually (minimum). Inspection results will be recorded using the Inspection Forms included at the end of this document.
Field Inlet - Infiltration Trench Systems	Each infiltration trench will be inspected when the system is installed and prior to directing stormwater to it. The infiltration trenches will be inspected twice annually (minimum) and after major storm events exceeding 2.5 inches in a 24-hour period. Trash and debris shall be removed at each inspection. At least once annually, the system shall be inspected for drawdown time. Inspection results will be recorded using the Inspection Forms included at the end of this document.

MAINTENANCE PROCEDURES

Catch Basins / Access Manholes	Debris will be removed from catch basin inlet grates, and inlet/outlet pipes inside the structures. Sediment will be removed from the interior of the structures by vac truck when the depth of sediment exceeds 25% of the structure diameter. Water and sediment from cleanout procedures must be disposed of in accordance with federal, state, and local regulations at an approved off-site disposal facility, and must not be discharged into sanitary sewer systems. Maintenance will be recorded in the Inspection and Maintenance Log included at the end of this document.
Infiltration Gallery	When the average depth of sediment in the isolator row exceeds 3 inches, clean out will be performed with the JetVac process. Trash and debris will be removed from the inlet/outlet structures when observed during inspections. Maintenance will be recorded in the Inspection and Maintenance Log included at the end of this document. If the infiltration system does not drain within 72 hours, a qualified professional shall be consulted.
Field Inlet - Infiltration Trench Systems	When the average depth of sediment in the field inlet exceeds half depth of inlet structure, sediment laden material will be removed and replaced. Trash and debris will be removed from the area when observed during inspections. Maintenance will be recorded in the Inspection and Maintenance Log included at the end of this document. If dewatering times exceed 72 hours following a rainfall event, then a qualified professional shall assess the condition of the facility to determine measures required to restore infiltration function.

RECORD KEEPING

Record keeping and inspection/maintenance activity will begin upon completion of all terrain activities that direct stormwater to the practices described herein. All records, including records from maintenance subcontractors, will be maintained by Banks Chevrolet and shall be sent annually to New Hampshire Department of Environmental Services (NHDES) Alteration of Terrain Bureau. Banks Chevrolet will be responsible for ensuring the effectiveness of the stormwater practices during construction. Following construction, long-term record keeping shall continue to be the responsibility of Banks Chevrolet.

WINTER MAINTENANCE

The proposed site plan for Banks Chevrolet, 234 Airport Road in Concord, NH proposes paved parking areas for employee parking. Paved surfaces are located within Groundwater Classification Areas. Stormwater runoff from the site is collected through catch basins and field inlets, which treat and infiltrate the majority of the project area's runoff. Excess runoff is discharged to the existing closed drainage system in Old Suncook Road, which ultimately drains to the Merrimack River. The stormwater runoff within the project area is managed through infiltration practices.

All winter maintenance contractors shall record salt usage by vehicle for each storm and periodically compare the usage rates to confirm spreader calibrations. All winter maintenance contractors shall record storm response data, including date, air temperature, ground surface temperature, storm start and end time, snow fall total, salt usage, application rates, application times, and plow times to be compared and analyzed by the applicators and property managers to improve and minimize salt use. The attached "Deicing and Anti-Icing Log" shall be used as a guide.

INVASIVE SPECIES MAINTENANCE

The site shall be inspected and monitored for the presence of invasive plants during maintenance activities. If invasive plants are found on-site, they will need to be controlled and removed in a safe and effective manner. In order to determine how to effectively remove the invasive plant(s), the reproduction of that particular plant type needs to be determined. The methodology of removal and disposal shall adhere to the guidelines set forth by UNH Cooperative Extension, located in "Methods for Disposing Non-Native Invasive Plants," which is attached to this manual for reference.

Catch Basin/Access Manhole Inspection Form

General Information	
Date of Inspection	
Inspector's Name(s)	
Inspector's Title(s)	
Type of Inspection:	<input type="checkbox"/> Routine (quarterly) <input type="checkbox"/> Post-storm event

Structure ID	Blockage?	Floatable Debris?	Visible Damage?	Depth of Buildup*	Odor?	Maintenance Required? Provide detail below
Access Manhole-1	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Access Manhole-2	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-1	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-2	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-3	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-4	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-5	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-6	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-7	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-8	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No
Catch Basin-9	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Petroleum <input type="checkbox"/> Sewage <input type="checkbox"/> Other	<input type="checkbox"/> Yes <input type="checkbox"/> No

Corrective Action Needed and Notes

**If the depth of sediment buildup in the bottom of the structure has reached approximately 25% of the diameter of the structure, the unit requires cleaning.*

Field Inlet - Infiltration Trench System Inspection Form

General Information	
Date of Inspection	
Location of Field Inlet Infiltration Trench (Field Inlet 1-3)	
Inspector's Name(s)	
Inspector's Title(s)	
Type of Inspection:	<input type="checkbox"/> Routine (annually) <input type="checkbox"/> Other

ID	Trash/Debris?	Visible Sediment?	Depth of Sediment Buildup*	Maintenance Required? Provide detail below
Field Inlet-1 System	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No
Field Inlet-2 System	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No
Field Inlet-3 System	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No

Visible Damage:

- Inlet
- Outlet
- None

Describe:

Corrective Action Needed and Notes

- * If the average depth of sediment buildup exceeds half the depth of the inlet structure, **the unit requires cleaning.**
- * If settlement, erosion, seepage, animal burrows, woody vegetation, and/or other conditions that could degrade the embankment and reduce its stability for impounding water, **immediate corrective action should be implemented.**

Infiltration Gallery System Inspection Form

General Information	
Date of Inspection	
Location of Infiltration Gallery (Infiltration Gallery-1)	
Inspector's Name(s)	
Inspector's Title(s)	
Type of Inspection:	<input type="checkbox"/> Routine (annually) <input type="checkbox"/> Other

ID	Trash/ Debris?	Visible Sediment?	Depth of Sediment Buildup*	Maintenance Required? Provide detail below
Infiltration Gallery 1	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No

Visible Damage:

- Inlet
- Outlet
- None

Describe:

Corrective Action Needed and Notes

* If the average depth of sediment buildup exceeds 3 inches, **the unit requires cleaning.**

* If settlement, erosion, seepage, animal burrows, woody vegetation, and/or other conditions that could degrade the embankment or site topography and reduce its stability for impounding water, **immediate corrective action should be implemented.**

Inspection and Maintenance Log

Date:			
Performed by:			
Practice:	<u>Catch Basin/Manhole</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Field Inlet System</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Infiltration Gallery</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance
Date:			
Performed by:			
Practice:	<u>Catch Basin/Manhole</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Field Inlet System</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Infiltration Gallery</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance
Date:			
Performed by:			
Practice:	<u>Catch Basin/Manhole</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Field Inlet System</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Infiltration Gallery</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance
Date:			
Performed by:			
Practice:	<u>Catch Basin/Manhole</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Field Inlet System</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Infiltration Gallery</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance
Date:			
Performed by:			
Practice:	<u>Catch Basin/Manhole</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Field Inlet System</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance	<u>Infiltration Gallery</u> <input type="checkbox"/> Inspection <input type="checkbox"/> Maintenance

Winter Maintenance Policy Checklist for Contractors

Recommended Practice	Y	N	Comments
Develop a Winter Maintenance Policy Plan outlining procedures for the preservation of the surface facilities and stating the adopted practices for salt minimization.			
Use de-/anti-icing logs with noted application rates, material usage totals, equipment calibration record, and material specifications (brine mix ratio, ice melt manufacturer recommendations, etc.).			
Record and log site storm event data including date, air temperature, ground surface temperature, storm start and end time, and snow fall/rain fall totals.			
Record total salt usage, application rates, application times, and plow times to improve current and future salt minimization efforts on site.			
Develop Winter Maintenance Policy training program for applicators.			
Use anti-icing pretreatment where applicable prior to snowstorm events.			
Plow/shovel areas before beginning de-icing activities.			
Use wet materials. Establish pre-wetting procedures and inspection checks for quality control.			
Do not apply sodium chloride (road salt) for pavement temperatures below 15° F. If possible, wait for warmer temperatures before deicing. Consult manufacturer specifications for deicer applications below 0° F.			
Use salt for melting and only use sand for traction in hazardous areas.			
Outside storage of salt, sand, and other like winter maintenance materials shall not be permitted on the property.			
Sweep up areas of sand application and dispose of properly.			

Checklist is adapted from UNH Technology Transfer Center's "Training Materials for Best Management Practices for Winter Road, Parking Lot, and Sidewalk Maintenance" dated January 31, 2014 in partnership with NHDES and NHDOT.

REVISION HISTORY

ISSUED FOR

PERMITTING

ALL DOCUMENTS PREPARED BY WILCOX & BARTON, INC. ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT WITNESSED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY WILCOX & BARTON, INC. FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO WILCOX & BARTON, INC. OWNER SHALL INDEMNIFY AND HOLD HARMLESS WILCOX & BARTON, INC. FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

OWNER

DAVAL REALTY ASSOCIATES LLC / BANKS CHEVROLET

**137 MANCHESTER ST
CONCORD, NH 03301**

**BANKS CHEVROLET
PARKING LOT
RECONSTRUCTION**

**234 AIRPORT ROAD
CONCORD, NH 03301**

MBLU: 782/Z/8

**GRADING, DRAINAGE &
UTILITY PLAN**

SCALE

DATE

DRAFTED BY

CHECKED BY

PROJECT MGR

PROJECT NO.

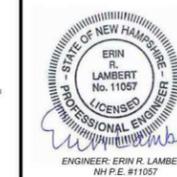
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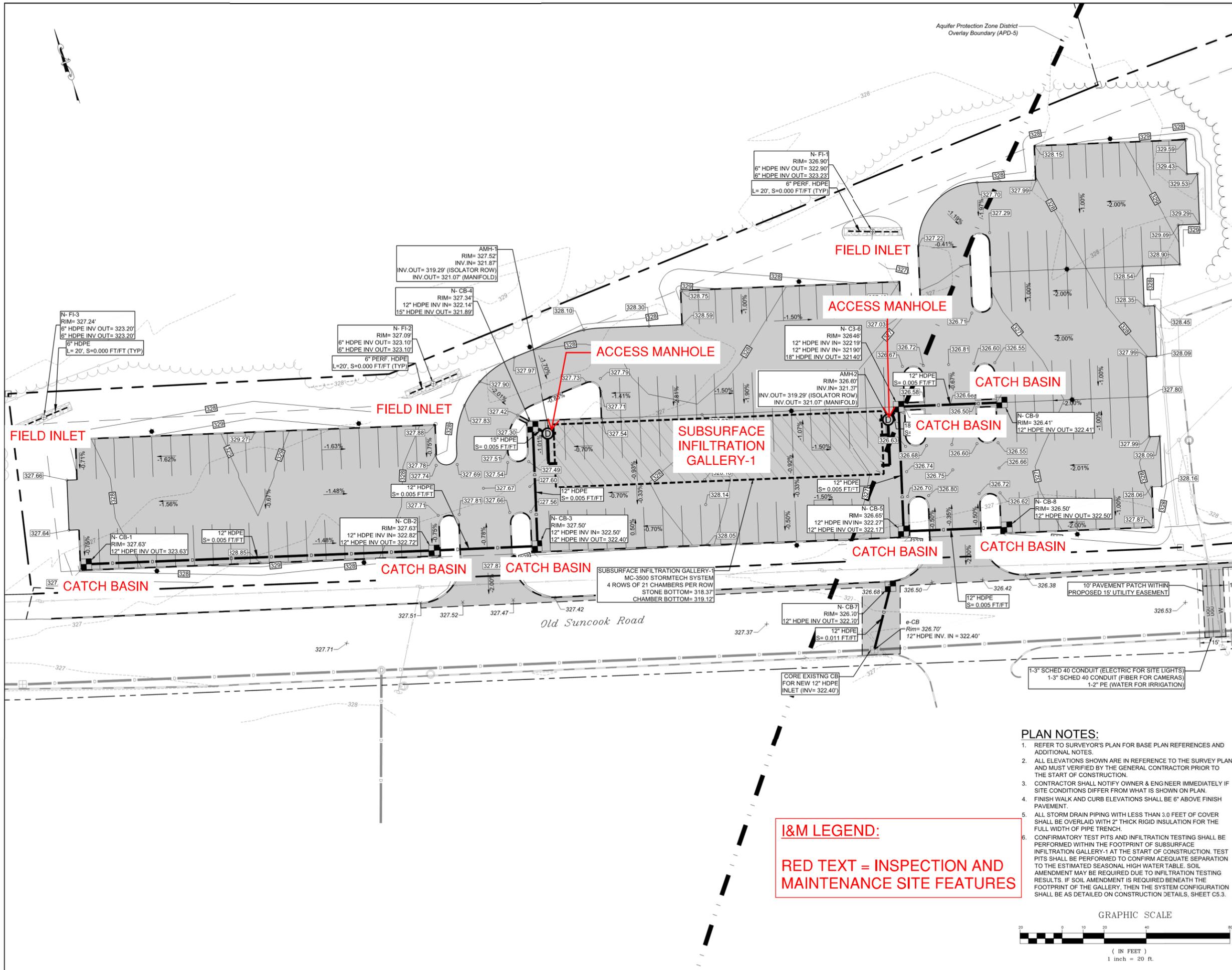
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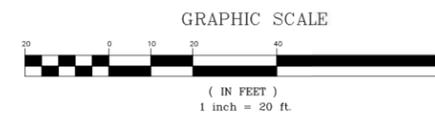
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07 OF 15



I&M LEGEND:
**RED TEXT = INSPECTION AND
MAINTENANCE SITE FEATURES**

- PLAN NOTES:**
- REFER TO SURVEYOR'S PLAN FOR BASE PLAN REFERENCES AND ADDITIONAL NOTES.
 - ALL ELEVATIONS SHOWN ARE IN REFERENCE TO THE SURVEY PLAN AND MUST BE VERIFIED BY THE GENERAL CONTRACTOR PRIOR TO THE START OF CONSTRUCTION.
 - CONTRACTOR SHALL NOTIFY OWNER & ENGINEER IMMEDIATELY IF SITE CONDITIONS DIFFER FROM WHAT IS SHOWN ON PLAN.
 - FINISH WALK AND CURB ELEVATIONS SHALL BE 6" ABOVE FINISH PAVEMENT.
 - ALL STORM DRAIN PIPING WITH LESS THAN 3.0 FEET OF COVER SHALL BE OVERLAID WITH 2" THICK RIGID INSULATION FOR THE FULL WIDTH OF PIPE TRENCH.
 - CONFIRMATORY TEST PITS AND INFILTRATION TESTING SHALL BE PERFORMED WITHIN THE FOOTPRINT OF SUBSURFACE INFILTRATION GALLERY-1 AT THE START OF CONSTRUCTION. TEST PITS SHALL BE PERFORMED TO CONFIRM ADEQUATE SEPARATION TO THE ESTIMATED SEASONAL HIGH WATER TABLE. SOIL AMENDMENT MAY BE REQUIRED DUE TO INFILTRATION TESTING RESULTS. IF SOIL AMENDMENT IS REQUIRED BENEATH THE FOOTPRINT OF THE GALLERY, THEN THE SYSTEM CONFIGURATION SHALL BE AS DETAILED ON CONSTRUCTION DETAILS, SHEET C5.3.



CONTROL OF INVASIVE PLANTS

During maintenance activities, check for the presence of invasive plants and remove in a safe manner as described on the following pages. They should be controlled as described on the following pages.

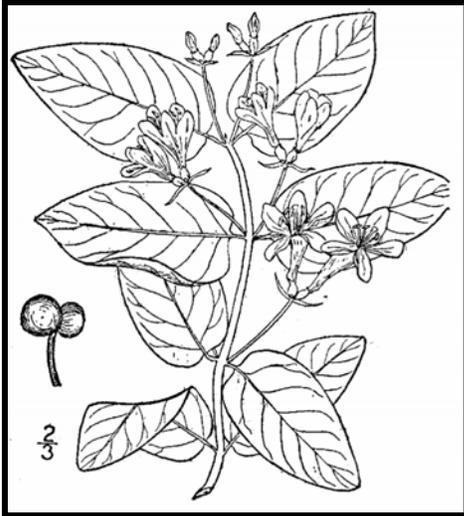
Background:

Invasive plants are introduced, alien, or non-native plants, which have been moved by people from their native habitat to a new area. Some exotic plants are imported for human use such as landscaping, erosion control, or food crops. They also can arrive as "hitchhikers" among shipments of other plants, seeds, packing materials, or fresh produce. Some exotic plants become invasive and cause harm by:

- becoming weedy and overgrown;
- killing established shade trees;
- obstructing pipes and drainage systems;
- forming dense beds in water;
- lowering water levels in lakes, streams, and wetlands;
- destroying natural communities;
- promoting erosion on stream banks and hillsides; and
- resisting control except by hazardous chemical.



Prepared by the Invasives Species Outreach Group, volunteers interested in helping people control invasive plants. Assistance provided by the Piscataquog Land Conservancy and the NH Invasives Species Committee. Edited by Karen Bennett, Extension Forestry Professor and Specialist.



Tatarian honeysuckle

Lonicera tatarica

USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 3: 282.

Non-native invasive plants crowd out natives in natural and managed landscapes. They cost taxpayers billions of dollars each year from lost agricultural and forest crops, decreased biodiversity, impacts to natural resources and the environment, and the cost to control and eradicate them.

Invasive plants grow well even in less than desirable conditions such as sandy soils along roadsides, shaded wooded areas, and in wetlands. In ideal conditions, they grow and spread even faster. There are many ways to remove these non-native invasives, but once removed, care is needed to dispose the removed plant material so the plants don't grow where disposed.

Knowing how a particular plant reproduces indicates its method of spread and helps determine

the appropriate disposal method. Most are spread by seed and are dispersed by wind, water, animals, or people. Some reproduce by vegetative means from pieces of stems or roots forming new plants. Others spread through both seed and vegetative means.

Because movement and disposal of viable plant parts is restricted (see NH Regulations), viable invasive parts can't be brought to most transfer stations in the state. Check with your transfer station to see if there is an approved, designated area for invasives disposal. This fact sheet gives recommendations for rendering plant parts non-viable.

Control of invasives is beyond the scope of this fact sheet. For information about control visit www.nhinvasives.org or contact your UNH Cooperative Extension office.

New Hampshire Regulations

Prohibited invasive species shall only be disposed of in a manner that renders them nonliving and nonviable. (Agr. 3802.04)

No person shall collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living and viable portion of any plant species, which includes all of their cultivars and varieties, listed in Table 3800.1 of the New Hampshire prohibited invasive species list. (Agr 3802.01)

How and When to Dispose of Invasives?

To prevent seed from spreading remove invasive plants before seeds are set (produced). Some plants continue to grow, flower and set seed even after pulling or cutting. Seeds can remain viable in the ground for many years. If the plant has flowers or seeds, place the flowers and seeds in a heavy plastic bag “head first” at the weeding site and transport to the disposal site. The following are general descriptions of disposal methods. See the chart for recommendations by species.

Burning: Large woody branches and trunks can be used as firewood or burned in piles. For outside burning, a written fire permit from the local forest fire warden is required unless the ground is covered in snow. Brush larger than 5 inches in diameter can't be burned. Invasive plants with easily airborne seeds like black swallow-wort with mature seed pods (indicated by their brown color) shouldn't be burned as the seeds may disperse by the hot air created by the fire.

