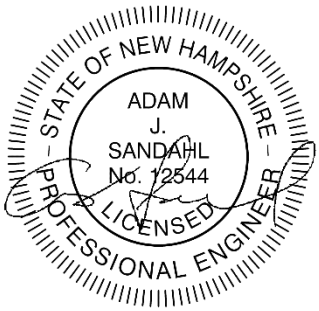
Granite State Landfill, LLC

Alteration of Terrain Permit Application

Granite State Landfill

Dalton, New Hampshire

November 2023



Submitted to:

NHDES Water Division – Alteration of Terrain Bureau
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03303-0095

Submitted by:

Granite State Landfill, LLC
1855 Vermont Route 100
Hyde Park, VT 05655

Prepared by:

CMA ENGINEERS
Civil and Environmental Engineers
35 Bow Street
Portsmouth, New Hampshire 03801

Alteration of Terrain Permit Application
Granite State Landfill, LLC
Granite State Landfill
Dalton, New Hampshire

November 2023

Loose:
Application Form and Checklist
Check for Application Fee
USGS Map

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ALTERATION OF TERRAIN PERMIT APPLICATION

Water Division/ Alteration of Terrain Bureau/ Land Resources Management
Check the Status of your Application: www.des.nh.gov/onestop

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: Granite State Landfill, LLC	Contact Name: John Gay	
Email: john.gay@casella.com	Daytime Telephone: (802) 651-5454	
Mailing Address: 1855 Vermont Route 100		
Town/City: Hyde Park	State: VT	Zip Code: 05655
2. APPLICANT'S AGENT INFORMATION If none, check here: ☒		
Business Name:	Contact Name:	
Email:	Daytime Telephone:	
Address:		
Town/City:	State:	Zip Code:
3. PROPERTY OWNER INFORMATION (IF DIFFERENT FROM APPLICANT)		
Applicant Name: N/A	Contact Name: Douglas Ingerson	
Email: rocks.dirt2022@gmail.com	Daytime Telephone:	
Mailing Address: Douglas Drive		
Town/City: Dalton	State: NH	Zip Code: 03598
4. PROPERTY OWNER'S AGENT INFORMATION If none, check here: ☒		
Business Name:	Contact Name:	
Email:	Daytime Telephone:	
Address:		
Town/City:	State:	Zip Code:
5. CONSULTANT INFORMATION If none, check here: ☐		
Engineering Firm: CMA Engineers, Inc.	Contact Name: Adam Sandahl	
Email: asandahl@cmaengineers.com	Daytime Telephone: (603) 627-0708	
Address: 1 Sundial Avenue, Suite 510N		
Town/City: Manchester	State: NH	Zip Code: 03103

6. PROJECT TYPE

☐ Excavation Only ☐ Residential ☒ Commercial ☐ Golf Course ☐ School ☐ Municipal
☐ Agricultural ☐ Land Conversion ☒ Other: Landfill

7. PROJECT LOCATION INFORMATION

Project Name: Granite State Landfill

Street/Road Address: 172 Douglas Drive

Town/City: Dalton/Bethlehem	County: Coos/Grafton

Tax Map: 406	Block:	Lot Number: 2.1 and 3	Unit:

Location Coordinates: 44.331N,71.695W ☒ Latitude/Longitude ☐ UTM ☐ State Plane

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:	☐ Yes ☒ No	☐ Withdrawal	☐ Discharge
2. Man-made pond created by impounding a stream or wetland Purpose:	☐ Yes ☒ No	☐ Withdrawal	☐ Discharge
3. Unlined pond dug into the water table Purpose:	☐ Yes ☒ No	☐ Withdrawal	☐ Discharge

Post-development, will the proposed project discharge to:

- A surface water impaired for phosphorus and/or nitrogen? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen**
- A Class A surface water or Outstanding Resource Water? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen**
- A lake or pond not covered previously? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus in the lake or pond**

Is the project a High Load area? ☒ Yes ☐ No
If yes, specify the type of high load land use or activity: Landfill

Is the project within a Water Supply Intake Protection Area (WSIPA)? ☐ Yes ☒ No
Is the project within a Groundwater Protection Area (GPA)? ☐ Yes ☒ No
Will the well setbacks identified in Env-Wq 1508.02 be met? ☒ Yes ☐ No