Bagging (solarization): Use this technique with softer-tissue plants. Use heavy black or clear plastic bags (contractor grade), making sure that no parts of the plants poke through. Allow the bags to sit in the sun for several weeks and on dark pavement for the best effect.

Tarping and Drying: Pile material on a sheet of plastic and cover with a tarp, fastening the tarp to the ground and monitoring it for escapes. Let the material dry for several weeks, or until it is clearly nonviable.

Chipping: Use this method for woody plants that don't reproduce vegetatively.

Burying: This is risky, but can be done with watchful diligence. Lay thick plastic in a deep pit before placing the cut up plant material in the hole. Place the material away from the edge of the plastic before covering it with more heavy plastic. Eliminate as much air as possible and toss in soil to weight down the material in the pit. Note that the top of the buried material should be at least three feet underground. Japanese knotweed should be at least 5 feet underground!

Drowning: Fill a large barrel with water and place soft-tissue plants in the water. Check after a few weeks and look for rotted plant material (roots, stems, leaves, flowers). Well-rotted plant material may be composted. A word of caution- seeds may still be viable after using this method. Do this before seeds are set. This method isn't used often. Be prepared for an awful stink!

Composting: Invasive plants can take root in compost. Don't compost any invasives unless you know there is no viable (living) plant material left. Use one of the above techniques (bagging, tarping, drying, chipping, or drowning) to render the plants nonviable before composting. Closely examine the plant before composting and avoid composting seeds.



Japanese knotweed
Polygonum cuspidatum
USDA-NRCS PLANTS Database /
Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 1: 676.

Be diligent looking for seedlings for years in areas where removal and disposal took place.

Suggested Disposal Methods for Non-Native Invasive Plants

This table provides information concerning the disposal of removed invasive plant material. If the infestation is treated with herbicide and left in place, these guidelines don't apply. Don't bring invasives to a local transfer station, unless there is a designated area for their disposal, or they have been rendered non-viable. This listing includes wetland and upland plants from the New Hampshire Prohibited Invasive Species List. The disposal of aquatic plants isn't addressed.

Woody Plants	Method of Reproducing	Methods of Disposal
Norway maple <i>(Acer platanoides)</i> European barberry <i>(Berberis vulgaris)</i> Japanese barberry <i>(Berberis thunbergii)</i> autumn olive <i>(Elaeagnus umbellata)</i> burning bush <i>(Euonymus alatus)</i> Morrow's honeysuckle <i>(Lonicera morrowii)</i> Tatarian honeysuckle <i>(Lonicera tatarica)</i> showy bush honeysuckle <i>(Lonicera x bella)</i> common buckthorn <i>(Rhamnus cathartica)</i> glossy buckthorn <i>(Frangula alnus)</i>		<p>Prior to fruit/seed ripening</p> <p>Seedlings and small plants</p> <ul style="list-style-type: none"> ▪ Pull or cut and leave on site with roots exposed. No special care needed. <p>Larger plants</p> <ul style="list-style-type: none"> ▪ Use as firewood. ▪ Make a brush pile. ▪ Chip. ▪ Burn.
		<p>After fruit/seed is ripe</p> <p>Don't remove from site.</p> <ul style="list-style-type: none"> ▪ Burn. ▪ Make a covered brush pile. ▪ Chip once all fruit has dropped from branches. ▪ Leave resulting chips on site and monitor.
oriental bittersweet <i>(Celastrus orbiculatus)</i> multiflora rose <i>(Rosa multiflora)</i>		<p>Prior to fruit/seed ripening</p> <p>Seedlings and small plants</p> <ul style="list-style-type: none"> ▪ Pull or cut and leave on site with roots exposed. No special care needed. <p>Larger plants</p> <ul style="list-style-type: none"> ▪ Make a brush pile. ▪ Burn.
		<p>After fruit/seed is ripe</p> <p>Don't remove from site.</p> <ul style="list-style-type: none"> ▪ Burn. ▪ Make a covered brush pile. ▪ Chip – only after material has fully dried (1 year) and all fruit has dropped from branches. Leave resulting chips on site and monitor.

Non-Woody Plants	Method of Reproducing	Methods of Disposal
<p>garlic mustard (<i>Alliaria petiolata</i>)</p> <p>spotted knapweed (<i>Centaurea maculosa</i>)</p> <ul style="list-style-type: none"> ▪ Sap of related knapweed can cause skin irritation and tumors. Wear gloves when handling. <p>black swallow-wort (<i>Cynanchum nigrum</i>)</p> <ul style="list-style-type: none"> ▪ May cause skin rash. Wear gloves and long sleeves when handling. <p>pale swallow-wort (<i>Cynanchum rossicum</i>)</p> <p>giant hogweed (<i>Heracleum mantegazzianum</i>)</p> <ul style="list-style-type: none"> ▪ Can cause major skin rash. Wear gloves and long sleeves when handling. <p>dame's rocket (<i>Hesperis matronalis</i>)</p> <p>perennial pepperweed (<i>Lepidium latifolium</i>)</p> <p>purple loosestrife (<i>Lythrum salicaria</i>)</p> <p>Japanese stilt grass (<i>Microstegium vimineum</i>)</p> <p>mile-a-minute weed (<i>Polygonum perfoliatum</i>)</p>	<p>Fruits and Seeds</p> 	<p>Prior to flowering</p> <p>Depends on scale of infestation</p> <p>Small infestation</p> <ul style="list-style-type: none"> ▪ Pull or cut plant and leave on site with roots exposed. <p>Large infestation</p> <ul style="list-style-type: none"> ▪ Pull or cut plant and pile. (You can pile onto or cover with plastic sheeting). ▪ Monitor. Remove any re-sprouting material. <hr/> <p>During and following flowering</p> <p>Do nothing until the following year or remove flowering heads and bag and let rot.</p> <p>Small infestation</p> <ul style="list-style-type: none"> ▪ Pull or cut plant and leave on site with roots exposed. <p>Large infestation</p> <ul style="list-style-type: none"> ▪ Pull or cut plant and pile remaining material. (You can pile onto plastic or cover with plastic sheeting). ▪ Monitor. Remove any re-sprouting material.
<p>common reed (<i>Phragmites australis</i>)</p> <p>Japanese knotweed (<i>Polygonum cuspidatum</i>)</p> <p>Bohemian knotweed (<i>Polygonum x bohemicum</i>)</p>	<p>Fruits, Seeds, Plant Fragments</p> <p>Primary means of spread in these species is by plant parts. Although all care should be given to preventing the dispersal of seed during control activities, the presence of seed doesn't materially influence disposal activities.</p>	<p>Small infestation</p> <ul style="list-style-type: none"> ▪ Bag all plant material and let rot. ▪ Never pile and use resulting material as compost. ▪ Burn. <p>Large infestation</p> <ul style="list-style-type: none"> ▪ Remove material to unsuitable habitat (dry, hot and sunny or dry and shaded location) and scatter or pile. ▪ Monitor and remove any sprouting material. ▪ Pile, let dry, and burn.

January 2010

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13.0 SALT MINIMIZATION PLAN

Wilcox & Barton INC.

CIVIL • ENVIRONMENTAL • GEOTECHNICAL

SALT MINIMIZATION PLAN for

**Banks Chevrolet Parking Lot Reconstruction
234 Airport Road
Concord, NH 03301**

Prepared for:
Banks Chevrolet
C/O Fred Booth
137 Manchester Street
Concord, NH 03301

Prepared by:
Wilcox & Barton, Inc.
2 Home Ave.
Concord, New Hampshire 03301
Contact: Erin Lambert, PE, (603) 369-4190 x527

**Wilcox & Barton, Inc.
Project No.: BACC0005**

November 19, 2025

Background

The project consists of paving an existing gravel parking area which supports the Banks Chevrolet car dealership. The parking area (project parcel) is located on Tax Map 782 Block Z Lot 8, with a street address of 234 Airport Road in Concord, while the existing dealership it supports is located across the street at 137 Manchester Street in Concord. Site improvements include the paved parking area, lighting, landscaping, and a stormwater management system. The existing project parcel is currently used for employee parking associated with the dealership. One portion of this parking area is paved while the other is gravel. The project area extent is at the gravel parking area only; the existing paved parking lot will remain unchanged. There is wooded cover to the rear of the property, adjacent to Sanel Park. The parcel has frontage along both Old Suncook Road and Airport Road and has five driveway locations along Old Suncook Road.

The presence of snow and ice on roadways, parking lots, and/or sidewalks creates a public safety concern – hence, the need for using salt and other deicing measures. However, salt (specifically the chloride in salt) can have a negative impact to plants, wildlife, aquatic species, surface water, and groundwater. The objective of this Salt Minimization Plan is to reduce the amount of chloride entering the surface waterbody and other environmentally significant areas while still maintaining roadway and site safety.

Project Area Description

The Banks Chevrolet Parking Lot Reconstruction project is an existing development consisting of one gravel parking lot and one paved parking lot to support the Banks Chevrolet car dealership. The existing gravel parking area to be reconstructed is located on the western portion of the project parcel. The existing paved parking lot on the eastern portion of the parcel will remain unchanged. The project parcel is located at 234 Airport Road in Concord, NH.

Access to the site is through the southern property line off Old Suncook Road at five driveway locations. Old Suncook Road is a public City maintained roadway (Class V roadway). Four driveways are proposed to be maintained with the parking lot reconstruction, which shall be graded to provide adequate access and circulation to the proposed parking area.

The Banks Chevrolet Parking Lot Reconstruction project is in the Highway Commercial zoning district and covers 6.95 acres of land. The proposed project area is approximately 2.3 acres. The redevelopment decreases the impervious cover by approximately 24,170 square feet for the overall project parcel.

The proposed redeveloped parking area will be serviced via conduits crossing Old Suncook Road for the water service for irrigational use and the electrical service for the lighting. The existing gravel area is to be redeveloped with paved parking, which shall direct runoff to the maximum extent feasible to the proposed subsurface infiltration system. One underground infiltration gallery shall be installed to collect and treat stormwater runoff from the proposed project area to provide necessary pretreatment and treatment on-site. The project requires a NHDES Alteration of Terrain Permit which has been submitted.

Responsibility

Banks Chevrolet and all property managers are responsible for implementing and complying with the Salt Minimization Plan; reviewing the success of the Plan; and continuing to update the Plan as new requirements, practices, and products are developed. A copy of this Plan shall be given to all personnel that are involved with winter maintenance within the Banks Chevrolet development for mandatory implementation.

Certifications

All salt applicators within the Banks Chevrolet property shall be current NHDES Certified Green SnowPro applicators or equivalent. Salt applicators are responsible for maintaining their annual certification. Information on these certifications can be found in the links provided below:

- <https://www.des.nh.gov/land/roads/road-salt-reduction/green-snowpro-certification>
- <https://t2.unh.edu/green-snowpro-salt-applicator-certification-training>

Weather Monitoring

Winter maintenance contractors and salt applicators employed within the Banks Chevrolet property shall monitor storm events using National Weather Service (<http://www.noaa.gov>), local TV stations, and website weather information. All vehicles used for the application of road salt or brining, and pre-wetting solution shall be equipped with an annually calibrated air and ground surface temperature monitor. Air and ground temperatures shall be monitored throughout the day to ensure that the operators are making informed decisions as to when and to what extent materials are applied to the roadways, parking lots and sidewalks.

Pretreatment and Treatment of Parking Lots and Roadways

Apply pre-wetted deicer, salt brine, or liquid deicers to parking lot prior frost or snow accumulation to prevent icing. Pre-wetting paved areas have been shown to limit the amount of salt needed in most snowstorms. Salt brine or liquid deicers shall not be applied before a rainstorm, but they can be applied before a light freezing drizzle. For more information, refer to attached Anti-Icing and Pre-wetting NH Best Management Practices sheets from the Technology Transfer Center at UNH.

If snow accumulates prior to salting the parking lot within Banks Chevrolet property, the surfaces should be plowed before applying deicers. Snow shall be stored in the designated areas on the civil plan set attached. Only apply salt to pavement surface or icy surfaces to prevent or reduce icing as necessary. Pavement surface temperature shall be monitored in parking lots and roadways. If pavement temperature is below 15° F, winter maintenance contractors shall only use pre-wetted salt or brining solution. Dry salt (sodium chloride) will not melt fast enough at these temperatures.

Note that winter sanding of non-porous pavement shall only be permitted in hazardous areas to provide traction.

Plowing

Plow operations should be timed to allow maximum melting by salt before snow is plowed off the parking lot. Snow piles shall not be located on top of catch basins. Within the parking redevelopment, snow piles should be stored at and adjacent to the parking lot as much as possible so that solids can be recovered after the snow melts.

Equipment & Equipment Calibration

Spreaders used within the Banks Chevrolet property shall be equipped with ground speed control applicators to regulate the amount of salt discharged consistently. All equipment utilized for the application of pre-wetted deicer, liquid chemical, and road salt aggregate should be calibrated each fall. Equipment should be checked after each storm and recalibrated if necessary. For more information, refer to attached Hydraulic-Run Spreader Calibration and Pony Motor-Run Spreader Calibration NH Best Management Practices sheets from the Technology Transfer Center at UNH.

Documentation

All winter maintenance contractors shall record salt usage by vehicle for each storm and periodically compare the usage rates to confirm spreader calibrations. All winter maintenance contractors shall record storm response data, including date, air temperature, ground surface temperature, storm start and end time, snow fall total, salt usage, application rates, application times, and plow times to be compared and analyzed by the applicators and property managers to improve the salt minimization process. The attached "Winter Maintenance Policy Checklist for Contractors" and "Deicing and Anti-Icing Log" shall be used as a guide.

WINTER MAINTENANCE POLICY CHECKLIST FOR CONTRACTORS



Winter Maintenance Policy Checklist for Contractors

Recommended Practice	Y	N	Comments
Develop a Winter Maintenance Policy Plan outlining procedures for the preservation of the surface facilities and stating the adopted practices for salt minimization.			
Use de-/anti-icing logs with noted application rates, material usage totals, equipment calibration record, and material specifications (brine mix ratio, ice melt manufacturer recommendations, etc.).			
Record and log site storm event data including date, air temperature, ground surface temperature, storm start and end time, and snow fall/rain fall totals.			
Record total salt usage, application rates, application times, and plow times to improve current and future salt minimization efforts on site.			
Develop Winter Maintenance Policy training program for applicators.			
Use anti-icing pretreatment where applicable prior to snowstorm events.			
Plow/shovel areas before beginning de-icing activities.			
Use wet materials. Establish pre-wetting procedures and inspection checks for quality control.			
Do not apply sodium chloride (road salt) for pavement temperatures below 15° F. If possible, wait for warmer temperatures before deicing. Consult manufacturer specifications for deicer applications below 0° F.			
Use salt for melting and only use sand for traction in hazardous areas.			
Outside storage of salt, sand, and other like winter maintenance materials shall not be permitted on the C.J. & J. Leasing site.			
Sweep up areas of sand application and dispose of properly.			

Checklist is adapted from UNH Technology Transfer Center's "Training Materials for Best Management Practices for Winter Road, Parking Lot, and Sidewalk Maintenance" dated January 31, 2014 in partnership with NHDES and NHDOT.

DEICING AND ANTI-ICING LOG



**UNH TECHNOLOGY TRANSFER CENTER SALT REDUCTION BMP
INFORMATION SHEETS**



**Training Materials for Best Management
Practices
for
Winter Road, Parking Lot, and Sidewalk
Maintenance**



Date of Publication: January 31, 2014



Green SnowPro

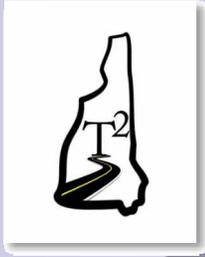
Salt Reduction for Parking Lots and Private Roads

A UNH T² Center Workshop

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800-423-0060 (NH only)
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Joined in 2018

Student Workers

UNH undergraduate and graduate students.

Our Mission

To foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers.

Training Opportunities: Over 80 workshops are offered annually in NH. Most are one-day and offer 5 Roads Scholar hours.

Website: t2.unh.edu provides information on the T² Center, LTAP training and workshops, Roads Scholar Program, newsletter, affiliate groups, and trade resource links.

Newsletter: *Road Business* is published quarterly and features technical, safety and management articles.

Technical Assistance: Personalized technical assistance is available through phone, fax, email, or walk-ins.

Mailing Lists: To receive copies of our newsletter, *Road Business*, or for other mailings call 603-862-2826 or email t2.center@unh.edu.

Listserv: PW.net is for anyone concerned with Public Works. To subscribe to this free list, send an email to t2.center@unh.edu.



New Hampshire LTAP

Congress established the Local Technical Assistance Program (LTAP) in 1982 to provide services to US cities and towns that maintain roads and bridges. Every US State and Puerto Rico has an established LTAP Center and Regional Center that serve Tribal Governments.

NH LTAP Program Supporters

Federal Highway Administration
NH Department of Transportation
University of New Hampshire



University of
New Hampshire



NH Local Technical Assistance Program (NH LTAP)

At the
UNH Technology Transfer Center



The NH LTAP Roads Scholar Program provides for:

- Recognition of training and achievement across various levels.
- Coverage of subjects essential to effective road management.

Recognition

As individuals achieve a level in the program, the NH LTAP recognizes them in several ways:

*Official letters sent to supervisor and town selectmen

*Name published in Road Business and Roads Scholar Directory

*Master Roads Scholars are featured in Road Business

*Material awards



Technology Transfer Center

33 Academic Way
Durham, NH 03284

1-800-423-0060 (NH)
603-862-2826
Fax: 603-862-0620
t2.center@unh.edu
www.t2.unh.edu

NH LTAP Roads Scholar Program Levels

<u>Levels</u>	<u>Contact Hours</u>
Safety Champion	20 Safety hours
1. Roads Scholar I	25
2. Roads Scholar II	50*
*Requires the following hours in the specified subject areas:	
	20 Technical
	5 Supervisory
	10 Safety
	5 Environmental
3. Senior Roads Scholar	75
4. Master Roads Scholar	100
5. Master Roads Scholar II	150 and Safety Champion Award
6. Advanced Master Roads Scholar	200**

**"Along with earning the minimum required 200 Road Scholar hours, the objective of earning this prestigious level of achievement is to participate in, and help improve, the working lives of your colleagues and the public works community. Your passion for this field is evident by your commitment to professional growth and development. In order to reach the Advanced Master Roads Scholar level, you must submit a request of intent to the LTAP Advisory Board for approval. Upon approval, a member of the Advisory Board will contact you to discuss what type of outreach initiative you would most like to participate in.* Think of this as a Capstone project of sorts. Whether your passion is to instruct, mentor, develop outreach programs, inspire teenagers in this field, or bring innovations to your community or others, this Advanced Master Roads Scholar program encourages you to dig deep to find a meaningful and supportive way to help other members of your PW community attain similar goals and achievements.

**You may present your own idea or concept that fits this description at the time of making your intent known.*

Electives

A maximum of 10 hours can be awarded for any training conducted by an approved institution. To receive credit for outside hours, deliver a copy of your certificate with specified hours to us.

Training Quality and CEUs

For training activity quality assurance, the NH LTAP has adopted the criteria of the International Association for Continuing Education. This association, in addition to setting standards for high quality training, also governs the issuance of continuing education units (CEUs). By fulfilling their standards, NH LTAP workshops and seminars qualify for the issuance for CEUs.



NH LTAP has

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- ◆ Get relevant news & updates, reminders, and tips.
- ◆ Find and follow other professionals who attend our training
- ◆ Be the first to learn about upcoming workshops

- ◆ Stay informed of our activities
- ◆ Be the first to know about special events and promotions
- ◆ See photos from our workshops and other events
- ◆ Learn about what others in your trade are doing.
- ◆ Share local news with your colleagues



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Anti-Icing

NH Best Management Practices

GET OUT EARLY

Typically anti-icing is most effective if applied 1-2 hours before the precipitation begins however it can be applied up to 24 hours in advance.

TRY IT FIRST

Trying anti-icing for the first time? Make a 23.3% brine solution and before a storm spray pavement on your own property using a masonry/plant sprayer. Use this experiment to determine how best to use it with your clients.

LEAVE SOME PAVEMENT BARE

It's always best to use stream nozzles instead of fan tip to avoid creating a slippery condition. If the anti-icing liquid freezes the bare pavement will still provide a traction surface.

USE A FILTER

Having a filter in your liquid dispensing system will reduce clogs in your nozzle. Automotive in line fuel filters work quiet well. If your liquid dispenser is not functioning properly be sure to check the filter first.

A Proactive Treatment

Anti-icing before a storm is very similar to using a non-stick spray on a pan before cooking. Just like a non-stick spray prevents food from bonding to the pan, anti-icing prevents snow and ice from bonding to the pavement so that it can be plowed away. Anti-icing can save you **money** as it costs 50% less than reactive deicing.



Make Your Own Salt Brine

When making brine it is important to add enough salt to produce a 23.3% solution which freezes around 0°F. Roughly 2.5lb per gallon of water will produce a 23.3% solution. You can verify using a salometer (~\$20) a 23.3% solution will have a specific gravity of 1.176, or 85% salinity. Consult the Brine Making BMP sheet for more info.

How Much Should I Use and When?

You can apply brine up to 24 hours in advance of the storm. Typical application rates range from 0.5 to 0.75 gallon per 1000 sq.ft. (10' x 100' area). Other chemicals such as magnesium are also available—consult your supplier for application rates. Anti-icing is **not** advised prior to freezing rain events.



Getting Started

Try making your own salt brine by putting 13 lb of salt in 5 gallons of water to get a 23.3% salt brine solution. Mix the brine until all of the salt is dissolved. Using a masonry sprayer apply the liquid several hours before a storm. Start by applying about 0.25—0.5 gallons to a 10' x 50' area. Adjust the application rates based on your experience. Being careful not to over apply and cause a slippery condition.

Produced in partnership with:





Pre-wetting

NH Best Management Practices

PRE-WETTING?

Pre-wetting is the process of coating a solid de-icer with a liquid before it is spread on a roadway.

WHY PRE-WET?

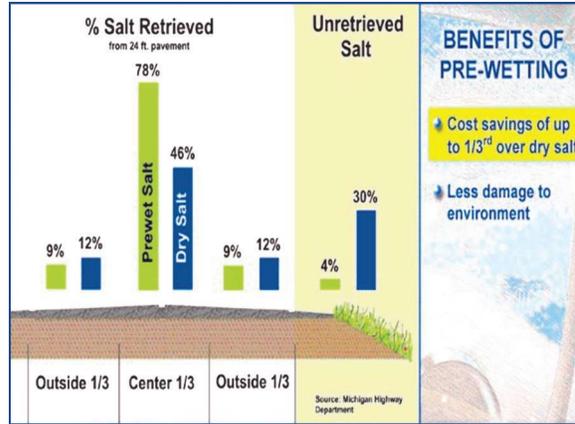
De-icing chemicals must form a brine before they can begin melting ice. Pre-wetting your chemicals accelerates the brine making process, which improves the melting action of the material. Pre-wetting also reduces bounce and scatter of material during spreading, and reduces the total amount of de-icer needed to obtain the desired results.

REDUCED RATES

If you are pre-wetting, don't forget to reduce your application rates accordingly. Reductions in the range of 15-20% are typical.

HOW MUCH LIQUID?

A good rule of thumb is to use 8-10 gallons of pre-wetting liquid for every ton of de-icer. For other chemicals, such as magnesium chloride, consult your supplier for application rates

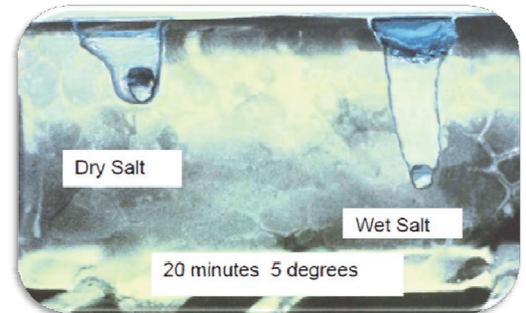


Getting Started

Wet the pile! There are two ways to pre-wet your de-icing chemicals. The easiest way to get started with pre-wetting is to spread your salt pile, spray it with pre-wetting liquid, mix it around, and re-pile it. More advanced truck mounted pre-wet systems can be installed on your trucks if you decide to make the investment.

Pre-wetting Liquids

You have a few options for pre-wetting liquids. The most commonly used is a 23% sodium chloride brine solution. Calcium chloride at 32% solution is also used, as well as Magic Minus Zero™ and other patented products.



Source: Wisconsin DOT Transportation Bulletin

Spraying the Pile

This is the easiest and most cost effective way to get started in pre-wetting. The first step is to spread your salt pile on a flat, impermeable surface. Next, spray the salt while it is spread out, and mix it around to ensure adequate and consistent liquid coverage. After the salt is sufficiently covered, re-stack the salt in your storage shed for later use.



Truck Mounted Systems

These systems are mounted in the truck bed and coat the de-icer with liquid as it comes off the conveyor/auger onto the spinner. These systems have the benefit of applying liquid only to the material you use as you use it. However, these systems must be installed on every truck that will be used to spread pre-wetted material.



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How Salt Works

NH Best Management Practices

BE PROACTIVE - ANTI-ICE

Anti-icing is the proactive method of preventing snow and ice from bonding to pavement. It can be more than 50% more efficient than deicing. See the NH Anti-icing Factsheet for more information.

PRE-WETTING FOR FASTER ACTING SALT

Adding brine to salt before you apply it to pavement jump starts the melting process which means your pavement will be clear sooner. See the Pre-wetting Fact Sheet for more information.

KNOW YOUR LIMITS

Dry salt becomes ineffective below 15°F if possible wait until the temperature rises before applying salt. At 30°F 1 lb of salt can melt 46.3 lb of ice in 5 minutes. At 15°F 1 lb of salt can melt 6.3 lb of ice in 1 hour.

PLOW FIRST

Always plow before applying any kind of chemical deicer to avoid pushing it away!

How Do We Melt Ice?

Ice can be melted by increasing the temperature, or lowering the freezing point of the water. It's not cost effective to use heat to melt ice on our roads so we use chemicals to reduce the freezing point—anything that will dissolve in water will work, including: salt, sugar, even alcohol!

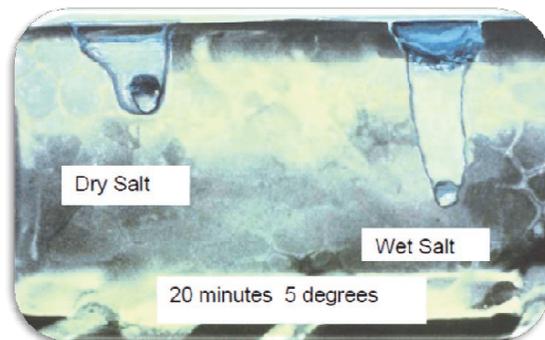


Why Use Salt?

Salt (Sodium Chloride) is the cheapest and most readily available chemical that efficiently melts ice and can be easily applied to our roadways and parking lots. However salt does corrode our cars and bridges, contaminates drinking water and pollutes our streams. Alternatives include potassium acetate, and calcium magnesium acetate (CMA), — all of which are considerably more expensive than calcium chloride, and have their own environmental concerns.

Brine Makes It Happen

The first step in melting ice is the formation of a brine. Salt crystals pull water molecules out of ice formation which creates a brine with a lower freeze point. Once the brine is formed melting is greatly accelerated. Save time and **money** by pre-wetting your salt with a brine before it hits the pavement to jump start melting! See the Pre-Wetting fact sheet for more information.



Source: Wisconsin DOT Transportation Bulletin #22



Produced in partnership with:



Save \$\$ and the Environment

In New Hampshire there are over 40 watersheds currently contaminated from road salt. As the pavement temperature drops more salt is required. As the pavement temperature rises less salt is required. Save money and the environment by using only what is needed to do the job. See NH application rate charts for recommended rates.





Material Storage and Housekeeping

NH Best Management Practices

IMPERMEABLE SURFACE STORAGE

Store salt and liquids on an impermeable surface to prevent groundwater contamination.

COVERED STORAGE AREAS

If possible, store your salt in a covered shed to prevent runoff. If there is not a shed available, cover your salt pile well with an impermeable membrane or tarp.

SECONDARY CONTAINMENT

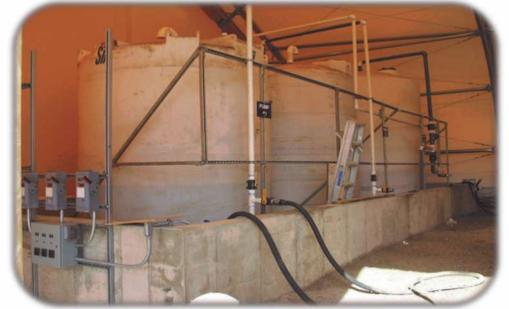
Keep your liquids in an appropriate storage container. Secondary containment should be used in case a leak develops in the primary container.

PROPER DRAINAGE & COLLECTION

Protect your ground water supply! A drainage system should be in place to collect runoff from your salt pile, as well as to collect any liquids that may escape containment. Remember, the collected liquid can be used as a base for salt brine.

Proper Material Storage

Proper storage of materials (especially chemicals) is essential. If impermeable surfaces are NOT used in your storage facilities and brine infiltrates the ground or groundwater, you need to register with the DES under the Groundwater Discharge Permit and Registration Rules, Env-Wq 402. It is a free registration used for tracking potential contaminant sources.

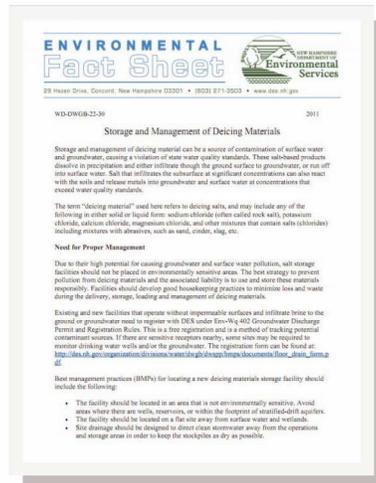
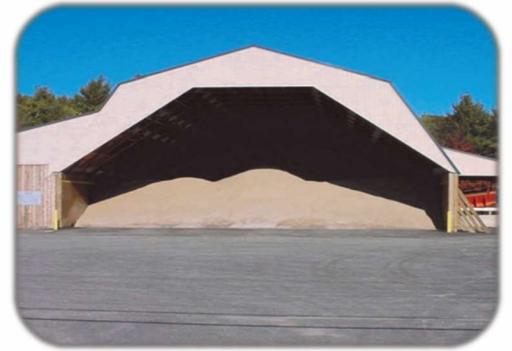


Liquid Storage

Brine stored using holding tanks must be managed so that there are no releases to drains, groundwater or surface water.

Secondary Containment

Secondary containment for your liquid storage is a HIGHLY recommended technique to help reduce soil and groundwater contamination. If a tank Begins leak, the secondary containment prevents liquid from seeping into sensitive environments.



NHDES Fact Sheet DWGB-22-30

This fact sheet outlines the basic required specifications for salt and chemical storage facilities. For additional information, please contact the Drinking Water and Groundwater Bureau at (603)271-2513 or dwgbinfo@des.nh.gov, or visit their website at: <http://des.nh.gov/organization/divisions/water/dwgb/index.html>. *The Salt Storage Handbook* contains more information and guidelines that should be referenced.

Produced in partnership with:





Pony Motor-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration card *will* be different than the sand calibration card).

Calibrations should be performed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration.

Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.



Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting to start (approximately 1" to 1.5"). After the truck is calibrated for the lowest gate setting, calibrate for each 1/2" increment greater than the lowest setting. Continue until all gate settings you use are calibrated.

Engine Speed: Set the pony motor speed to the maximum setting, or to the setting you would normally use.



Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each gate setting you are calibrating. Round your numbers to the nearest half foot and record them in column "W" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each gate opening that is typically used. Average these three values together and record in the orange column in the calibration chart.



Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and gate setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration card in the truck you just calibrated. Also, leave a copy of the calibration card in the office so you have a copy in case the original is damaged.

Produced in partnership with:



Calibration Chart (Pony Motor Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight:												
Gate Opening	W	A	Discharge Rate (lb./min.)			B	D					
	Spread Width (ft.)	5.28 x W	Run 1	Run 2	Run 3		Pounds of Material Discharged per 1000 square ft. (D = B x C ÷ A)					
						Average Discharge Rate ((Run1 + Run2 + Run3)/3)	5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1"												
1.5"												
2"												
2.5"												
3"												
EX	14	5.28 x 14 = 73.92	87	92	93	(87+92+93)÷3 = 90.67	12 x 90.67 ÷ 73.92 = 14.72	6 x 90.67 ÷ 73.92 = 7.36	4 x 90.67 ÷ 73.92 = 4.91	3 x 90.67 ÷ 73.92 = 3.68	2.4 x 90.67 ÷ 73.92 = 2.94	2 x 90.67 ÷ 73.92 = 2.45

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each gate setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$



Hydraulic-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration chart *will* be different than the sand calibration chart).

Calibrations should be performed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration.

Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.



Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting (~2"). This should be kept constant throughout the calibration process. If you find that not enough material is dispensed with this setting, try 2.5" to 3".

Engine Speed: Warm the truck up and run the engine at the typical rate seen during spreading (approximately 2000 rpm).



Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each conveyor/auger setting you are calibrating. Round your numbers to the nearest half foot and record them in column "W" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each conveyor/auger setting that is typically used. Average these three values together and record in the orange column in the calibration chart.



Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and conveyor/auger setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration chart in the truck you just calibrated. Also, leave a copy of the calibration chart in the office so you have a copy in case the original is damaged.

Produced in partnership with:



Calibration Chart (Hydraulic Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight:		Pounds of Material Discharged per 1000 square ft. (D = B x C ÷ A)										
Conveyor or Auger Setting	W	A	Discharge Rate (lb./min.)			B	D					
	Spread Width (ft.)	5.28 x W	Run 1	Run 2	Run 3	Average Discharge Rate ((Run1 + Run2 + Run3)/3)	5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1												
2												
3												
4												
5												
EX	14	5.28 x 14 = 73.92	87	92	93	(87+92+93)÷3 = 90.67	12 x 90.67 ÷ 73.92 = 14.72	6 x 90.67 ÷ 73.92 = 7.36	4 x 90.67 ÷ 73.92 = 4.91	3 x 90.67 ÷ 73.92 = 3.68	2.4 x 90.67 ÷ 73.92 = 2.94	2 x 90.67 ÷ 73.92 = 2.45

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each conveyor/auger setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$



Brine Making

NH Best Management Practices

GET THE LOWEST FREEZE POINT

When salt brine is 23% salt (measured with a hydrometer: 1.176, or with a salimeter: 85%) it has the lowest freeze point possible (about 0°F).

BRINE STORAGE

23% brine solution may be stored outside, however if temperatures get below 0°F the brine may freeze. A circulator pump will reduce the risk of freezing. If possible store brine indoors to eliminate risk of freezing.

COST OF BRINE

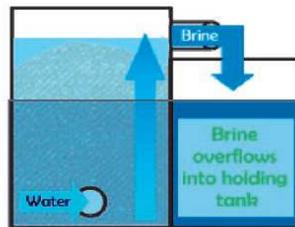
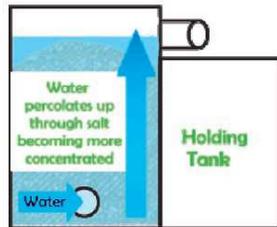
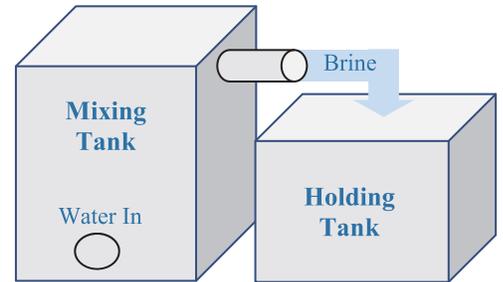
Calcium chloride brine costs about 7¢ / gallon (assuming \$58/ton for salt) after you have your equipment setup.

MULTIPLE USES

Brine can be used directly for anti-icing, for prewetting salt as it is dispensed from your truck, or to pretreat salt before it is loaded into your truck. Brine can be safely stored for up to a year, however, the concentration should be tested before use.

What Do You Need?

Brine making is a fairly simple process—the only ingredients are salt and water, and the only equipment you'll need is an open top mixing tank, a holding tank, a small pump, and a salimeter.



Images courtesy of Iowa DOT

Step 1: Fill Mixing Tank

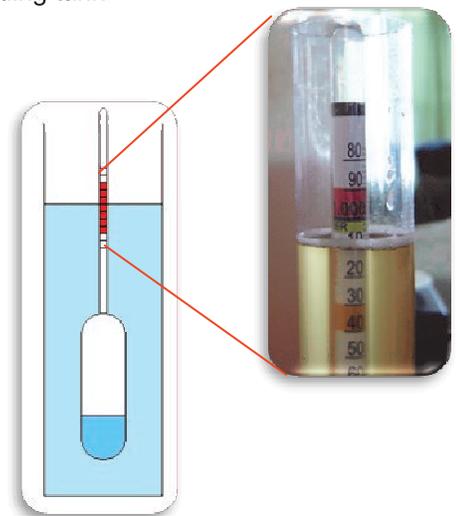
Add Salt: Add about 2.5 lb of salt per gallon of water you plan to add. Make sure your mixing tank has a large opening to make adding salt easy.

Add Water: Slowly add water from the bottom of your brine mixing tank. This will allow it to percolate up through the salt and overflow into the holding tank.

Step 2: Check Concentration

Float a hydrometer or salimeter directly in your holding tank and read the value at the surface of the water. The number should be either 85% or 1.176 depending on the units of your device.

If the values are too low, pump some brine from your holding tank back into the mixing tank and allow it to overflow. If values are too high simply add some fresh water



Quality Control & Documentation

Make sure that you record the date when you create each batch of brine and document who mixed it and checked the concentration. It is also a good idea to note the final concentration. These records should be kept for at least two years to protect your group in the event of litigation.

Produced in partnership with:





Safe and
Sustainable
Snowfighting

Safe and *Sustainable* Snowfighting

— The — **Snowfighter's Handbook** *A Practical Guide for Snow and Ice Control*



*Dedicated to the people
who provide safety and mobility
on roads in winter — the snowfighters*



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PUBLISHED BY THE SALT INSTITUTE: The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition. See saltinstitute.org and safewinterroads.org for more information.