Note: Guidance document titled "*Using NHDES's OneStop WebGIS to Locate Protection Areas*" is available online. 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? ☐ Yes ☒ No
If yes: Cut volume: _____ cubic feet within the 100-year floodplain
Fill volume: _____ cubic feet within the 100-year floodplain

☒ Project **IS** within **¼ mile of a designated river** Name of River: Ammonoosuc River
☐ Project is **NOT** within ¼ mile of a designated river

☐ Project **IS** within **a Coastal/Great Bay Region community** - **include info required by Env-Wq 1503.08(l) if applicable**
☒ Project is **NOT** within a Coastal/Great Bay Region community

8. BRIEF PROJECT DESCRIPTION (PLEASE DO NOT REPLY "SEE ATTACHED")

This project is for the development of the Granite State Landfill project, which will consist of tree clearing, wetland filling (permitted seperately) construction of lined landfill and berms, site infrastructure area, roadway improvements, and stormwater facilities.

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)[1]: 11/7 /2023
(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)[2]: 11/7 /2023
(Attach proof of delivery)

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

D. Additional plans required: ☒ Stormwater Drainage & Hydrologic Soil Groups ☒ Source Control ☐ Chloride Management

E. Total area of disturbance: 6,400,000 square feet

F. Additional impervious cover as a result of the project: 578,100 square feet (use the "-" symbol to indicate a net reduction in impervious coverage).
Total final impervious cover: 1,152,200 square feet

G. Total undisturbed cover: +/-20,000,000 square feet

H. Number of lots proposed: N/A

I. Total length of roadway: 8,500 linear feet

J. Name(s) of receiving water(s): Alder/Hatch Brook

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

Type of Approval	Application Filed?	Status	
		Pending	If Issued:
1. Water Supply Approval	☐ Yes ☒ No ☐ N/A	☐	Permit number:
2. Wetlands Permit	☒ Yes ☐ No ☐ N/A	☒	Permit number:
3. Shoreland Permit	☒ Yes ☐ No ☐ N/A	☒	Permit number:
4. UIC Registration	☐ Yes ☐ No ☒ N/A	☐	Registration date:
5. Large/Small Community Well Approval	☐ Yes ☐ No ☒ N/A	☐	Approval letter date:
6. Large Groundwater Withdrawal Permit	☐ Yes ☐ No ☒ N/A	☐	Permit number:
7. Other: DES-WMD Std. Permit	☒ Yes ☐ No	☒	Permit number:

L. List all species identified by the Natural Heritage Bureau as threatened or endangered or of concern: Marsh Horsetail and Common Loon

M. Using NHDES's Web GIS OneStop program (www2.des.state.nh.us/gis/onestop/), 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/applicant's agent have a pre-application meeting with AOT staff? ☒ Yes ☐ No
If yes, name of staff member: Ridge Mauck

O. Will blasting of bedrock be required? ☐ Yes ☒ No If yes, estimated quantity of blast rock: _____ cubic yards
If yes, standard blasting BMP notes must be placed on the plans, available at:
http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-10-12.pdf

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 AOT staff for additional detail.

[1] 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.

[2] 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.

11. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

LOOSE:

- ☒ Signed application form: des.nh.gov/organization/divisions/water/aot/index.htm (with attached proof(s) of delivery)
- ☒ Check for the application fee: des.nh.gov/organization/divisions/water/aot/fees.htm
- ☒ Color copy of a USGS map with the property boundaries outlined (1" = 2,000' scale)
- ☒ If 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.

BIND IN A REPORT IN THE FOLLOWING ORDER:

- ☒ Copy of the signed application form & application checklist (des.nh.gov/organization/divisions/water/aot/index.htm)
- ☒ 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
- ☒ Web GIS printout with the "Surface Water Impairments" layer turned on - http://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx
- ☒ Web GIS printouts with the AOT screening layers turned on - http://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx
- ☒ NHB letter using DataCheck Tool – www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/
- ☒ The Web Soil Survey Map with project's watershed outlined – websoilsurvey.nrcs.usda.gov
- ☒ Aerial photograph (1" = 2,000' scale with the site boundaries outlined)
- ☒ Photographs representative of the site
- ☒ Groundwater Recharge Volume calculations (one worksheet for each permit application): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- ☒ BMP worksheets (one worksheet for each treatment system): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- ☒ Drainage analysis, stamped by a professional engineer (see Application Checklist for details)
- ☒ 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, *Site-Specific Soil Mapping Standards for NH & VT, SSSNNE Special Publication No. 3*.
- ☒ Infiltration Feasibility Report (example online) [Env-Wq 1503.08(f)(3)]
- ☐ Registration and Notification Form for Storm Water Infiltration to Groundwater (UIC Registration-for underground systems only, including drywells and trenches): (http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge)
- ☒ 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 & post-development color coded soil plans on 11" x 17" (see Application Checklist for details)
- ☒ Pre & post-development 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 Checklist for Details