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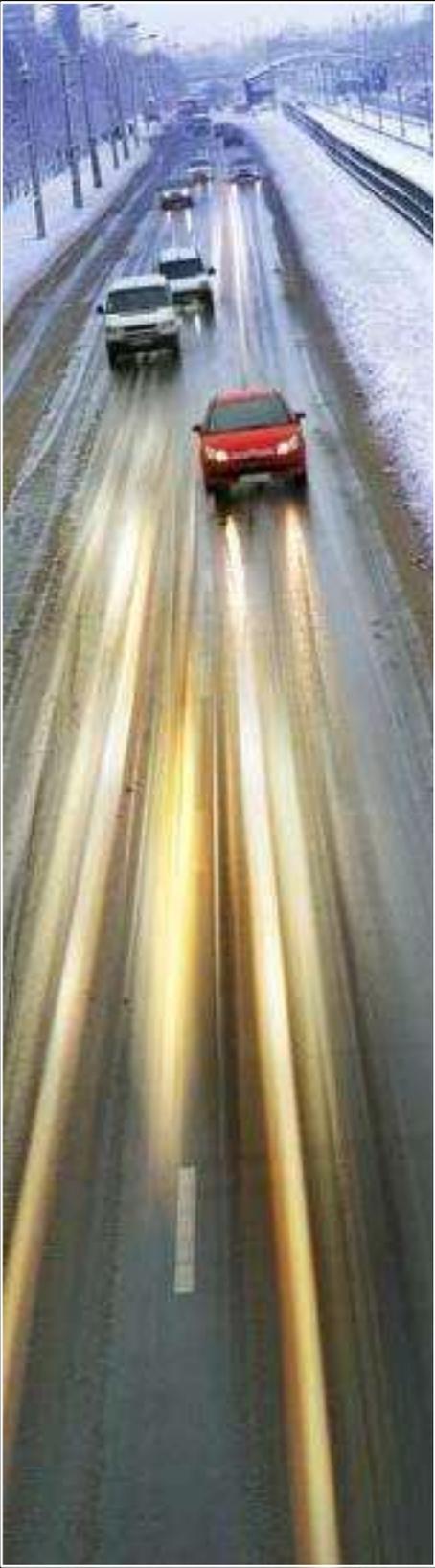
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FOREWORD

This manual, prepared by the Salt Institute is dedicated to the thousands of men and women in public works agencies at all levels whose task is providing safe streets and highways during winter storms.

The modern snowfighter must be accountable for meeting the community's needs for safety and mobility, as well as the safeguarding of our environment.

We commend all those agencies practicing the Safe and Sustainable Snowfighting approach to snow and ice control, which emphasizes getting the most from every application of deicing salt while maintaining the safest roads possible in the most economical way, and protecting the environment.

Every winter, over 115,000 people are injured and over 1,000 are killed on snowy or icy American roads. Clear roads protect lives and commerce and salt is a necessary strategic resource.

- Road salting and effective plowing can reduce injury crashes by up to 88%.

- The economic impact of snow-related closures far exceeds the cost of timely snow removal. A one day major snowstorm that shuts down roads can cost a state between \$300 and \$700 million in indirect costs.
- Deicing pays for itself within the first 25 minutes after salt is applied.

Modern strategies to effectively deal with winter road hazards depend upon having the most up-to-date information of expected weather conditions, the timely deployment of anti-icing to prevent ice-pavement bonding, properly calibrated application of road salt, improved equipment, automatic spreader controls, sufficient covered storage, and stockpile logistics to make salting of roads the most effective and safest customer-driven method for snow and ice control.

Environmental problems concerning use and storage of salt need not exist if there is a balanced approach to the use of salt for snow and ice control —one that demonstrates excellent practices in achieving safety, mobility and care for the environment.

The Snowfighter's Handbook was originally published in 1967. It has been widely accepted as a recommendation for proper salting procedures and techniques.

The purpose of this manual is to provide the snowfighter with information and suggestions for combating winter storms.

The *Sustainable Snowfighting* methods contained in this manual are the cornerstones of an effective winter maintenance program which will help snowfighters provide the public with the most effective snow and ice control program possible at the lowest overall cost and least impact on the environment.

Two other practical publications, *Highway Salt and Our Environment* and *The Salt Storage Handbook*, are also available from the Salt Institute. Two websites, saltinstitute.org and safewinterroads.org, are further resources. ❄️



1 HOW IMPORTANT IS THE WINTER MAINTENANCE FUNCTION?

Snow and ice control is often the single largest cost item in the maintenance budget for streets and highways. In a recent year, snow removal in 33 snow belt states accounted for 20-25% of total maintenance costs and almost 5% of all highway expenditures.

For this reason, and because of its impact on public safety and essential mobility, snow and ice control deserves special attention from top highway management as well as from those in maintenance at all levels.

With nearly 300 million motor vehicles registered in the U.S., and more than four million miles of roads and streets, more must be done with the winter maintenance dollar than simply providing traction over ice and snow.

Most Canadian road authorities have an even tougher job than their U.S. counterparts. Canada's commerce and industry depend upon safe transportation and communication throughout the vast nation. Yet, Canadian winters threaten for six months every year, with colder temperatures and more frequent snows than in the United States.

The common practice for snow and ice control on many miles of streets and highways is removal of these substances as soon as possible to provide safe pavement through Sustainable Snowfighting. Nearly every state, province, city and toll road in the snow belt has some mileage on a clear pavement program. These facts about our motorized economy show why:

- Motorists now travel more than three trillion vehicle miles each year.
- More than 75% of workers who commute drive to work.
- More than 80% of intercity travel is by motor vehicle.
- Suburban growth has drastically increased traffic densities on most street and highway systems.
- Access to retailers, service establishments and other businesses is often wholly dependent on auto or truck transportation.

- Just-in-time manufacturing practices require reliable highway access for economic efficiency and competitiveness in snow belt areas.
- Web-based sales are pushing incredible parcel delivery growth.
- Increasing traffic volumes, the reliance of our society on daily mobility and the urgency of moving emergency vehicles without delay demand efficient snow and ice removal to keep traffic moving all year around.

Sustainable Snowfighting provides safe pavement in an environmentally sensitive manner. By preventing the bonding of snow and ice to pavement and clearing all snow and ice from pavements as soon as possible, snow fighting materials are used most efficiently with minimal loss to the environment. Benefits of this high maintenance are apparent:

- Traffic keeps moving.
- Commerce and industry go on at near-normal pace.
- There are fewer accidents, injuries and deaths.
- Minimal environmental impact.
- Emergency vehicles get through.

The public is less tolerant of failure in snow and ice control than in any other highway or street department function. A snowstorm affects the entire community—often entire states. Unless a storm is handled capably by maintenance forces, it can upset considerably the daily routines of individuals, endangering public safety and adversely affecting business and commerce. ❄



2 TRAIN FOR TEAMWORK

Maintenance people typically feel a keen obligation to the traveling public. They have a kind of esprit de corps that comes only with training and experience.

Proper training for maintenance personnel is vital. It provides the know-how to get the job done and encouragement to perform in a way that brings praise rather than discredit to your organization.

Many maintenance organizations conduct training courses in the early fall months to assure that:

- Equipment operators fully understand how to operate and maintain plows, spreaders, loaders and other equipment used for winter maintenance.
- All employees are thoroughly familiar with their responsibilities.
- All employees receive a full review of snow removal schedules, snow routes and personnel and equipment assignments.
- Dry-runs are made over areas to be covered during actual snowfighting operations.
- All employees understand how salt works in snow and ice so they know how, when and in what amounts it should be applied.

The underlying theme of all training sessions should be the Sustainable Snowfighting concept, which includes:

- Concern for public safety
- Concern for mobility and commerce
- Concern for the environment
- Proper covered storage
- Good maintenance of storage areas
- Good equipment maintenance and knowledge of equipment
- Proper spreader calibration
- Proper salt application

Every agency should have a fall meeting.

A session on snow and ice removal well ahead of winter gives a chance to discuss your plans with the people expected to carry

them out. This meeting is a refresher course on snowfighting tactics for experienced employees and an introduction to winter maintenance for new personnel.

This meeting gives management a chance for a formal review of the previous winter's operation with operators and supervising

personnel. Use it to determine what may have gone wrong last winter, and then make corrections for the coming season.

Promote a free exchange of ideas at the fall meeting. Encourage all personnel to speak up. New ideas and better tactics can come out of this session. ✧

Suggested Program Outline For Fall Training Sessions

I. The Importance of Coordination

- Know Your Plowing and Spreading Routes
- Effective Radio Communication
- The Storm Warning System
- Working with Police, Other Public Agencies and the Media

II. Equipment — Its Operation and Maintenance

- Plows
- Spreaders, Sprayers and Their Controls
- Loaders
- Emergency Repair and Refueling Stations
- The Importance of Preventive Maintenance

III. Application Procedures

- How Salt Works
- How and When to Salt
- Anti-Icing vs Deicing
- Application Rates
- Special Storm Conditions
- Special Deicing Problems (Bridges, Elevated Curves, Ramps, Intersections)
- When to Re-Apply Salt

IV. Review of Winter Maintenance Policy

- Snow Emergency Routes
- Parking Ordinances
- Procedures for Helping Motorists
- Importance of Personal Public Relations by Maintenance Personnel

V. On-the-job Safety

- Safety Equipment
- Safety Practices

VI. Discussion, Questions and Answers

To assure yourself that your department is ready for winter, you might have superintendents or foremen complete a check list showing their progress in pre-winter preparations.

3 Making Equipment Count

Equipment can make or break a maintenance organization. It must be suited to the job – and it's a tough job. Winter operations require the highest level of equipment maintenance.

It is a good idea to review equipment needs immediately after each winter season, when they are fresh in your mind. If new equipment is required, it can be ordered with good assurance of delivery prior to the next winter season.

A secret to successful winter maintenance is the ability to fight storms with equipment already on hand. The key is proper equipment maintenance. Snow and ice control equipment should never be stored without being cleaned. It should be inspected for possible repairs, and repaired if necessary.

In Fall training sessions, discuss each type and class of equipment which employees will operate. Go over strengths and weaknesses of each. Describe performance capabilities, load and weight limits, specifications, safety considerations, attachments and modifications.

If possible, assign each operator to a specific spreader, plow or loader. Man and machine make a better team when they work together regularly. The feeling that a vehicle "belongs" to an employee also will make an operator show more responsibility for its upkeep.

In some organizations, it may be necessary to switch operators from one piece of equipment to another. Then management must depend on a system of checks to ensure that equipment is properly operated and maintained.

Thoroughly inspect all equipment during late summer or early fall. Make all repairs and order stocks of parts not locally available. Pay particular attention to these components:

- Inspect condition of moldboard and cutting edge of all snowplows. Order adequate stocks of parts for all types of plows.
- Inspect snowplow hoists and under-body blades. Check air and hydraulic hoses and other critical parts of power units and obtain adequate replacement stocks.

- Mount, load and test all spreaders and sprayers. Make necessary repairs and order critical parts. Calibrate all spreaders and lace the calibration card on a visor or in the glove compartment of the truck. Supervisors should have copies of all calibration cards on file.
- Inspect all vehicle lighting, including wiring and sockets on headlights, tail lights, stop lights and turn signals. (Warning lights must be visible from all sides, whether bodies are raised or lowered.)
- Make sure sufficient stocks of tire chains, tires, spreader repair parts and other miscellaneous supplies are on hand.
- Make sure all personnel are familiar with spreader/sprayer controls, whether manual or automatic.

To keep equipment in top condition, establish a regular maintenance routine to be followed all winter. Equipment operators should inspect vehicles after each storm and report needed repairs to the garage or to the staff mechanic. Spreader/sprayers will need to be recalibrated after repair to the hydraulic system.

The first step in vehicle maintenance is to make sure every operator knows what to expect of each piece of equipment. Operators should check these items carefully.

Spreader/Sprayers – Inspect pumps, hoses, controls, and fittings. Check spinners, augers, and auxiliary engines.

Controls – The two major components of any hydraulic system are the pump and the controls, whether manual or automatic. All operators should become thoroughly familiar with spreader controls. No two hydraulic systems are exactly the same. Therefore, controls may differ from truck to truck. Know your equipment and how the auger or conveyor and the spinner react at various settings.

Plows – Carefully inspect blades after each use. If blade wear begins eating into the moldboard, it will be very costly to replace. Remember that snow plow blades do not wear evenly. Replace blades when they are badly worn at any point! Have operators check blade wear during storms.



(Right-hand plows wear most rapidly on the left side, while the opposite is true for left-hand plows. Reversible plows may show wear on either side, depending upon operating time in each position.)

All Electrical Equipment—Inspect and service all lighting and electrical equipment regularly, including wiring and sockets. Carry ample stocks of parts for rotating flasher units, including lenses and lamps. Faulty wiring and failure of alternators, generators and batteries cause the most downtime in winter maintenance vehicles. Nothing is more terrifying and dangerous than a stalled and darkened vehicle in a winter storm.

Safety Equipment—Make sure there are flashlights, flares, flags and safety vests in truck cabs. A first aid kit is also a good idea. It is preferable to wear hardhats at all times and don't start out without securing seat belts.

All vehicle operators should know the location and telephone numbers of emergency repair and refueling stations. Qualified personnel should be on hand in garages during storms to carry out minor repairs promptly or make a start on major repairs. **Replenish spare parts inventories immediately following storms.**

Equipment needs vary markedly. How many plows, spreaders or sprayers are necessary for each mile of pavement depends upon snowfall, frequency of storms, traffic and topography. How much equipment an agency can afford is an important consideration as well. A straight salt program requires less equipment than one using abrasives, or alternative deicers.

Despite careful planning, equipment on hand may be inadequate in certain situations. *Don't be caught short!* Compile a list of all rental equipment available from contractors or haulers during snow emergencies. List specifications, rental rates and the names, addresses and telephone numbers of owners.

Establish ground rules for contracting for this equipment. It is important that every supervisor understands who has the authority to call rental equipment into action.



Arrange before winter to borrow equipment and operators in emergencies from local military installations, reserve units or neighboring maintenance agencies. Determine which officer is responsible for specific equipment and negotiate details for its use, if it is needed. It is difficult to know when a blizzard will strike, requiring tracked vehicles or other heavy equipment. Training sessions should include operators who may be brought in during emergencies, whether contract operators and/or equipment. They should also include other departments such as sewer and water or the park service. In fact, anyone capable of driving a plow and/or spreader should be trained and included whenever possible.

Warning! Before permitting rented or loaned equipment to operate, make sure your department is protected from liability for property damage or injuries resulting from accidents, and that insurance coverage is adequate and complies with all state and local laws or ordinances.

Preventive maintenance is crucial! After each storm, all equipment must be cleaned, washed and allowed to dry. When dry, components such as chains, sprockets, hinges, spinners and other moving parts should be coated with used motor oil, diesel fuel or kerosene. Grease all bearings.

Check hydraulics and quick disconnects for leakage. All washing and maintenance must be conducted in specific areas to protect the equipment and to allow capture and treatment/recycling of washwater.

The versatile underbody plow is very valuable in snowfighting. In light snow, it can run at fairly high speeds with safety. It can usually be purchased economically. The underbody blade is also a good training tool for new operators. ❄

4 OTHER PRE-WINTER PLANNING



All major arteries and feeders, including interstates, primary and secondary roads should be included in an agency's *Sustainable Snowfighting* program. Primary routes should have higher priority than secondary roads.

Only someone thoroughly familiar with a given locality can assign levels of maintenance and schedule performance of the work for optimum results. Local traffic patterns, traffic volume, the needs of local industry and business and special problems created by topography or climate must be considered.

However, here are a few recommendations for determining required levels of maintenance:

- Many agencies determine maintenance levels based on average daily traffic (ADT)
- Give priority to important local arterials, including school bus routes, access roads to industrial parks or major plants, mail delivery routes and streets leading to hospitals, fire stations and maintenance garages.
- Provide safe pavement on all truck routes that carry heavy vehicles around a city or through selected sections. Remember that these routes require around the clock attention.
- Carry levels of maintenance to logical stopping points, such as traffic signals, intersections or slow speed zones. This priority gives motorists time to adjust to the shift in maintenance levels.
- Make sure maintenance sections link or overlap. Leaving a gap between sections on a high-speed roadway can present potentially hazardous conditions.

Interstate and expressway routes that pass through or near cities carry increased traffic volumes onto city arterials. Ramps and other approaches to major city routes need special attention. A bare street or road is worthless unless traffic can get on and off. Flow and salt ramps of major arterials early in storms.

After thorough planning has been done, post a master-map showing routes, snow plowing and salting schedules and equipment and operator assignments.

For added control, give each driver an individual map of his route or area. Be sure to update maps each year to show new roads, interchanges, streets, bridges and governmental boundary lines.

For top efficiency in scheduling operations, aim for maximum equipment and manpower utilization. Try setting up salt routes that bring spreaders back to storage sites as

they empty. It may be desirable to stockpile salt at several locations so spreaders won't waste time deadheading.

Spreading rates differ based on types of storm, weather conditions and operational procedures. Application rates generally range from 300 to 800 lb per two-lane mile. **For convenience in estimating your season needs, the following chart is based on four 500 lb applications per storm.**

Mark the spots that won't be there.

Before winter, mark all structures, such as drop inlets, catch basins, ends of curbing and guardrail and fire hydrants. Once covered with snow, they will be difficult or impossible to see from a plowing or spreading vehicle. Use special markers to pinpoint locations of drains and waterways that must be opened after each storm.

Where does snow fencing go? Only practical experience and analysis can tell where to erect snow fencing. Where it is placed depends entirely upon topography, prevailing winds and existing vegetation. Fencing should never be erected nearer than 75 to 100 ft from the centerline. It always is placed on the side of the roadway from which prevailing winter winds blow and should be perpendicular to wind direction, not necessarily parallel to the road. Positioning of snow fencing may be changed from one year to the next. Slopes, grading and tree growth often alter placement.

Notify property owners. Remember to contact property owners before erecting snow fence outside rights-of-way. In long fence sections, leave an occasional gap so livestock can go through. It is good community relations and will prevent damage to fencing as well. *

Tons of Salt Required Per Season							
(Based on 4 applications of 500 lb per 2-lane mile per storm)							
No. of Storms	Miles of Two-lane Highway on Clear Pavement						
	100	200	300	400	500	600	700
4	400	800	1200	1600	2000	2400	2800
6	600	1200	1800	2400	3000	3600	4200
8	800	1600	2400	3200	4000	4800	5600
10	1000	2000	3000	4000	5000	6000	7000
12	1200	2400	3600	4800	6000	7200	8400
14	1400	2800	4200	5600	7000	8400	9200
16	1600	3200	4800	6400	8000	9600	10,200
18	1800	3600	5400	7200	9000	10,800	11,600
20	2000	4000	6000	8000	10,000	12,000	14,000

Note: Minimum storage requirement is usually 3/4 of annual salt use.
 This chart is computed on the basis of one ton of salt per two-lane mile per storm, or four 500 lb applications per storm.
 Note: These are average figures. Conditions in some areas require several times the salt needed in some other areas.

5 KNOW DIFFERENT TYPES OF SNOW

In spots where unusual drifting is expected, place one or more rows of fence, with the second line parallel to and about 50 ft from the first. **What about “self-help” barrels?** Many public works agencies place “self-help” salt barrels at critical points where motorists are likely to have tough going during winter.

Eliminate runoff from stored salt.

Improper stockpiling of salt is responsible for as much as 80% of environmental problems associated with salt use. Rain and melting snow can carry salt from uncovered piles into the ground and nearby bodies of water and possibly cause chloride build-up.

Salt piles **must** be covered on an impermeable pad. Salt users usually prefer permanent structures on asphalt pads with proper drainage. Temporary waterproof coverings can be effective if tended carefully. Covering salt also helps avoid loss of material through leaching and caking. Also, salt without cakes and lumps spreads with no difficulty.

Snow occurs when water vapor in an air mass is cooled below freezing. Density of snow varies greatly. Some storms produce wet snow like wet sand, others dry snow like sawdust. Wet or heavy snow can often be plowed away. Time is of the essence. Use of reliable weather forecasting services allows for crew readiness in advance of storms. Salt should be applied as soon as snow or ice begins to accumulate.

Winter storms produce a number of hazardous conditions other than snow. Even without rain, ice may occur when moist air contacts a cold surface, particularly on bridge decks. Rain may freeze as it falls on pavement. Frozen rain falls as sleet or hail; it may stick to pavements.

There are roughly five major kinds of storms, as shown in the “Stormfighting Practices” box. Each requires a somewhat different approach. Everyone on the maintenance force should know these basic kinds of storms and how to combat them.

Stormfighting Practices

The following chart is designed to combat various types of storms. Local conditions and policies will be the final determining factor.

<p>Condition 1 Temperature Near 30 Precipitation Snow, sleet or freezing rain Road Surface Wet</p>	<p>If snow or sleet, apply salt at 500 lb per two-lane mile. If snow or sleet continues and accumulates, plow and salt simultaneously. If freezing rain, apply salt at 200 lb per two-lane mile. If rain continues to freeze, re-apply salt at 200 lb per two-lane mile. Consider anti-icing procedures.</p>
<p>Condition 2 Temperature Below 30 or falling Precipitation Snow, sleet or freezing rain Road Surface Wet or Sticky</p>	<p>Apply salt at 300-800 lb per two-lane mile, depending on accumulation rate. As snowfall continues and accumulates, plow and repeat salt application. If freezing rain, apply salt at 200-400 lb per two-lane mile. Consider anti-icing and deicing procedures as warranted.</p>
<p>Condition 3 Temperature Below 20 and falling Precipitation Dry Snow Road Surface Dry</p>	<p>Plow as soon as possible. Do not apply salt. Continue to plow and patrol to check for wet, packed or icy spots; treat them with heavy salt applications.</p>
<p>Condition 4 Temperature Below 20 Precipitation Snow, sleet or freezing rain Road Surface Wet</p>	<p>Apply salt at 600-800 lb per two-lane mile, as required. If snow or sleet continues and accumulates, plow and salt simultaneously. If temperature starts to rise, apply salt at 500-600 lb per two-lane mile, wait for salt to react before plowing. Continue until safe pavement is obtained.</p>
<p>Condition 5 Temperature Below 10 Precipitation Snow or freezing rain Road Surface Accumulation of packed snow or ice</p>	<p>Apply salt at rate of 800 lb per two-lane mile or salt-treated abrasives at rate of 1500 to 2000 lb per two-lane mile. When snow or ice becomes mealy or slushy, plow. Repeat application and plowing as necessary.</p>

Note: The light, 200 lb application called for in Condition 1 and 2 must be repeated often for the duration of the condition.

Most storms occur under Conditions 1, 2, or 3. But variations in temperature, precipitation, pavement condition or other factors are common. Management must depend upon well-trained maintenance crews to use initiative and imagination in coping with unforeseen problems.

Pavement will often freeze dry following a storm, if the last salt application is properly timed. Often, moisture on the pavement will turn to vapor and disappear as it freezes, leaving a completely clear, dry surface.

Keep an eye on the weather. Proper preparation for a storm is not possible unless management anticipates when it will arrive, how long it will last and the nature of its special characteristics. Arrange with the U.S. Weather Bureau, a local airport weather station or a private forecasting service to get complete, detailed reports during winter.

Some maintenance departments hire a private forecaster to assure a balanced and more localized weather picture. Some progressive agencies are using pavement sensors and local weather instruments to receive instantaneous road and atmospheric conditions for more precise snow and ice control operations.

It may also be useful to call 511 to get road conditions. Some states also have excellent 511 websites such as Minnesota (www.511MN.org) or Wisconsin (www.511WI.org) where road and travel conditions are described. In addition, the National Weather Service has a website (<http://www.nws.noaa.gov/>) that provides a comprehensive report of both local and surrounding conditions.

While weather conditions are generally measured 30 ft above ground, it is critical in snowfighting to know what is happening

where the rubber meets the road. Pavement temperatures are what counts when determining application rates. This requires some type of road surface sensors or gaining access to the Road Weather Information System (RWIS).

There are a variety of electronic sensors that can be used to measure surface temperatures. Hand-held or truck-mounted infrared, laser-based sensors are able to quickly get a pavement temperature and are very useful in establishing application rates.

RWIS is a system consisting of several meteorological stations strategically located alongside the highway that allows the DOTs to make more informed decisions during winter storms. Specialized equipment and computer programs monitor air and pavement temperature to make forecasts regarding how the winter storms will impact the highways. This provides the opportunity to make optimal use of materials, equipment and staff, and practice anti-icing and deicing techniques perfected through years of experience.

Any changes in weather conditions should be relayed to all personnel. If late afternoon reports indicate possibility of overnight snowfall, prepare equipment by attaching snowplows and spreaders before the workday ends. If weather forecasts indicate, a certain portion of the work force should remain on duty to start fighting the storm when it arrives. If the forecast indicates snow during the night, the work force should be sent home to get some rest, but alerted that they may be called back during the night. Arrange with the highway patrol, local police, sheriff's department or weather service to notify key personnel of storms that develop late at night. Ensure that someone is responsible for relaying the alert to the entire maintenance force, if and when the need arises. *

Pounds of Ice Melted Per Pound of Salt

Temperature Degrees F	One Pound of Sodium Chloride (Salt)
30	46.3 lb of ice
25	14.4 lb of ice
20	8.6 lb of ice
15	6.3 lb of ice
10	4.9 lb of ice
5	4.1 lb of ice
0	3.7 lb of ice
-6	3.2 lb of ice

Application of Salt

Rate of Application Per Two-Lane Mile	Coverage Per Cu. Yd. of Salt Per Two-Lane Mile
800 lb	2 1/2
700 lb	2 3/4
600 lb	3
500 lb	4
400 lb	5
300 lb	6
200 lb	10

Note: Salt meeting ASTM Specification D632 weighs approximately 80 lb per cubic foot.

6 CALIBRATION

Different materials will spread at different rates at the same setting, so spreaders must be calibrated with the material that will be used.

Spreader Calibration Procedure

Calibration of spreaders is simply calculating the pounds per mile actually discharged at various spreader control settings and truck speeds. It is carried out by first counting the number of auger or conveyor shaft revolutions per minute, measuring the salt discharged in one revolution, then multiplying the two and finally multiplying the discharge rate by the minutes it takes to travel one mile. An excellent example of a calibration chart in spreadsheet format can be found on the Salt Institute website. Operational spreadsheets can be found on the same page. A sample calibration chart is on this page.

With hopper-type spreaders, specific gate openings must be calibrated. Measure from floor of conveyor to bottom edge of gate.

Each spreader must be calibrated individually, even the same models can vary widely at the same setting.

Equipment needed:

1. Scale for weighing
2. Canvas or bucket/collection device
3. Chalk, crayon or other marker
4. Watch with second hand

Calibration steps:

1. Warm truck's hydraulic oil to normal operating temperature with spreader system running.
2. Put partial load of salt on truck.
3. Mark shaft end of auger or conveyor.
4. Dump salt on auger or conveyor.
5. Rev truck engine to operating RPM (at least 2000 RPM).
6. Count number of shaft revolutions per minute at each spreader control setting, and record.
7. Collect salt for one revolution & weigh, deducting weight of container. (For greater accuracy, collect salt for several revolutions and divide by this number of turns to get the weight for one revolution.) This can be accomplished at idle or very low engine RPM. Multiply shaft RPM (Column A) by discharge per revolution (Column B) to get discharge rate in pounds per minute (Column C), then multiply discharge rate by

minutes to travel one mile at various truck speeds to get pounds discharged per mile.*

*For example, at 20 MPH with 30 Shaft RPM and 7 lb discharge – $30 \times 7 = 210 \times 3.00 = 630$ lb per mile.

Calibrating Automatic Controls

Automatic controls come with factory calibration cards that indicate the proper rate of spread for each setting. However, when there is a need to calibrate, use the following steps:

1. Remove or turn off spinner.
2. Set auger on given number, such as No. 2.
3. Tie sack or heavy canvas under discharge chute.
4. Mark specific distance, such as 100 or 1,000 ft.
5. Drive that distance with spreader operating.
6. Weigh salt collected in sack or canvas.
7. Multiply weight of salt by 5.3 (in case of 1,000 ft) or 52.8 (in case of 100 ft).

This will be the amount of salt discharged per mile, which remains constant regardless of speed, but calibration must be done for each control setting. *

Calibration Chart

Agency: _____

Location: _____

Truck No.: _____ Spreader No.: _____

Date: _____ By: _____

Gate Opening (Hopper Type Spreaders)				Pounds Discharged Per Mile								
Control Setting	A Shaft RPM (Loaded)	B Discharge Per Revolution (Pounds)	C Discharge Rate (lb/min)	Minutes to Travel One Mile								
				5 mph x 12.00	10 mph x 6.00	15 mph x 4.00	20 mph x 3.00	25 mph x 2.40	30 mph x 2.00	35 mph x 1.71	40 mph x 1.50	45 mph x 1.33
1		This weight remains constant										
2												
3												
4												
5												
6												
7												
8												
9												

7 RECOMMENDATIONS FOR SALT APPLICATION

Timing is crucial in applying salt. Ideally, brine is sprayed as an anti-icing treatment prior to the storm's arrival. If that is not possible, then salt should be spread as soon as a storm begins in order to prevent bonding of snow or ice to the pavement. The salt will quickly produce brine or keep snow mealy, allowing for efficient plowing.

The melting action of salt applied early in a storm works from the pavement surface up so snow and ice do not form hardpack.

There are times and storm conditions where salt alone is the only answer to keeping the pavements clear. For example, freezing rain cannot be plowed and salt is the only solution for clearing the roads when it occurs.

Anti-icing is rapidly becoming the best and most popular means of preventing ice-pavement bonding.

The best advice is to be prepared to mobilize all forces as soon as a winter storm approaches.

There are no easy answers or solutions with snow and ice control because there are too many variables. It has been estimated there are over 66,666 different storm conditions – pavement temperature, ambient temperature, pavement type, solar radiation, traffic volume, traffic speed, wind direction and velocity, type of precipitation, topography, lake or ocean effect, shaded areas (by mountains, trees or buildings) and wind chill factor, to name a few.

Snow and ice control is a very complex issue and those people on the front line need the best information possible.

Salt is usually applied at the rate of 300 to 800 lb per two-lane mile. As temperatures drop, either the quantity of salt or the frequency of application must be increased.

Anti-icing, that is spraying brine on pavement before the storm arrives, requires anywhere from 1/3 to 1/4 the material of deicing, making it the most cost-effective option for improving winter traffic safety.



Ideally, with any deicer, at the end of the storm all material should be completely used. Since storm forecasting is not precise, some residue may remain on the surface after some storms. That residue, if not blown off or washed away, will be effective in helping prevent bonding of ice and snow in the next storm. A deicer only has residual effect if too much was applied for the storm condition.

Prewetting salt with brine speeds the reaction time of salt and also keeps salt from bouncing off the road so more of it is available to do the work. See Section 10, page 18, for details on this deicing procedure.

There may also be a combination of applications of any of the above. Most agencies agree that early anti-icing spraying is most effective and that prewetting of salt provides a faster, higher level of service at all temperatures.

Spreading can be done full-width or windrow. Both have strengths depending on conditions. Pay special attention to spinner speeds. A spinner that revolves too fast will throw salt over a wide area, possibly wasting material. You may correct overthrow by adjusting the drop location on the spinner by using your directional baffles or reducing spinner speed. Traffic density and highway design largely determine the spreading pattern required.

A **windrow** of salt applied in a 4-8 ft strip along the centerline is effective on two-lane pavements with a low to medium traffic count. Less salt is wasted with this pattern and quickly gives vehicles clear pavement under at least two wheels. Traffic will soon move some salt off the centerline and the salt brine will move toward both shoulders for added melting across the entire road width.

The **full-width** spreading pattern is used most often on multiple-lane pavements with medium to high traffic volumes. Melting action is obtained over the full pavement width. Vehicles tend to stay in line to clear wheel paths in the lanes.

Often the full width pattern is used when trying to get salt down under a storm. But be careful not to waste salt when using this pattern.

Play the wind in spreading. A strong wind blowing across a street or highway can cause salt to drift as it comes out of the spreader, pushing it onto the shoulder or into a gutter. This is particularly true in rural areas where there are few windbreaks. How the wind affects spreading depends on both wind velocity and pavement condition. Spreader operators should play the wind to put salt where it will do the most good.

Because of the much greater control inherent to the spray process, anti-icing is best applied with full-width stream nozzle systems to maintain a small width of bare pavement to reduce slipperiness. A fan spray is not recommended and care must be exercised during windy conditions.

Give salt time to work. Time plowing operations to allow maximum melting by salt. When you plow salt off the pavement, you waste the deicing material and increase the cost of snow removal.

Know when to plow and reapply salt. The need for another salt application can be determined by watching melting snow kicked out behind vehicle tires. If the slush is soft and fans out like water, the salt is still working. Once the slush begins to stiffen and is thrown directly to the rear of vehicle tires, it is time to plow and spread more salt.

Has the weather changed? Remember that salt application rates may have to be increased at night, on sunless days and when the temperature drops sharply. Without the sun, the effect of solar radiation and warmth is lost. At night, traffic usually diminishes, minimizing another heat source that helps melt ice and snow. It is important to remember that pavement temperatures are seldom the same as air temperatures—a critical thought when choosing the options for snow and ice control—it is the pavement that will be treated.

Don't overlook salt's anti-skid value. For years, maintenance people have observed that salt, applied as an ice melter, also gives anti-skid protection. Tests conducted in cooperation with the National Safety Council show that salt, applied at normal deicing rates, gives as much anti-skid protection as abrasives. The anti-skid effect of salt is immediate as it starts melting snow or ice.

Safeguard the environment. The way salt is spread can make the difference between whether the public appreciates or condemns snowfighters' efforts. Misuse ignores concern for the environment. Proper calibration of spreading equipment and good storage can avoid most problems.

There is no correlation between yearly snowfall and the total quantity of salt used. The type of storm dictates frequency of application and total amount of salt necessary. A freezing rain or ice storm may require enormous amounts of salt, perhaps even more than a prolonged snowstorm. There is no way to combat freezing rain other than salt use. ❄️



8 SPECIAL SPREADING AND PLOWING PROBLEMS

Salt bridges first. Bridges freeze long before road surfaces because they do not hold warmth as a roadbed does, since cold air reaches both the top and bottom surfaces of bridge decks.

They should receive early attention and an application of salt. Bridge decks may ice over even when there is no precipitation because of high humidity and low temperatures. (Or under certain other conditions, bridges will frost over without precipitation and must be salted.)

Salt on the high side of elevated curves. Salt brine will flow down and across a banked curve. If salt is spread down the centerline, everything above it will remain icy. Spread salt on the high side of the curve and let gravity do the rest of the work. Leave no gaps.

Operators must go beyond their assigned areas, if necessary, to plow or salt a gap that has not been treated for some reason. A short, neglected stretch of roadway can be very hazardous to an unsuspecting motorist.

Watch for drifting. In continued high winds, maintain a patrol to watch for drifting and slick spots, even after the pavement has been cleared. Treat icy buildups with a salt application. If the highway has a blacktop or stabilized shoulder, drifting may be controlled with a salt application on the shoulder to form a melting barrier.

During some very low temperature storms with dry blowing snow, the use of salt may not be appropriate. The dry snow may blow off the pavement if no salt is used.



Avoid slick conditions from buildup of ice or packed snow by applying a salt application heavy enough to prevent refreezing.

Traffic icing is very dangerous. Occasionally, under certain weather conditions, a paper-thin sheet of ice forms in wheel paths on a bare pavement even when pavement looks clear. This black ice formation can be deadly. Maintenance operators should be instructed to watch for this condition and to apply salt immediately when it is detected.

Get equipment on the road. Once a word of an impending storm has been received and plows are mounted and trucks loaded, get vehicles out of the yard and onto their plowing and spreading sections as soon as possible.

Delay in getting to critical areas may cause severe traffic tie-ups.

Make a list of trouble spots that operators should salt first during storms. Make sure all

personnel understand that bridges, intersections, ramps, hills and curves come first. Have operators patrol highways rather than wait at maintenance areas for direction.

It is far better to have equipment on the road when snow begins than in the maintenance yard. Nothing is more reassuring to motorists than to see anti-icing sprayers or loaded spreaders and plows patrolling prior to storms.

Give interchanges special attention. Salt on and off-ramps as quickly as possible. A safe road or street is of little value without safe entrances and

exits. Can trucks be kept out of the way? Intelligent transportation systems have been developed to do just that.

Basic management controls such as truck navigation, traffic light controls, container management systems, variable message signs or speed cameras as well as monitoring applications such as security CCTV systems which have been designed to manage trucking logistics. Additionally, predictive techniques are being developed, to allow advanced modeling and comparison with historical baseline data. *

9 ANTI-ICING

A relatively new weapon in the sustainable snowfighting arsenal in North America is anti-icing. But it has a long history of keeping European roads safe and passable.

Anti-icing differs significantly from deicing because brine is applied before precipitation to prevent the formation or development of bonded snow and ice on the road surface. It is a proactive approach to snowfighting and is often the first in a series of strategies employed for a winter storm. By applying freezing point depressant materials before a storm it is possible to prevent the bond from forming between the pavement and snow or ice. Research has shown that timely applications of anti-icing materials can cut the cost of maintaining a safe road surface by 90% compared to traditional deicing. Liquid sodium chloride (NaCl) is the most effective choice for anti-icing above 15°F.

Anti-icing has many advantages.

- Anti-icing returns road surfaces to normal faster, resulting in fewer accidents and delays.
- Anti-icing can reduce airborne dust and salt particulates.
- Salt needs moisture to be effective. Applying brine jumpstarts the melting process.
- Brine sticks to the road surface. It will not be as easily blown off the road by wind or traffic, so material is more efficiently used.
- If the storm is delayed, salt residue remains on the road ready to begin work when precipitation begins.
- Crews can begin treatment in advance of a storm. Because anti-icing prevents the bonding of snow and ice to pavement, snowfighters have less work to maintain safe roadways as the storm progresses.
- Increased efficiency results in use of less deicer and manpower, therefore lowering the cost of maintaining safe road conditions. The use of less deicing materials also minimizes environmental concerns.

Products available for use in an anti-icing program are sodium chloride, calcium chloride, magnesium chloride, potassium acetate, and calcium magnesium acetate.

Each product has its own advantages and disadvantages. The most common material in use is sodium chloride (salt) in the form of a brine made from a mixture of rock salt and water. Salt brine is effective to -6°F and is a proven anti-icing agent in use throughout the snowbelt.

Some agencies use calcium or magnesium chloride in a brine solution which is effective down to -6° F, but is more than six times more expensive than salt, and is more difficult to handle. Also, calcium and magnesium chloride residue on road surfaces can attract moisture at lower relative humidity than salt resulting in dangerous, slippery conditions under certain circumstances.