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

12. REQUIRED SIGNATURES

JBG By initialing here, I acknowledge that I am required by Env-Wq 1503.20(e) to submit a copy of all approved documents to the department in PDF format on a CD within one week after permit approval.

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.

☒ **APPLICANT** ☐ **APPLICANT'S AGENT:**

Signature: J. Gay Date: 4/4/23

Name (print or type): John Gay, Granite State Landfill, LLC Title: Region Engineer

☒ **PROPERTY OWNER** ☐ **PROPERTY OWNER'S AGENT:**

Signature: Douglas Ingerson Date: 4-14-23

Name (print or type): Douglas Ingerson Title: Property Owner

ATTACHMENT A:
ALTERATION OF TERRAIN PERMIT APPLICATION CHECKLIST

Check the box to indicate the item has been provided or provide an explanation why the item does not apply.

DESIGN PLANS

☒ Plans printed on 34 - 36" by 22 - 24" white paper

☒ PE stamp

☒ Wetland delineation

☒ Temporary erosion control measures

☒ Treatment for all stormwater runoff from impervious surfaces such as roadways (including gravel roadways), parking areas, and non-residential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the NH Stormwater Management Manual.

☒ Pre-existing 2-foot contours

☒ Proposed 2-foot contours

☐ Drainage easements protecting the drainage/treatment structures

☒ Compliance with the Wetlands Bureau, RSA 482- A http://des.nh.gov/organization/divisions/water/wetlands/index.htm. Note that artificial detention in wetlands is not allowed.

☒ Compliance with the Comprehensive Shoreland Protection Act, RSA 483-B. http://des.nh.gov/organization/divisions/water/wetlands/cspa

☒ Benches. Benching is 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 need state Dam permits.
http://des.nh.gov/organization/divisions/water/dam/documents/damdef.pdf

DETAILS

☒ Typical roadway x-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 BMP's proposed

☐ Any innovative BMP's proposed

CONSTRUCTION SEQUENCE/EROSION CONTROL

☒ Note that the project is to be managed in a manner that meets the requirements and intent of RSA 430:53 and Chapter 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/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. (Reed canary grass is listed in the Green Book; however, this 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 double-side 8 ½" × 11" sheets where possible but, **do not** reduce the text such that more than one page fits on one side.

☒ PE stamp

☒ Rainfall amount obtained from the Northeast Regional Climate Center- http://precip.eas.cornell.edu/. Include extreme precipitation table as obtained from the above referenced website.

☒ 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/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 & Grafton counties are Type II, all others Type III).

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PRE- AND POST-DEVELOPMENT 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-DEVELOPMENT 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 which identifies each soil series symbol and its associated soil series name (e.g., 26 = Windsor).

☒ The hydrologic soil group color coding (A = Green, B = yellow, C= orange, D=red, Water=blue, & Impervious = gray).

Please note that excavation projects (e.g., gravel pits) have similar requirements to that above, however the following are common exceptions/additions:

☐ Drainage report is not needed if site does not have off-site flow.

☐ 5 foot contours allowed rather than 2 foot.

☐ No PE stamp needed on the plans.

☐ Add a note to the plans that the applicant must submit to the Department of Environmental Services 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.

See NRCS publication titled: *Vegetating New Hampshire Sand and Gravel Pits* for a good resource, it is posted online at: http://des.nh.gov/organization/divisions/water/aot/categories/publications.