Salt Brine Manufacture

Salt brine is made by mixing rock salt or solar salt with water. The process is simple: the resulting brine should be approximately 23% NaCl.

The proportion of salt to water is critical to the effectiveness of the brine. Too much or too little salt affects the freeze point depressing qualities of the brine. The proper brine mixture is 23.3% salt content by weight. This is the concentration at which salt brine has the lowest freezing point, -6° F. Can we keep adding salt to water until the freezing point goes down much further? No. The solubility of salt in water decreases with decreasing temperature. We eventually reach what is called the eutectic point. This is the point at which a solution achieves a maximum salt concentration. Any colder and salt will begin to leave the solution and raise the freezing point. At the eutectic temperature, ice, saltwater, and solid salt exist in equilibrium. For water, the eutectic temperature is -6° F. The percentage of salt is measured with a salometer, a specialized hydrometer, until a 88.3% measurement on the salometer is obtained. This results in the proper 23.3% salt content.

Commercial brine makers are available at a cost of approximately \$5,000. Many agencies have made their own brine makers using water tanks and PVC pipe for substantially lower cost. Brine is usually made at the local maintenance facility sites and stored in large tanks in locations convenient for loading into saddle tanks on the sides of the V-box or anti-icing equipment. It is essential to clean out brine makers after brine is prepared to reduce the potential for corrosion.

Application Equipment

Brine applicators are commercially available for about \$1,500. Some agencies have manufactured their own application equipment using large tanks and PVC piping. Some equipment is designed to be

Hydrometer/Salometer Chart for Salt Brine		
% Salt	Hydrometer Specific Gravity	Salometer Using 0-100%
0	1.000	0
1	1.007	4
2	1.014	7
3	1.021	11
4	1.028	15
5	1.036	19
6	1.043	22
7	1.051	26
8	1.059	30
9	1.067	33
10	1.074	37
11	1.082	41
12	1.089	44
13	1.097	48
14	1.104	52
15	1.112	56
16	1.119	59
17	1.127	63
18	1.135	67
19	1.143	70
20	1.152	74
21	1.159	78
22	1.168	81
23	1.176	85
24	1.184	89
25	1.193	93
26	1.201	96
27	-	100

loaded onto the bed of spreading trucks, towed behind maintenance equipment or permanently mounted on truck beds. It can be as simple as a gravity fed spraying system with a operator controlled cut-off valve or a more complex (and more controllable) pump driven sprayer system. Fan sprayers are not recommended. Control should be available to vary spreading rates from 25 to 60 gallons per lane mile.

If large, horizontal tanks are used in the design, consider installing baffles inside the tanks to help prevent the liquid from suddenly shifting in the tank, creating a hazardous control situation for the operator.

Application

Accurate weather and road surface information are critical for the efficient use of anti-icing materials. Road surface temperatures, precipitation amounts and form, wind conditions, and road environment (sunlight exposure, surface condition, bridges, etc.) all affect the use and application of anti-icing measures.

Understanding the freeze point depressing qualities of brine is important to its use and application as an anti-icing agent. (See the Phase diagram below.) As you can see from the chart, the minimum freeze point of salt brine is -6°F at a concentration of 23.3%. Road surface temperatures are indicated on the side of the chart, solution concentrations along the bottom. The line represents the freeze point of the solution at a given temperature. The colored portion in the center of the chart shows the melting range of brine solutions. The area to the left shows the results of a solution with too little salt, the road surface will refreeze unless more salt brine or deicing salt is applied. The area to the right shows the results with too much salt, with a resultant non-functional loss of material to the environment. As you can see, additional precipitation and heavy traffic can dilute the brine solution allowing the road to refreeze.

ADDITIONAL PRECIPITATION ALWAYS RESULTS IN A DILUTION OF BRINE AT THE ROAD SURFACE.

Weather information is getting better with everything from air temperature, dew point, optical weather identifiers, to pavement temperature, surface status, and compound information being available. Some agencies utilize remote television cameras to monitor traffic and bridge conditions. This information will help agencies accurately determine the appropriate application of anti-icers.

Do not apply anti-icer under blowing conditions, particularly in areas prone to drifting and anywhere else that might be problematic for salt, such as all areas subject to wind issues.

Don't apply too much or the roadway may become slippery. Always follow application recommendations.

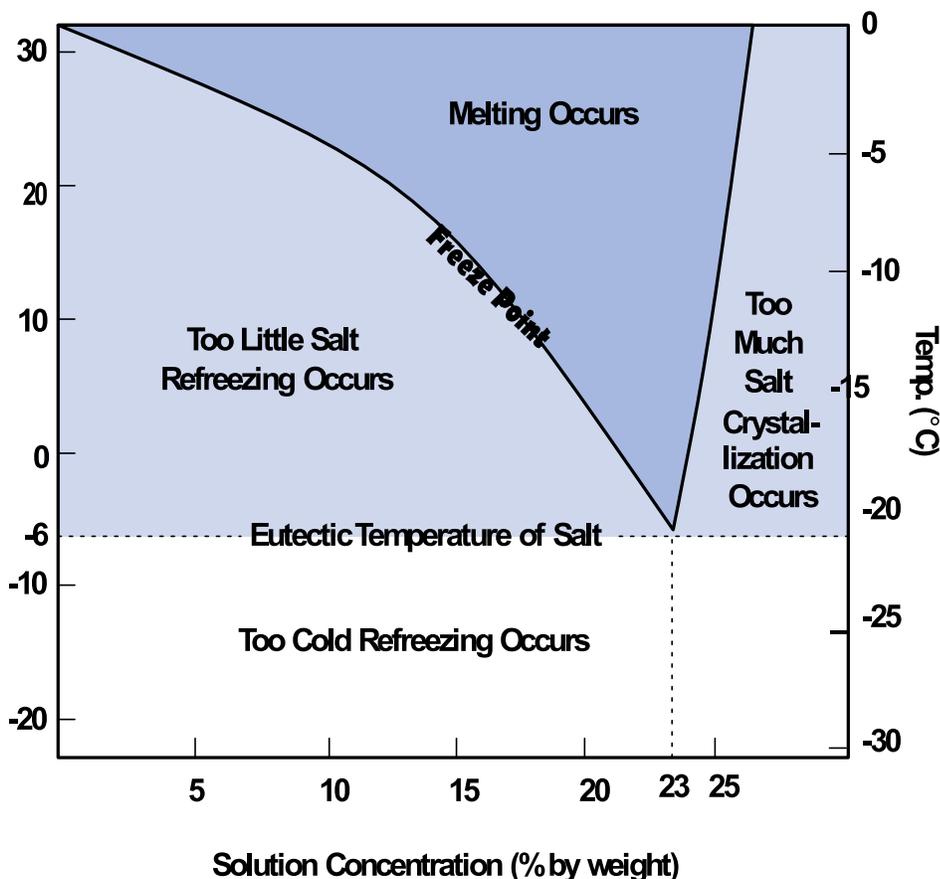
Don't apply CaCl₂ or MgCl₂ to a warm road (above 28°F pavement temperature). It can become very slippery and cause crashes!

Summary

Anti-icing measures are an important weapon in the snowfighter's arsenal. The appropriate use of anti-icing techniques results in:

- Returning to bare pavement conditions more quickly, saving lives and reducing property damage due to fewer accidents, as well as the reduction of traffic delays and the resulting reduction of losses to local economies;
- Reduction in the quantity of deicer use, resulting in cost savings and less environmental concerns; and
- Reduction in the manpower necessary to maintain safe road conditions, resulting in less overtime costs, less operator fatigue and safer working conditions. ❄

Phase Diagram for Salt



10 DEICING-PREWETTING

Once snow has accumulated and bonded to the road or an ice storm has glazed road surfaces, deicing operations must begin to restore safe driving conditions. The bond between snow and/or ice and the pavement surface must be destroyed by chemical or physical means or a combination of the two.

More than a dozen compounds have been tested for deicing use. The most common products used are sodium chloride, calcium chloride and magnesium chloride. Sodium chloride in the form of rock salt or brine (see previous chapter) is by far the most commonly used chemical in deicing operations due to its lower cost and proven effectiveness. Therefore, in the words of the Transportation Research Board in its 1992 analysis of deicers, salt remains the “deicer of choice.”

Abrasives have no melting effect for deicing operations; in fact research by the Strategic Highway Research Program (SHRP) and the University of Wisconsin suggests that sand inhibits the melting process of deicing materials.

Choosing the Proper Application

Salt can be applied in solid, prewetted solid, or liquid form. Application methods are determined by weather and road conditions as well as equipment available. Salt needs moisture to provide melting action. Deicing rock salt or solar salt dissolves in road surface moisture to form a brine which melts snow and ice to form more brine which continues the process. Once salt has penetrated the packed snow and ice to make brine on the pavement surface, the bond will be broken and removal operations can be successful in restoring bare pavement conditions.

Forecasted conditions and road surface temperatures at the time of treatment determine whether winter maintenance materials should be applied in solid, prewetted solid or liquid form. The type of precipitation event, dry snow, wet snow, ice, sleet, freezing rain, etc., must be considered. Keep in mind that changing conditions will affect operations. Falling temperatures can cause

refreezing. Additional precipitation can dilute winter maintenance materials, rendering them ineffective. Refer to the Phase Change diagram in the previous chapter for assistance in determining the proper course of action.

If the road surface is wet and temperatures will not cause refreezing, then application of dry salt is appropriate. Necessary moisture is already present so brine will be formed immediately and melting action can begin. The application rate will be determined by the amount of snow and ice coverage. Keep in mind the reduced mobility effect as dilution of deicing salt occurs.

If snow pack and ice is solid, or temperatures will fall to the point that refreezing will take place, then prewetted solid application of deicers may provide more rapid results. Adding moisture to the salt either at loading or at the spinner when applied will jump start the deicing process by providing more moisture to begin the melting process.

Spraying liquids is not recommended for packed snow as the liquid destroys surface friction and the brine may become so diluted before melting action is completed that refreezing could occur. Application of brine is an effective treatment for black ice conditions. Although salt can melt ice at temperatures as low as -6°F , the practical limitation of brine application is considered by the Federal Highway Administration to be around 15°F . Below that temperature, pre-wet with calcium chloride or calcium magnesium chloride mixed with sodium chloride.

Deicers should be applied close to the crown or high point of the road. The resulting brine will run downhill from the crown to the rest of the surface. Spinner speed should be low enough to ensure that deicing materials remain on the road surface. Spinner speed and application rates should be higher at intersections and other high traffic areas to spread deicing material over a larger area or in higher concentrations as required by the conditions. However, use of the BLAST override on automatic controls while stopped at a stop sign or light is not appropriate.

Road conditions, temperature, amount of snow and ice cover, storm progress, and traffic conditions all affect deicing application rates.

The tables in section 5 of this Handbook, will assist in determining appropriate application rates.

Materials Selection

Generally, all deicers work in the same way. They depress the freezing point of water and turn snow and ice into a liquid or a semi-liquid slush. Solid chemical salts infiltrate down through ice and snow, dissolving to form a strong brine solution which spreads out under the ice or hard-packed snow and breaking the bond to the road surface. Once the bond is broken, the ice and snow can be plowed off or removed by other means. By applying material prior to the storm, we can prevent the bond to the road surface and melt the snow and ice as it comes in contact with the brine.

Agricultural byproducts work in a similar fashion. The resulting solutions act by depressing the freezing point of snow and ice. These products are usually used in combination with other materials.

Although all these materials work in much the same way, they vary widely in performance. Several factors are considered in determining performance, such as effective temperature range, speed of action, amount of material required, and duration of melting action.

Other important criteria for material evaluation include: availability, cost, infrastructure and environmental impacts. Each community will place a particular emphasis on each of the criteria to suit their own specific needs. At times, their needs may change depending upon shifting political priorities. The ability to be able to make a rational decision on material selection to closely fit with ongoing needs is of tremendous importance to winter maintenance planners.

In order to come to grips with this issue, a consortium of state DOTs commissioned a study to develop an evidence-based decision tool for materials selection. This was published by the Transportation Research Board (TRB)

of the National Academy of Sciences in May, 2007. The full report can be downloaded from the TRB website.

Now agencies can objectively compare the de-icing compounds they use in terms that each agency defines for itself to be important. The computer program (called the Material Selections Wizard) crunches the data based upon the agency's set of priorities.

This computer program can be downloaded from the TRB website.

Here is an example of how the new Materials Selections Wizard works.

The winter maintenance agency has had budget cuts and decides that the following priorities reflect their particular needs — see Chart 1.

Price is the primary concern (45%), snow- and ice-melting performance is almost but not quite so important (35%), while environmental (11%) and infrastructural (9%) are somewhat lower down on the overall scale of things.

Using the Materials Selection Wizard, the data is inputted and the following results are obtained showing which material will fit the agency's needs for which temperatures — see Chart 2.

The wizard makes an informed choice based on specific priorities. It is a choice that can be defended before City Council. Citizens value their hard-earned dollars and expect them to be spent wisely to keep roads open and safe while safeguarding the environment. The City Council and the citizens determine the policy. This tool turns the policy into a practical and functional choice.

As another example, here is an extreme environment/infrastructure priority model. It disregards deicer costs and weights performance low (25%, with the logic that a lower weighting would be irresponsible since the material must perform its life-saving deicing mission). Environment and infrastructure together account for three-fourths of the total weighting (split evenly with 37.5% weight for each).

Chart 1

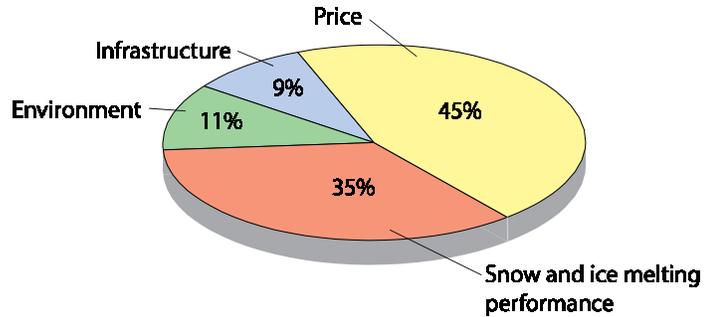


Chart 2

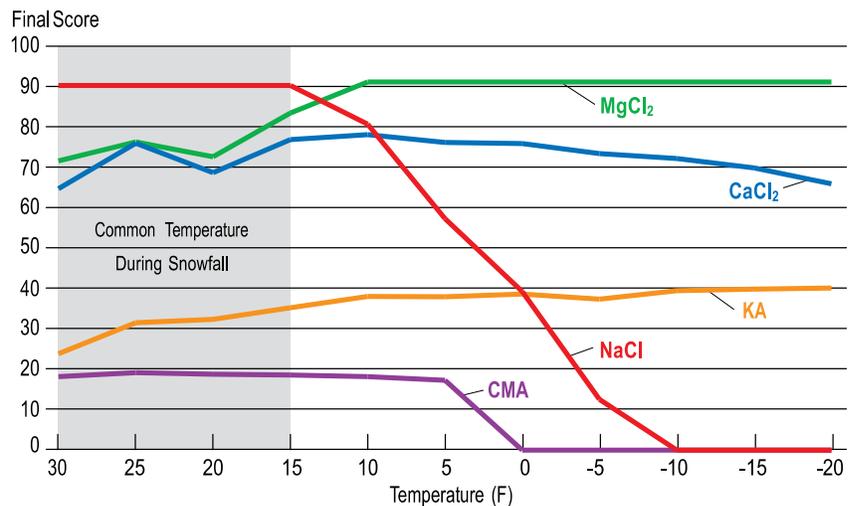
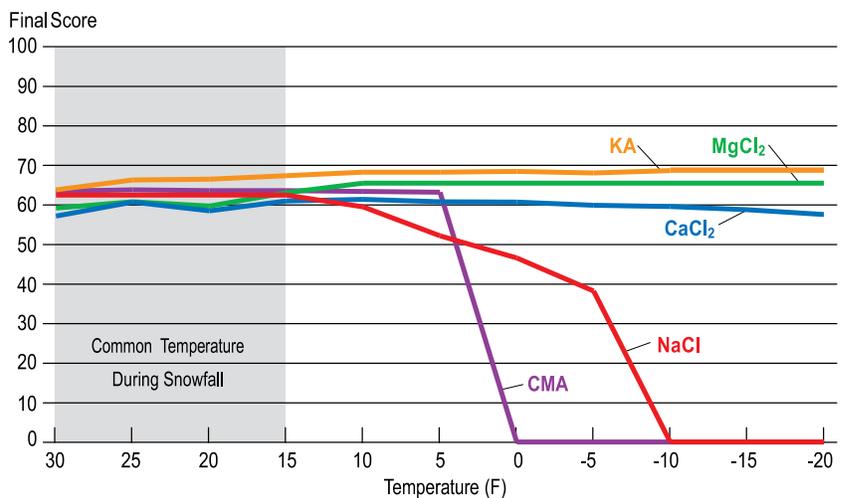


Chart 3



STORM

Here is how the various materials stack up with this set of priorities —see Chart 3

So, the choice belongs to the agency that can now be assured that at the temperatures to be encountered, they are choosing materials that comply with their community's particular priorities.

Equipment Used

Solid deicers or prewetted salt is applied with spreader trucks. If the load is wetted, then no additional equipment is necessary. Saddle tanks and a sprayer at the spinner are necessary if brine is applied to the salt at the time of application to the roadway. Brine can be applied with tank trucks or towed equipment using the same equipment discussed in Chapter 9.

Summary

Use of salt is a proven snowfighting technique with many advantages:

- Returns roadway surfaces to bare pavement conditions more quickly, thereby reducing the number of accidents and property damage, and saving lives. Research has shown that deicing pays for itself within the first 25 minutes after the salt is spread;
- Lowers manpower costs by reducing the time necessary to restore dry pavement conditions;
- Eliminates or greatly reduces cleanup costs;
- Compared to alternatives, salt is safer to handle, and kinder to the environment when properly used.

Prewetting may enhance salt use:

- Salt can be spread more uniformly with less waste on shoulders and in ditches because wetted salt sticks to the pavement;
- The amount of dry materials used can be cut by 20-30% (IADOT) because of the dual action of added brine and more materials remain on roadway;
- Works faster because more brine is present;
- Driving/spreading speeds can be increased because salt stays on the roadway. ❄️

Most snowstorms occur at 20°F or above, with the temperature dropping most severely after the snow stops. After the storm, with the pavement clear and dry, is the time to wing back shoulders, clear structures and haul snow away from critical areas to make room for future snow storage or snow removal.

In plowing, a windrow of snow is often left on each side of bridges. These windrows reduce the usable roadway width on the bridge. Moreover, if allowed to remain, they will later melt and form ice. Remove this snow as soon as possible.

Caution. Do not dump material from overhead bridges onto roadway or railroad tracks below. Hand shovel the snow away, if necessary, to ensure all drains in the bridge floor are open and free-draining.

Clear snow from raised medians to prevent drifting. Also clear snow from barrier walls and traffic dividers to reduce later melting and refreezing and to improve driver visibility.

Clear those drains! It is vital that roadway drains and catch basins be kept open to allow melting ice and snow to run off. When water ponds and puddles around drains, falling temperatures may cause it to refreeze. A salt application on frozen drains, catch basins and culverts frees them of snow and ice.

Accurately record all material used. Hazards, such as raised utilities or low hanging branches, and problems encountered such as area-specific snow accumulations should also be recorded.