ADDITIONAL INFORMATION RE: NUTRIENTS, CLIMATE

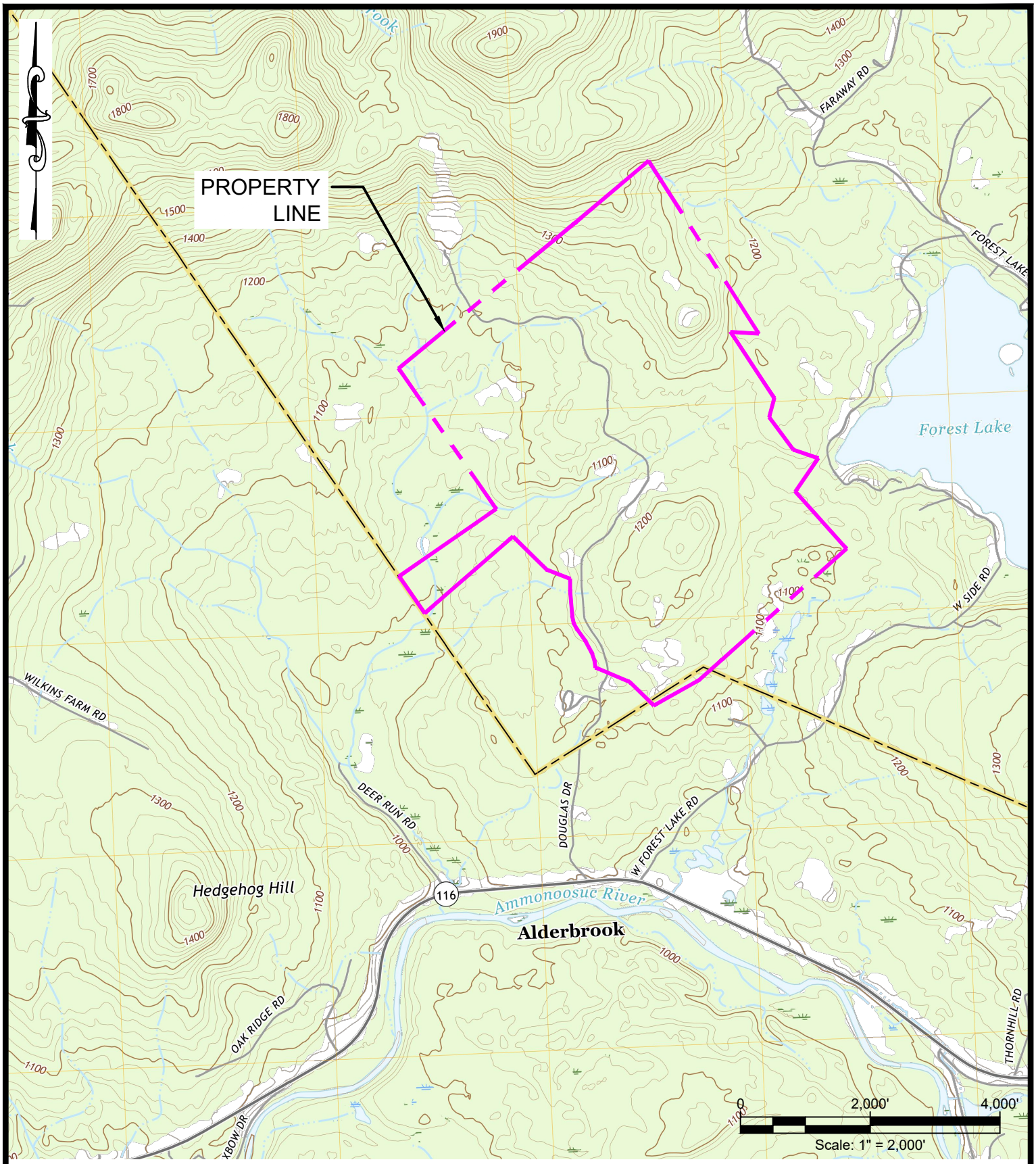
☐ If project will discharge stormwater to a surface water impaired for phosphorus and/or nitrogen, include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen.

☐ If project will discharge stormwater to a Class A surface water or Outstanding Resource Water, include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen.

☐ If project will discharge stormwater to a lake or pond not covered previously, include information to demonstrate that project will not cause net increase in phosphorus in the lake or pond.

☐ If project is within a Coastal/Great Bay Region community, include info required by Env-Wq 1503.08(l) if applicable.

THIS PAGE REPLACES A CHECK IN THE AMOUNT OF $81,875 MADE PAYABLE TO "TREASURER, STATE OF NEW HAMPSHIRE" SUBMITTED TO THE NHDES ON OCTOBER 16, 2023



CMA ENGINEERS
CIVIL/ENVIRONMENTAL/STRUCTURAL
Portsmouth, NH • Manchester, NH • Portland, ME
603/431-6196 • 603/627-0708 • 207/541-4223
c m a e n g i n e e r s . c o m

Granite State Landfill, LLC.
Granite State Landfill
Dalton, New Hamsphire
Alteration of Terrain Permit Application

USGS Map

PROJECT DESCRIPTION

This Alteration of Terrain (AoT) Permit Application is for development of the proposed Granite State Landfill (GSL) in Dalton, New Hampshire. The Applicant for the project is Granite State Landfill, LLC – a subsidiary of Casella Waste Systems, Inc. (CWS) based in Hyde Park, Vermont. The project will provide continued waste management services for customers of CWS and will replace the North Country Environmental Services (NCES) Landfill in Bethlehem after it ceases operations in 2027. The critical GSL capacity is expected to be permitted, constructed, and operational prior to closure of the NCES landfill to allow for uninterrupted service to New Hampshire customers and beyond.

The intent of this report is to demonstrate that stormwater infrastructure is designed to mimic existing conditions for the developed site in compliance with NHDES-AoT requirements. This includes reducing post-development peak flows to below pre-development, providing treatment for proposed impervious surfaces, and recharging groundwater to areas around the landfill where infiltration is blocked by the geomembrane liner and cap systems. The project is proposing a total disturbance of approximately 148 acres.

PROJECT SCHEDULE

The 20-year NHDES-Waste Management Division (WMD) planning period begins upon issuance of the facility's Solid Waste Management Permit. GSL will submit an application for an NHDES-WMD Standard Permit in late-2023 and it is anticipated that the permit will be issued in 2025. The landfill is proposed to be developed in two stages, each with three cells.

Initial earthwork for the project is expected to begin in 2025 with landfill operations beginning in early 2028. The landfill footprint will provide about 18 years of capacity with operations extending through 2046. The project will proceed with construction on the approximate schedule outlined below. This schedule anticipates issuance of an AoT permit in 2024.

- Solid Waste Permit modification for initial construction approval (2025)
- Erosion controls and stormwater infrastructure (2025)
- Improvements at site entrance and NH Route 116 (2025)
- Improvements to Douglas Drive (2025/2026)
- Roadway, Infrastructure Area, Stage 1, Cell 1 earthwork (2026/2027)
- Landfill berms and access roads (2026)
- First landfill cell (Stage 1, Cell 1) – 16.1-acre lined landfill footprint (2026/2027)
- Leachate and landfill gas conveyance piping and other utilities (2026/2027)
- Stage 1, Cell 1 Operations (2028)
- Stage 1, Cells 2 &3 (2031/2034)
- Remaining wetland filling of Stage 2 footprint (2033)
- Stage 2, Cells 1/2/3 (2037/2040/2043)

The total proposed disturbance, including the development described above, is 148 acres. The waste disposal (lined) footprint is 70 acres and is within the 148 acres of proposed disturbance.

This application covers the sequenced development of cells to be constructed approximately every three years. We are requesting approval for full development of Stages I and II of the Granite State Landfill in this NHDES-Alteration of Terrain (AoT) permit, which exceeds the typical 5-year term (with option for another 5 years by request). This requested permit term will align with the NHDES-WMD Solid Waste Management permit term. Under these conditions, we anticipate that NHDES-AoT would require progress plans be submitted every five years. GSL proposes to fill all affected wetlands within the 10-year permit term.

Historical aerial photographs dating from 1960 to 2019 and USGS maps dating from 1900 to 2018 are provided in Appendix T which help to document historical activities at the site. USGS maps dated 1900, 1935 and 1938 show the site as being undeveloped. The 1960 aerial photograph indicates the central portion of the site was being logged although there was no development of the property. The site access road was improved and extended to the northern portion of the site in the 1986 photo. Extensive logging of most of the site is shown in the 1993 photo. The 1999 photo shows sand and gravel mining operations that had begun in the northern portion of the site. The 2008 photo shows sand and gravel mining expanded to a second adjacent pit, the rock quarry operating in the central portion of the site, and a truck scale, residence, and equipment garage in the southern portion of the site. A former asphalt plant is first shown in the 2011 photo and was removed sometime between 2019 and 2022 based on Google Earth imagery. There are no known or suspected conditions at the site which are or should be environmental, public health or safety concerns.