Discuss opportunities to improve operations.

Carry out interim cleaning and maintenance of equipment.

At end of season, do full cleaning and maintenance of all equipment and ensure all remaining supply piles are securely placed on impervious pads and covered. ❄️

The main purpose of snow and ice removal is, of course, to provide safe travel for motorists. In doing this, those in maintenance must not overlook their own safety; neither must they overlook the possibility that in trying to provide safe pavement they may be creating another safety hazard.

Become familiar with a few “do’s and don’ts” that can make your work far safer:

- Check all equipment before each use. Make sure lights, brakes, windshield wipers, exhaust systems, tires, chains and steering are safe.
- Promptly report all mechanical trouble.
- Remember that speed can kill, especially in a snowstorm and at night.
- Resist the urge to get the job done in a hurry.
- Respect rights of others. Be considerate of motorists who have trouble driving in snow; report stranded motorists when possible.
- Keep first aid kits completely stocked. Check fire extinguishers and flares often.
- Observe traffic laws.
- Watch for signs of fatigue in equipment operators. A limit of twelve continuous hours on duty seems fairly common in public works agencies in the snow belt, although some organizations permit longer work periods. Usually, however, the routine is twelve hours on and twelve off. ❄️

13 KEEP THE PUBLIC INFORMED

Publicize snow emergency procedures and regulations. Keep broadcasters and newspapers periodically informed of snow clearing progress and specific problem areas. This way, motorists will know on which routes they will be able to travel with the least difficulty. Advance publicity on snow clearing priorities will reduce time-consuming calls from people demanding to know when their streets or roads will be cleared.

Before storms arrive, pass on information about approaching snow in time for schools, industry and government agencies to decide whether or not to remain open or to close early.

Make contact with other agencies. Long before winter, meet with representatives of other public agencies to discuss means of cooperating in snow and ice removal. Take the initiative to let others know of your plans and to enlist their cooperation.

Consider inviting these people to the pre-winter session: a representative of the top elected public official in your area, the local civil defense director, those in charge of bus transportation for school systems, police and fire officials, emergency road service managers of nearby clubs of the American Automobile Association (AAA), officers from local military units and news media representatives.

Snowfighters are not miracle workers. They are dedicated, hardworking human beings who pit their will against the forces of nature — and usually win!

The real record of their accomplishment is not the tons of snow removed or the miles of pavement kept clear or number of streets plowed. The achievement of open highways that allow business, industry and government to function and people to travel safely and without undue delay is the testament of good snowfighting.

According to a Marquette University study, road salting and plowing can reduce crash frequency by 88%.

A one-day major snowstorm can cost a state \$300-700 million in both direct and indirect costs.

Suggested Program Outline For Fall Training Sessions

I. The Importance of Coordination

- Know Your Plowing and Spreading Routes
- Effective Radio Communication
- The Storm Warning System
- Working with Police, other Public Agencies and the Media

II. Equipment—Its Operation and Maintenance

- Plows
- Spreaders, Sprayers and Their Controls
- Loaders
- Emergency Repair and Refueling Stations
- The Importance of Preventive Maintenance

III. Application Procedures

- How Salt Works
- How and when to Salt
- Anti-Icing vs Deicing
- Application Rates
- Special Storm Conditions

- Special Deicing Problems (Bridges, Elevated Curves, Ramps, Intersections)
- When to Re-Apply Salt

IV. Review of Winter Maintenance Policy

- Snow Emergency Routes
- Parking Ordinances
- Procedures for Helping Motorists
- Importance of Personal Public Relations by Maintenance Personnel

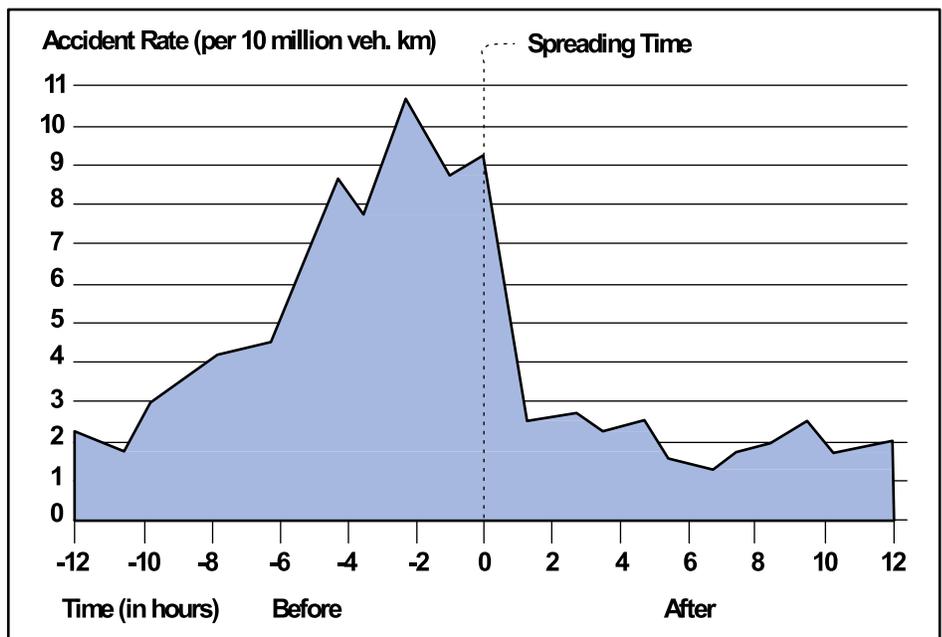
V. On-the-job Safety

- Safety Equipment
- Safety Practices

VI. Discussion, Questions and Answers

To assure yourself that your department is ready for winter, you might have superintendents or foremen complete a checklist showing their progress in pre-winter preparations. *

Accident Rate Before and After Salt Spreading



STORM RECORD



Storm No:			Sec:			Div:			Date:		
1. Time		AM	PM	Day of Week			2. Location			Miles	
Storm Started							From:				
Storm Ended							To:				
Road Cleared											
3. Description											
Dry Snow			Temp			Wind					
Wet Snow			Max:	Min:	Direction:		Velocity	MPH			
Sleet			Depth of Snow			Visibility					
Freezing Rain			Avg (in)	Drifts (ft)		Good:	Fair:	Poor:			
4. Procedures						5. Results					
	No of Apps	Time				Excellent	Good	Poor			
Salt		From:	To:		Salt						
Plowing		From:	To:		Plowing						
Abrasives		From:	To:		Abrasives						
6. Labor, Equipment & Materials											
Personnel		Reg Hrs.	O.T. Hrs.	Total	Equip. No.	Type	Hours	Material (TONS)			
								Salt			
Total											
Comments:											
<p>Completed by: _____</p> <p>Name, Title</p>											

Safe and Sustainable Snowfighting Award Application

The Salt Institute began promoting safe and sustainable snowfighting in 1972, when it began its Sensible Salting Program. Decades later, SI is still leading the way in advancing effective in snowfighting to ensure winter safety, mobility, and protection of the environment.

Partnering with leaders in winter maintenance, SI has expanded its long-standing “Excellence in Storage Award” to include safe and sustainable operations. In 2012, we presented the Salt Institute’s “Safe and Sustainable Snowfighting Award,” a program that recognizes agencies that demonstrate best practices in salt storage and snowfighting.

Clear winter roads protect lives and commerce. Road salting and effective plowing can reduce injury crashes by up to 88%. And a one-day major snowstorm that shuts down roads can cost a state between \$300 and \$700 million in direct and indirect costs. Snowfighting is often an underappreciated vocation, but at the Salt Institute we recognize snowfighters as heroes who protect lives and enable our winter economy.

To apply for the “Safe and Sustainable Snowfighting Award” the facility manager should complete the application form and checklist (found as an insert to this handbook, on saltinstitute.org, or on safewinterroads.org), have it signed by an immediate supervisor and returned with all supporting documentation to the Salt Institute by May 1. Please answer all questions.

Applications will be judged by our evaluation committee and in some cases a Salt Institute representative will make an on-site facility visit.

Award recipients will receive a “Safe and Sustainable Snowfighting Award” certificate and will be recognized in a Salt Institute press release.

Publications Available *from the* Salt Institute



Refer to saltinstitute.org for further details and other literature

Salt Storage Handbook

A guide for environmentally sensitive handling and storing deicing salt.

ABOUT THE SALT INSTITUTE: The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition. See saltinstitute.org or call 703-549-4648.

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ENVIRONMENTAL Fact Sheet



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WD-DWGB-22-1

2011

The N.H. Groundwater Protection Act: RSA 485-C An Overview

Sixty percent of New Hampshire’s residents are dependent on groundwater for their drinking water supplies. New Hampshire’s Groundwater Protection Act, passed in 1991, authorizes DES to regulate large groundwater withdrawals and commercial discharges of wastewater, establishes best management practices that must be employed by activities that are considered potential contamination sources, creates four classes of groundwater (Table 1), establishes groundwater quality standards, and enables local entities, such as water suppliers and town boards, to play a role in actively managing activities having the potential to contaminate valuable groundwater.

Preventing Contamination of Groundwater

Potential contamination sources (PCSs) are activities that use significant quantities of substances that have the potential to contaminate groundwater and/or affect human health. DES has established best management practices (BMPs), codified in Env-Wq 401, involving the use, transfer or storage of regulated substances in containers having a capacity of five or more gallons. The BMPs must be employed by all PCSs in the state.

The act establishes four classes of groundwater: GAA, GA1, GA2 and GB.

Table 1. CLASSES OF GROUNDWATER

Class	Local Inspection Of PCSs	Description/Comments
GAA	Yes	<ul style="list-style-type: none"> • Most protected class • Includes groundwater flowing to public water supply wells (wellhead protection areas). • Prohibits six high risk land uses
GA1	Yes	<ul style="list-style-type: none"> • Local entities identify valuable groundwater resources they want to protect via management of potential contamination sources.
GA2	No	<ul style="list-style-type: none"> • Includes high-yield stratified drift aquifers mapped by the USGS that are potentially valuable sources of drinking water.
GB	No	<ul style="list-style-type: none"> • Includes all groundwater not in a higher classification. As in all classes, groundwater must meet drinking water quality standards.

Under the act, all areas were initially classified as GA2 or GB. Wellhead protection areas and other valuable groundwater may be reclassified to Classes GAA or GA1, with both DES and the local entity (typically the municipality or water supplier) taking on specific responsibilities to prevent groundwater contamination in the reclassified areas. (See Table 1.) For guidance

concerning how to reclassify important groundwater resources, download DES's Guide to Groundwater Reclassification at <http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-24.pdf> or contact the groundwater reclassification program manager at (603) 271-0688.

DES's fact sheet WD-DWGB-22-2 Local Reclassification of Groundwater to Implement Protection Programs: A Six Step Process, provides a summary of the process and is available online at <http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm>.

The DES Groundwater Discharge Permitting and Registration Program regulates commercial discharges to groundwater to minimize improper disposal of waste and wastewater containing solvents, petroleum products and other industrial and commercial wastes. All discharges of non-domestic wastewater to the ground must be registered with, and in some cases permitted by, the DES Water Division. In all cases state rules prohibit any discharge of non-domestic wastewater containing regulated contaminants above ambient groundwater quality standards established under the act. For more information visit the program's webpage at http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge/index.htm.

Preventing Unacceptable Impacts from Groundwater Withdrawals

To address concerns about the impacts of groundwater withdrawals, the act, along with the N.H. Safe Drinking Water Act, was amended in 1998 to give DES the authority to regulate groundwater withdrawals in excess of 57,600 gallons over a 24-hour period. The act ensures that no adverse impacts to water users or groundwater-dependent natural resources will occur. Adverse impacts as defined under the act include reducing the withdrawal capacity of private and public water supply wells, reducing river flows below acceptable levels established pursuant to the Rivers Management and Protection Act, or altering the flow or movement of any existing groundwater contamination. For more information concerning large groundwater withdrawals, see WD-DWGB-22-15, Large Groundwater Withdrawal Permitting Process for Major Projects at <http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm>.

The New Hampshire Groundwater Protection Act is available online at www.gencourt.state.nh.us/rsa/html/indexes/485-C.html or you may contact the DES Source Water Protection Program, (603) 271-0688.

Note: This fact sheet is accurate as of December 2011. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.

WD-DWGB-22-10

2015

Wastewater Discharges from Vehicle Washing

Water used in washing cars, trucks, and other vehicles may contain a wide range of contaminants. These contaminants can include oil, fuels and other hydrocarbons, metals, detergents, road salt and grit. Discharged into surface waters, these contaminants can degrade water quality and harm aquatic life. Discharged into groundwater, they can make water unfit for drinking. To avoid these problems and the legal consequences that may result, the following guidelines apply to facilities where vehicles are washed on a regular basis and the wash water is collected by a conveyance such as a drain, catch basin, ditch or swale and infiltrated to the ground or groundwater*. Owners of facilities that conduct washing activities have four options for their wastewater discharges:

1. Operate a closed system with wastewater recycling (no discharge of wastewater).
2. Discharge to a municipal sanitary sewer.
3. Obtain a groundwater discharge permit.
4. Obtain registration to wash fewer than 30 vehicles per week and discharge to the ground *surface only*.

1. Closed System with No Discharge

This does not require a permit. However, it may require a “Holding Tank Registration” if the treatment system has a grit and oil tank that is pumped out. The water and sludge that are pumped from the tank must be collected and disposed of at an approved disposal facility, i.e., a wastewater treatment plant or hazardous waste disposal facility, depending on the nature of the material.

2. Discharge to Municipal Sanitary Sewer

Connections to your municipal sanitary sewer are controlled by the local sewer authority. Contact the local authority regarding restrictions. Some local sewer authorities do not allow connection of floor drains, while others allow connection only with adequate pretreatment, e.g., an oil/grit separator, or other controls. If you connect an existing floor drain to a municipal sanitary sewer, you still need to notify NHDES.

* These restrictions do not apply to occasional vehicle washing, such as at residences or occasional events such as fundraising car washes. For more information on community car washes and water quality see fact sheet WD-WMB-14 “Community Car Washes and Water Quality” at <http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-14.pdf>.

4. Wash Fewer than 30 Vehicles per Week

If you wash fewer than 30 vehicles per week, you may be able to discharge indirectly to groundwater without obtaining a groundwater discharge permit. However, you need to follow Env-Wq 401 Best Management Practices for Groundwater Protection to avoid contamination of your wash water with regulated substances. You also need to register your discharge and floor drain, if any. To avoid having to obtain a groundwater discharge permit, you must meet *all* of the following conditions:

- a. Best Management Practices for Groundwater Protection are followed.
- b. The floor drain is *not* in an area where regulated contaminants are used or stored.
- c. The wastewater:
 - Is *not* from power washing, steam cleaning, engine cleaning or undercarriage cleaning.
 - Does *not* contain soaps or other products that contain regulated contaminants.
 - Does *not* result in a surface water discharge.
 - Discharges to the ground surface.
 - Contains only approved detergents.
 - Leads to an oil-water separator or other pretreatment method prior to infiltration.
 - Is registered with DES in accordance with [Env-Wq 40 2 .33](#) .

Owners of facilities with these discharges are responsible for ensuring that regulated contaminants are not discharged and that groundwater is suitable for drinking without treatment.

Surface Water Discharges

In order to adequately protect the quality of surface water in New Hampshire, direct discharges of wastewater derived from car washing into surface water is **prohibited**. For more information about permitting of discharges to surface water, contact the DES Wastewater Engineering Bureau at (603) 271-3908.

For Additional Information

For more information about groundwater discharges, holding tank registration, floor drain registrations, and rules, please visit the DES Drinking Water Source Protection webpage at <http://des.nh.gov/organization/divisions/water/dwgb/dwsp/index.htm>, or call (603) 271-2858.

For additional information, please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or dwgb_info@des.nh.gov, or visit <http://des.nh.gov/organization/divisions/water/dwgb/index.htm>. All of the bureau's fact sheets are on-line at <http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm>.

Note: This fact sheet is accurate as of June 2010. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.

TITLE L: WATER MANAGEMENT AND PROTECTION

485-C:5 Classes of Groundwater:

- I. All groundwater shall be classified for the purpose of prescribing protections and management practices. These classifications do not necessarily reflect existing water quality. For purposes of classification, all groundwater shall be assigned to one of 4 classes as follows:
 - a. Class GAA groundwater shall be the most protected class. Groundwater in this class is within the wellhead protection area for wells which presently are used or well sites which have been identified for future use as drinking water supply for public water systems. An inventory of potential contamination sources in the wellhead protection area shall be conducted, and a management program shall be implemented as provided under RSA 485-C:8.
 - b. Class GA1 shall be assigned to groundwater in a defined zone of high value for present or future drinking water supply. An inventory of potential contamination sources in the contributing area of this class shall be conducted, and a management program shall be implemented as provided under RSA 485-C:8.
 - c. Class GA2 shall be assigned to groundwater within aquifers identified as highly productive for potential use as a public water supply by the U.S. Geological Survey regional groundwater studies, or other regional studies. Zones of stratified drift with a saturated thickness greater than 20 feet, and a transmissivity greater than 1,000 feet squared per day shall be designated as class GA2. Zones of bedrock with average well yields greater than 50 gallons per minute shall also be designated as class GA2.
 - d. Class GB shall be assigned to all groundwater not assigned to a higher class.
- II. The land area vertically above shall be assigned to the highest class of groundwater beneath it, for purposes of managing potential contamination sources.

485-C:12 Prohibited Uses: Within any wellhead protection area classified as GAA, the following new uses are prohibited:

- I. The siting or operation of a hazardous waste disposal facility as defined under RSA 147-A.
- II. The siting or operation of a solid waste landfill.
- III. The outdoor storage of road salt or other deicing chemicals in bulk.
- IV. The siting or operation of a junk or salvage yard.
- V. The siting or operation of a snow dump.
- VI. The siting or operation of a wastewater or septage lagoon.

Source. 1991, 344:1, eff. June 28, 1991.

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WD-DWGB-22-13

2010

Groundwater Rights and the Groundwater Protection Act

Several questions often arise when groundwater withdrawals are considered, among them “Who owns groundwater?” and “Which laws govern groundwater withdrawals?” Groundwater is a shared resource in New Hampshire. Therefore the question of “who owns groundwater” may better or more practically be restated as who has the right to use water and how much? New Hampshire’s water rights system is based on common law (law that is based on historic court decisions opposed to written codified law). New Hampshire’s common law with respect to water use is governed by the doctrine of reasonable use. “Reasonable use” is generally taken to mean that one property owner’s water use may not unreasonably interfere with the water use of another property owner, regardless of which use was established first. “Reasonable use” is a mixed question of fact and law, and the standard may change over time – so what was once reasonable may over time become unreasonable.

Because the movement of groundwater does not respect municipal boundaries, it makes sense that the state is the entity that can regulate or restrict groundwater use. New Hampshire’s Groundwater Protection Act (RSA 485-C) is intended to ensure that new “large” groundwater withdrawals (those that exceed 57,600 gallons over any 24-hour period) do not adversely impact the quality or quantity of groundwater or water resources such as neighboring wells, wetlands, streams, rivers and lakes. Since August 1998, any proposed “large” groundwater withdrawal must undergo a comprehensive permitting process to demonstrate that other water users or water resources (lakes, rivers and wetlands) would not be adversely impacted. The permitting process includes public notification, two public hearings, extensive field testing and assessment of data, and development of an environmental monitoring, reporting, and mitigation plan.

It is important to note that RSA 485-C does not replace common law with respect to water rights; rather, common law coexists with the statute. This means that landowners developing a groundwater withdrawal of any amount have a right to reasonable use of the water under common law, that large new groundwater withdrawals are regulated under RSA 485-C, and that civil cases may be brought to the courts to resolve conflicts when the water rights of another land owner are unreasonably impacted by any withdrawal.

More information about the DES Large Groundwater Withdrawal Permitting Program may be found at http://des.nh.gov/organization/divisions/water/dwgb/dwgb_pplg_witdrawals/index.htm.

For Additional Information

Please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or dwgbinfo@des.nh.gov or visit our website at <http://des.nh.gov/organization/divisions/water/dwgb/index.htm>. All of the bureau’s fact sheets are on-line at <http://des.nh.gov/organization/committees/pip/factsheets/dwgb/index.htm>. All drinking water and related rules can be accessed at <http://des.nh.gov/organization/committees/legal/rules/index.htm#drinking>.

Note: This fact sheet is accurate as of June 2010. Statutory or regulatory changes, or the availability of additional information after this date may render this information inaccurate or incomplete.

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WD-DWGB 22-4

2009

Best Management Practices (BMPs) for Groundwater Protection

Sixty percent of New Hampshire residents rely primarily on groundwater for their drinking water. Recognizing the importance of protecting the natural quality of groundwater, the legislature passed the Groundwater Protection Act (RSA 485-C) in 1991. This legislation recognized that a wide variety of activities involve the use of materials that can, if not properly handled, contaminate groundwater. There have been numerous instances of groundwater contamination in New Hampshire from leaking storage facilities, improper waste disposal, accidental spills, and even from normal use of these materials. Potentially contaminating substances can be more safely managed if certain basic guidelines are followed. The Groundwater Protection Act directed the N.H. Department of Environmental Services to adopt rules specifying best management practices (BMPs) for the Potential Contamination Sources (PCSs) listed below.

DES developed and adopted N.H. Code of Administrative Rules Part Env-Wq 401 Best Management Practices for Groundwater Protection, (formerly Env-Ws 421) which apply to all potential contamination sources in the state. The BMPs within the rules are essentially common-sense operating practices that are simple and economical to implement. The purpose of the BMPs is to help prevent a release of regulated substances. Regulated substances include oil, as defined under RSA 146-A, III, regulated contaminants established pursuant to RSA 485-C:6, and hazardous substances listed under federal regulations at 40 CFR 302. Cleaning up the release of a regulated substance can be very expensive. Following the BMP rules reduces environmental liability and minimizes potential cleanup costs.

Potential Contamination Sources (PCSs) ¹	
<ul style="list-style-type: none"> • Vehicle service and repair shops • General service and repair shops • Metalworking shops • Manufacturing facilities • Underground and above-ground storage tanks • Waste and scrap processing and storage • Transportation corridors • Septic systems (at commercial and industrial facilities) • Laboratories and certain professional offices (medical, dental, veterinary) 	<ul style="list-style-type: none"> • Use of agricultural chemicals² • Salt storage and use • Snow dumps • Stormwater infiltration ponds or leaching catch basins • Cleaning services • Food processing plants • Fueling and maintenance of earth moving equipment • Concrete, asphalt, and tar manufacture • Cemeteries • Hazardous waste facilities
<p>¹As identified in New Hampshire's Groundwater Protection Act (RSA 485-C)</p> <p>²Subject to BMPs developed and administered by NH Dept. of Food, Agriculture, and Markets</p>	

Summary of BMP for Groundwater Protection Rules

Storage

- Store regulated substances on an impervious surface.
- Secure storage areas against unauthorized entry.
- Label regulated containers clearly and visibly.
- Inspect storage areas weekly.
- Cover regulated containers¹ in outside storage areas.
- Keep regulated containers that are stored outside more than 50 feet from surface water and storm drains, 75 feet from private wells, and up to 400 feet from public wells.
- Secondary containment is required for regulated containers stored outside, except for on-premise use heating fuel tanks, or aboveground or underground storage tanks otherwise regulated.

Handling

- Keep regulated containers closed and sealed.
- Place drip pans under spigots, valves, and pumps.
- Have spill control and containment equipment readily available in all work areas.
- Use funnels and drip pans when transferring regulated substances; perform transfers over impervious surface.

Release Response Information

- Post information on what to do in the event of a spill.

Floor Drains and Work Sinks

- Cannot discharge into or onto the ground.

¹Regulated container means any device in which a regulated substance is stored, transported, treated, disposed of, or otherwise handled, with a capacity of five gallons or more. The term does not include fuel tanks attached to and supplying fuel to a motor vehicle.

For more information on best management practices for groundwater protection visit the DES Drinking Water Source Protection webpage at <http://des.nh.gov/organization/divisions/water/dwgb/dwsp/index.htm>, or contact the NH Department of Environmental Services at (603) 271-2947 or (603) 271-0688.

Disclaimer: Statutory information contained in this fact sheet is current as of February 2, 2007. Statutory or regulatory changes that may occur after February 2, 2007, may cause part or all of the information to be invalid. If there are any questions concerning the status of the information, please contact DES at (603) 271-3644.

ENVIRONMENTAL Fact Sheet



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WMB-3

2015

Snow Disposal Guidelines

Introduction

Each winter, the Department of Environmental Services receives numerous complaints related to snow disposal into and/or near surface water. There are several different concerns regarding disposal of snow cleared from streets and parking lots ranging from aesthetic concerns, such as minimizing the visibility of debris and huge snow piles, to environmental concerns, such as protection of groundwater quality, drinking water supplies, surface water quality and aquatic life.

The environmental impacts of disposed snow result from high levels of salt, sand, debris and trash, along with contaminants from automobiles including oil and exhaust. The debris and contaminants that inevitably end up in plowed snow make it illegal to dump snow directly into water bodies. RSA 485-A:13, I(a) prohibits discharging wastes to surface waters without a permit. In addition to water quality impacts, snow disposed in open water can cause dangerous ice jams.

Groundwater is sensitive to snow dumping due to the high levels of chloride and automotive waste in plowed snow. RSA 485-C:12 prohibits the siting or operation of snow dumps within classified wellhead protection areas.

Refer to the following guidelines for siting legal snow dumps and protecting New Hampshire's water.

Recommended Guidelines for Snow Disposal

These guidelines will assist in identifying snow disposal sites that minimize impact to the environment. Please note that snow dumps are kept out of water bodies due to waste materials, such as litter and debris. Waste does not belong on the land surface either; after the snow melts, all waste must be collected and disposed of properly.

- Disposed snow should be stored near flowing surface waters, but at least 25 feet from the high water mark of the surface water and/or top of stream bank. If a site cannot be found near a flowing surface water, then upland sites further from surface waters are acceptable, provided they do not impact water supply sources as described below.
- A silt fence or equivalent barrier should be securely placed between the snow storage area and the high water mark and/or the top of stream bank with care taken not to exceed the barrier with over-piling. This area should also be accessible for post-melt cleanup. Note: silt fence must be installed prior to the ground freezing.



Manchester NH sign prohibiting snow dumping. Photo: Robert Robinson, City of Manchester

WD-DWGB-22-30

2011

Storage and Management of Deicing Materials

Storage and management of deicing material can be a source of contamination of surface water and groundwater, causing a violation of state water quality standards. These salt-based products dissolve in precipitation and either infiltrate through the ground surface to groundwater, or run off into surface water. Salt that infiltrates the subsurface at significant concentrations can also react with the soils and release metals into groundwater and surface water at concentrations that exceed water quality standards.

The term “deicing material” used here refers to deicing salts, and may include any of the following in either solid or liquid form: sodium chloride (often called rock salt), potassium chloride, calcium chloride, magnesium chloride, and other mixtures that contain salts (chlorides) including mixtures with abrasives, such as sand, cinder, slag, etc.

Need for Proper Management

Due to their high potential for causing groundwater and surface water pollution, salt storage facilities should not be placed in environmentally sensitive areas. The best strategy to prevent pollution from deicing materials and the associated liability is to use and store these materials responsibly. Facilities should develop good housekeeping practices to minimize loss and waste during the delivery, storage, loading and management of deicing materials.

Existing and new facilities that operate without impermeable surfaces and infiltrate brine to the ground or groundwater need to register with DES under Env-Wq 402 Groundwater Discharge Permit and Registration Rules. This is a free registration and is a method of tracking potential contaminant sources. If there are sensitive receptors nearby, some sites may be required to monitor drinking water wells and/or the groundwater. The registration form can be found at: http://des.nh.gov/organization/divisions/water/dwgb/dwsp/bmps/documents/floor_drain_form.pdf.

Best management practices (BMPs) for locating a new deicing materials storage facility should include the following:

- The facility should be located in an area that is not environmentally sensitive. Avoid areas where there are wells, reservoirs, or within the footprint of stratified-drift aquifers.
- The facility should be located on a flat site away from surface water and wetlands.
- Site drainage should be designed to direct clean stormwater away from the operations and storage areas in order to keep the stockpiles as dry as possible.

- Drainage that is contaminated with salt should be directed to a sewage treatment plant (subject to municipal approval), collected for use in pre-wetting activities or sent for proper disposal.

Structures and Work Areas

Ideally deicing material storage facilities should be completely enclosed, with storage and working areas on impervious surfaces such as asphalt or coated concrete. There should be stormwater drainage controls to prevent runoff water and snow melt from contacting or running through loading and material storage areas. Overhead cover to protect material from exposure to snow and rain should be installed to minimize runoff and inventory loss. A fixed roof is preferred over a tarp, because it is very difficult to keep storage piles completely covered with tarps during winter months and storm events.

Buildings should have concrete foundations and can be designed using dome, barn, or fabric style structures. For more information on constructing salt storage units, calculating how much space is needed for storage, and salting practices, see the Salt Institute's publications at www.saltinstitute.org/. *The Salt Storage Handbook* contains tables that indicate how much space is required to cover different height piles, and provides surface areas of exposed salt piles, to help in calculating number and size of tarps for *temporarily* covering salt piles.

The following BMPs should be considered when storing and managing deicing materials.

Storage Structures

- All salt and sand/salt mixtures should be stored on pads of impermeable asphalt or concrete. Storage and loading areas should have an impermeable floor constructed of asphalt, concrete or other suitable material that extends around the buildings and work area exterior. The area should be sloped away to prevent stormwater from entering the loading areas or structure.
- Concrete pads and walls should be treated to prevent concrete deterioration (spalling).
- Structure hardware should be galvanized and concrete block buildings should be waterproofed inside.
- If using a three-sided building, the exposed salt at the open end should be covered.
- Stormwater and snowmelt runoff should be properly controlled. Building floors and storage pads should be sloped to prevent ponding and allow any water to drain away from the storage piles.

On-Site Management: Delivery/Handling/Loading

- All sand and sand/salt mixtures temporarily out in the open should be covered to prevent salt from being washed or blown from the pile.
- If a permanent under-roof work area is not possible, then storage and handling activities should be conducted on impermeable (bituminous) pads. Any deicing materials left outdoors should be completely covered with waterproof tarpaulins.
- All surplus materials must be removed from the site when winter activity is finished.
- Working areas should be bermed and sloped to allow snow melt and stormwater to drain away from the area. In some cases, it may be necessary to channel water to a collection point, such as a sump, holding tank, or lined basin for collection.
- Storage and distribution should only be conducted during the fall/winter season.

- Spreaders should not be overloaded such that material spills off the vehicle. A plan for loading operations to prevent overfilling vehicles and eliminating material spillage during transportation should be developed and implemented.
- Salt spilled at the storage yard and loading areas should be collected and returned to the storage pile.
- Annual inspection and repairs should be carried out prior to the start of each season. Ongoing inspection of storage structures, work areas, and deicing liquid storage tanks should be carried out during the season.
- Solid bagged materials should be stored securely, indoors if possible.
- Spreaders should only be washed at a location where the wash water is properly managed. (See DES fact sheet WD-DWGB-22-10 Management of Vehicle Wash Water.)
- Liquid storage tanks should be designed such that a plumbing failure will not result in release of the contents. Backflow prevention may be necessary on some plumbing applications.
- Liquid storage tanks should be protected from impact from vehicles moving about the yard and be located such that spilled material can be contained and retrieved in the event of a tank or piping failure. Secondary containment should be provided around large liquid storage tanks.

Brine Storage and Management

In recent years brine has been used on roads prior to storms as an effective ice preventative, reducing the amount of deicing materials needed during a storm event. The water that runs off storage and loading areas can be collected into watertight tanks or lined basin(s) and re-used in pre-storm wetting of roads. Any brine storage should be designed with inert materials that are compatible with salt.

Brine stored using holding tanks must be managed so that there are no releases to drains, groundwater or surface waters. If there is a floor drain in a building where brine is stored, it must be connected to a municipal sewer system (with the approval of the local authority), routed to a registered holding tank or permanently sealed. (see fact sheet WD-DWGB-22-8 Holding Tanks for Floor Drains)

Storage ponds or collection basins used for brine storage must be lined and must not receive runoff from areas other than the storage and operations areas. The basin itself must be impermeable to prevent infiltration of the collected water into the ground. The basin may need a roof or cover to reduce the accumulation of snow and rain water. The collection of this runoff water would only be necessary during the winter maintenance months (November through March). During the remaining seven months of the year, the non-brine stormwater can be redirected from the brine storage to a natural discharge point.

The preferred management option for any brine collected is for use as a pre-wetting agent for roads prior to winter storms. The release of this collected water to the ground, groundwater, or a stormwater system during operation or at season's end is not permissible and as a consequence, this type of runoff management may require disposal of the brine by one of the following methods: (1) discharge directly to a publicly owned treatment works (POTW) with local approval; (2) pumping and transporting the salt water to a POTW system by tank truck; (3) evaporation; or (4) treatment to remove salt and on-site discharge under a Nondomestic Wastewater Registration.

For Additional Information

For more information, please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or dwgbinfo@des.nh.gov, or visit our website at

<http://des.nh.gov/organization/divisions/water/dwgb/index.htm>. All of the bureau's fact sheets are online at <http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm>.

References:

Salt Institute (www.saltinstitute.org)

Michigan Department of Environmental Quality (www.michigan.gov/deq/)

Salt and Brine Storage Guidance

Guide to Salt Storage Requirements for Small Commercial Snow Removal Services

Environnement Canada (<http://www.ec.gc.ca/nopp/roadsalt/en/index.cfm>)

Best Management Practices for Salt Use on Private Roads, Parking Lots & Sidewalks

SIMA (Snow & Ice Management Assoc.) www.sima.org

**NH Road Salt Application Rates for Deicing Parking Lots
(Pounds per 1000 sq.ft.)**

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewet/ Pretreated with salt brine	Salt Prewet/ Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	4.5	4	4.5	Not recommended
	Frz. Rain	Apply chemical	5.75	5.25	6.5	Not recommended
30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	7	6.5	8.25	10.5
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	8.75	7.5	10	10.5
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	8.25	7.5	10	10.5 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	10	Not recommended	13 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

**NH Road Salt Application Rates for Deicing Roads
(Pounds per Lane Mile)**

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewet/ Pretreated with salt brine	Salt Prewet/ Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	150	125	150	Not recommended
	Frz. Rain	Apply chemical	175	150	200	Not recommended
30 ↓	Snow	Plow and apply chemical	175	150	200	Not recommended
	Frz. Rain	Apply chemical	200	175	225	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	200	175	225	Not recommended
	Frz. Rain	Apply chemical	225	200	225-275	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	250	200	275	Not recommended
	Frz. Rain	Apply chemical	275	250	275-300	450
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	275	275	275-300	450 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	275	250	300-325	Not recommended
	Frz. Rain	Apply chemical	300	275	325-400	450
15 - 20 ↑	Snow	Plow and apply chemical	300	275	325	Not recommended
	Frz. Rain	Apply chemical	300-375	275-350	325-400	450
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	325	300	350	450 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300-350	Not recommended	600 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	350-500	Not recommended	600 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Winter Maintenance Guidelines for Porous Asphalt

<p>General Maintenance</p>	<ul style="list-style-type: none"> • Plow after every storm. Special plow blades may be used to prevent scarring but are not necessary. Raised blade is not recommended • Up to ~75% net salt reductions for porous asphalt have been documented. USE SALT REDUCTION NUMBERS WITH CAUTION!!! • Excess salt application maybe needed during challenging storm events. Salt reductions typically occur between storm events with no black ice formation. • Salt reduction amounts are site specific and are affected by degree of shading and hours of operation. • Apply anti-icing treatments prior to storms. Anti-icing has the potential to provide the benefit of increased traffic safety at the lowest cost and with less environmental impact. • Apply deicing treatments during, and after storms as necessary to control compact snow and ice not removed by plowing. • Sand application should be limited since its use will increase the need for vacuuming. • Mixed precipitation and compact snow or ice is problematic for all paved surfaces, but is particularly problematic for porous surfaces. This is corrected by application of excess deicing chemicals. • Recommended posting of signs indicating difference of performance after sunrise and sunset.
<p>During Event</p>	<ul style="list-style-type: none"> • Apply standard amounts of deicing agents during storm events. • Amounts will be adjusted based on site specific requirements, hours of operation, and degree of shading. • Additional Deicing may be required during challenging storm events.
<p>Between Storms</p>	<ul style="list-style-type: none"> • Deicing is NOT required for black ice development. Meltwater readily drains through porous surfaces thereby preventing black ice. • Night time deicing may require additional maintenance activities. • Daytime deicing may be minimal once pavement is exposed to sunlight.
<p>Additional Resources</p>	<ul style="list-style-type: none"> • The UNH Stormwater Center: http://www.unh.edu/erg/cstev/ • Pennsylvania Asphalt Pavement Association (PAPA) Porous Asphalt Pavements Guide: http://www.pahotmix.org/PDF/porous1.pdf • National Asphalt Pavement Association (NAPA) Porous Asphalt Pavements for Stormwater Management Revised 11/2008, Information Series 131

NHDES HIRING A NH CERTIFIED GREEN SNOWPRO APPLICATOR FLYER





Hiring a NH Certified Green SnowPro as your snow removal contractor will help protect you and your company from slip and fall claims arising from snow and ice conditions.

What can you do?

Look for a certified salt applicator at

<http://des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/salt-applicator-certification.htm> or ask your current contractor to take the Green SnowPro course and become certified.

How can your organization benefit from the certification?

Reduce Your Liability

Under RSA 508:22, certified applicators **and those who hire them** are granted liability protection from claims arising from snow and ice conditions (slip and fall claims).

Certified Green SnowPros

NH Certified Green SnowPros are leaders in the snow removal industry who are trained in the most up to date technologies and snow management practices to ensure a high level of service and safety to their customers.

Reduce Impacts to Local Waterbodies

Once in our water supplies, there is no practical way to remove salt. Certified Green SnowPros are trained in salt reduction practices to help ensure clean water for future generations.

Why is salt reduction important?

As of 2014, 46 water bodies in New Hampshire are polluted with chloride due to road salt application. In several watersheds analyzed in the southern I-93 corridor, more than 50% of the salt load comes from private roads and parking lots. The other major sources are state and local roads and highways.

Training

For upcoming Green SnowPro Training dates

<http://t2.unh.edu/green-snowpro-training-and-certification>

For more information:

Visit www.des.nh.gov and see "Road Salt Reduction" under the A-Z list.



Contact: Salt Coordinator

salt@des.nh.gov

(603) 271-5329