The properties where the project will be sited are currently owned by Mr. Doug Ingerson, DBA J.W. Chipping. Mr. Ingerson's properties total approximately 1,850 acres. This project will occupy two of his properties (site), which total approximately 713 acres. The site currently operates as a sand and gravel pit and rock quarry, and these operations are expected to continue while the landfill is operating. Materials generated by these operations will be used for landfill construction and operations, including daily soil cover. Mr. Ingerson's personal residence and garage are also located on the site. Additionally, areas of the property are planned for a drag strip and industrial park – some of these areas are located on landfill properties. These projects are not immediately anticipated and are not covered by this application.

Mr. Ingerson's parcels are bounded by undeveloped wooded properties in Littleton to the west, a gun club and shooting range to the southwest, residences and undeveloped properties in Bethlehem to the south, residential properties to the southeast in Whitefield, residential properties on Forest Lake to the east, Forest Lake State Park and managed forest land in the Park to the northeast, and woodlands and an off-road driving school to the north and northwest. Forest Lake and the surrounding properties are

outside of the watershed evaluated for this project. The Dalton/Whitefield town line bisects Forest Lake.

The landfill and site infrastructure area are entirely in the Town of Dalton and the site is accessed by Douglas Drive (private road) via Route 116 in Bethlehem. The location of the landfill footprint, access roads, and infrastructure were sited such that impacts to wetlands and waterbodies are minimized and views of the landfill from roadways and abutters are limited.

Surface water and groundwater flow at the site is generally east to west towards the Alder Brook wetland complex. A ridgeline east of the landfill acts as a groundwater and surface water divide between the Alder Brook and the Forest Lake drainage basins. The landfill and disturbed area are entirely within the Alder Brook drainage basin.

GSL is preparing several NHDES permit applications that are being submitted concurrently or are in process, which are summarized below:

- NHDES-Wetlands Standard Dredge and Fill Permit Application
    - Army Corps Wetland Application (404)
- NHDES-Waste Management Division Standard Permit for Solid Waste Landfill
- NHDES Groundwater Protection Bureau Groundwater Management Permit
- NHDES Air Resources Division Permit
- NHDES 401 Water Quality Certification
- NHDOT Driveway Permit submitted on November 3, 2020 (under review)
- NHDES Shoreland Permit

Local approvals are not required for Dalton, or in Bethlehem where the site entrance is located.

Upon approval of these permits, which are expected to be received between 2024 and 2026, GSL would purchase two parcels (site) needed for the project from Mr. Ingerson. These lots are depicted on the enclosed Abutter Exhibit in Appendix P and identified by Town of Dalton records as:

- Map 406 Lot 2.1
- Map 406 Lot 3

GSL and Mr. Ingerson will establish easements across the GSL lots for Mr. Ingerson to access his existing sand and gravel mining and tree harvesting operations which are not covered by this application.

Similarly, easements will be established across Ingerson parcels for GSL to access the landfill site. Parcels requiring easements from Mr. Ingerson to GSL include:

- Map 405 Lot 33
- Map 406 Lot 2.3
- Map 406 Lot 2.4
- Map 406 Lot 2.5
- Map 406 Lot 1 (Bethlehem)

The project is redesigning the site entrance at Route 116 from the current configuration to meet required traffic safety criteria, which include connecting the entrance at 90 degrees as part of the NHDOT Driveway Permit for the project. This modification, depicted on the enclosed plans, is part of several improvements at the driveway entrance and includes an inbound deceleration lane and outbound acceleration lane on Route 116. These improvements are covered by this application. The site entrance, Route 116 improvements, and the southern portion of Douglas Drive are within the quarter-mile designated river corridor of the Ammonoosuc River, which is on the opposite side (south) of Route 116 from the site entrance, therefore the Ammonoosuc River Local Rivers Advisory Committee is being provided a copy of this application. Parts of the Route 116 improvements are also within the protected shoreland of the Ammonoosuc River, which will require an NHDES-Shoreland Permit.

Douglas Drive will be paved throughout and widened to a width of 32-feet in most locations of the approximately 1.5-mile length of road to the landfill. Existing culverts along Douglas Drive will also be replaced during construction with new corrugated HDPE pipe (N-12 or approved equivalent) as depicted on the enclosed plans. Additionally, GSL will be providing two new replacement open bottom culverts at stream crossing locations. Wetland impacts associated with the installation of these culverts are covered by the Standard Dredge and Fill application for the project, which is being filed by GSL concurrently with this application.

The landfill containment system is designed to meet and exceed current NHDES-WMD waste containment standard rules and regulations. A geosynthetic clay liner, not required by the regulations, will be added to the containment system to provide superior containment barrier properties. The landfill containment system includes the following layers, from bottom to top:

- 12-inch low-permeability soil layer
- Secondary 60-mil high density polyethylene (HDPE) geomembrane liner
- Secondary drainage geocomposite (HDPE drainage net between bonded layers of 8 oz non-woven geotextile fabric)
- 12” drainage sand
- Geosynthetic clay liner (GCL – not required by NHDES Solid Waste Rules)
- Primary 60-mil HDPE geomembrane liner
- Primary drainage geocomposite
- 18-inches of drainage sand

The purpose of this liner system is to prevent liquids that drain through the waste mass, referred to as leachate, from entering the environment. Leachate within the landfill drains to low collection areas, also known as sumps, where it is pumped to leachate storage tanks in the site infrastructure area via underground forcemains. These HDPE forcemains are dual walled (3-inch forcemain inside a 6-inch containment pipe) with leak detection capabilities where they are located outside of the landfill. Dual-wall contingency storage tanks are sited at the landfill's pump station and at the low point on Douglas Drive. From the infrastructure area, tanker trucks transfer leachate to remote wastewater treatment facilities for disposal.

NHDES-WMD rules (Env-Sw 804.02[d]) require that the secondary geomembrane be constructed at a minimum separation of 6-feet from bedrock and the seasonal high groundwater table. Groundwater levels across the site have been monitored at regular frequent intervals since 2017 to develop seasonal high groundwater levels. We note that groundwater, rather than bedrock, controls the liner separation in most locations. The elevation of the secondary liner has been set at 7-feet from seasonal high groundwater or bedrock. It is not anticipated that bedrock will need to be removed as part of this project based on the data reviewed to date. If removal of bedrock is necessary as determined by field observation during construction, initial attempts will be made by mechanical means, such as ripping with an excavator, as explorations indicate the upper bedrock is weathered. We are providing a Blasting Plan (Appendix U), as required by Section Env-Wq 1510 of the Rules, in the event blasting is determined to be necessary during construction.

The site infrastructure area is proposed to be located approximately 3,000 feet to the south of the landfill and will consist of:

- Leachate tanks
- Leachate forcemain (dual wall)
- Leachate forcemain leak detection manhole
- Leachate loadout area
- Operations office
- Weigh scales and scale house
- Truck odor station
- Landfill gas flare stations
- Equipment maintenance garage

The infrastructure area also provides for space for a future leachate treatment building and landfill gas processing plant to convert the landfill gas to pipeline quality natural gas. The processed gas would be compressed and transferred to an end user, similar to the RUDARPA project at the NCES Landfill in Bethlehem.

The landfill waste will be supported by foundational perimeter berms incorporating perimeter access roads with stormwater swales. The landfill bottom liner system will extend from the base grades (bottom of landfill) to the top of the berm at its termination point, also known as an anchor trench, at a maximum slope of 3 horizontal to 1 vertical (3H:1V) to the base. Base grades have a minimum cross slope of 2% and are pitched from the north to the southwest,

towards the landfill sump. The landfill will be filled within the limit of the anchor trench and covered with a minimum of 12" of intermediate cover soil, which will be seeded/grassed to provide temporary slope stabilization. The landfill will be filled above the anchor trench level at an average filling slope up to 2.5H:1V until final permitted closure grades are met.

The side slopes of the landfill will drain to benched swales built into the landfill side slopes, which are spaced horizontally every 100 feet (vertically every 40 feet). The purpose of these swales is to limit the potential for stormwater sheet flow to converge to more erosive concentrated flows, which generally occur after 100 feet of sheet flow. The stormwater swales have a minimum pitch of 4% until they drain to a drop chute which conveys the stormwater in an engineered channel down the sideslope (2.5H:1V max), perpendicular to the toe swale adjacent to the perimeter access road. From this swale, stormwater is directed to one of the infiltration basins around the perimeter of the landfill for flow attenuation and treatment.

As the landfill is developed, filled areas will be closed, involving the construction of a geomembrane-lined capping system that is welded to the bottom liner anchor trench to encapsulate the waste mass. The geomembrane cap, commonly 40-mil linear low-density polyethylene (LLDPE), is underlain (bottom to top) by a 6-inch sand layer and a 12-inch common borrow layer above the waste and daily cover, and is overlain by drainage geocomposite, an 18-inch drainage sand layer, 6-inch moisture retention layer (low-permeability soil), and a 4-inch topsoil/vegetative layer. This capping system will also incorporate the above-described stormwater swales and drop chutes to direct surface water to the stormwater infrastructure. Rainwater falling over geomembrane-capped areas infiltrates through the upper cap soils vertically to the drainage geocomposite (HDPE drainage net with non-woven geotextile above and below) which sits directly above the geomembrane. Any water that reaches the drainage geocomposite will drain through the composite to the landfill bench and toe swales. The volume of this drainage geocomposite water is significantly less than the total volume of water generated by a storm event.

The stormwater infiltration basins have been sized to manage peak stormwater flow and provide stormwater treatment for landfill development. Infiltration basins are designed with a stone-lined spillway for events larger than the 50-year storm. During interim operation phases, active areas of the landfill are graded to drain inward, such that stormwater that contacts waste areas will not leave the site as stormwater, and instead drain through the waste mass to the leachate collection system below. Stormwater modelling would therefore not consider these drainage areas as stormwater contributors. Typically, active landfilling areas are restricted to 10 acres to limit leachate generation.

Other interim conditions that would affect stormwater management at the site could include the use of temporary exposed geomembrane covers that are frequently utilized by landfills to shed clean stormwater more efficiently off the landfill and to aid in controlling landfill gas emissions. The exposed geomembrane generates more stormwater runoff than typical vegetated surfaces, so each area of exposed geomembrane would need to be evaluated to ensure that the pond system is adequately sized to accommodate the higher flows. Preliminary locations for exposed geomembrane cover are depicted on the plans and modeled in the intermediate-development condition stormwater models. For GSL, this exposed

geomembrane will be white, rather than the conventional black color, to reduce the temperature of the runoff water.

Groundwater quality will be monitored via an NHDES-issued Groundwater Management Permit detailing the site monitoring points, parameters, and testing frequencies. Further, surface water flows will be monitored during storm events under an EPA-issued Multi-Sector General Permit (MSGP) requiring quarterly monitoring and inspections of surface water and requirements under the 401 Water Quality Certification under Env-Wq 1700. A draft Stormwater Pollution Prevention Plan (SWPPP) for the site which meets the MSGP and AoT Source Control Plan requirements has been provided in Appendix O.

WETLAND FILLING

Concurrent with the filing of this application, GSL will be filing a Standard Dredge and Fill wetlands permit application to NHDES to fill wetlands within the project limits (approximately 10 acres) in support of the development of this project. NHDES wetland permits are issued for a period of five years with an option to request an extension of another five years. This application assumes that the project will receive the five-year extension to the wetlands permit. The project intends to fill the wetlands as cell development progresses from south to north. The landfill will be developed in six construction sequences, each between 10 and 16 acres in size and constructed in approximately 3-year intervals. Assuming that the wetlands permit is received in 2025, the landfill will likely be operating in the third cell when the permit expires. GSL anticipates completing the remaining permitted wetland fills before the Stage II cells are constructed to meet the 10-year timeline of the wetland permit.

The enclosed plan set includes sheets that detail proposed landfill and stormwater infrastructure construction, including infiltration basins, stormwater ponds, and lined rain gardens needed for each of the landfill development sequences. As shown on the enclosed plans, perimeter erosion controls such as silt fencing, compost sock, or mulch berms (see erosion and sedimentation control details and notes) will surround all disturbed areas. Appendix S includes the erosion control specification, Section 02270.

Prior to the expiration of the wetland permit (with assumed 5-year extension), the project anticipates that construction associated with Douglas Drive, the site infrastructure area, and Stage I of the landfill will be complete and wetland fills associated with those areas will have taken place. Towards the end of Stage I development, GSL would fill the remainder of the wetlands in the Stage II footprint. These wetland soils are proposed to be replaced with a granular fill (see “Select Sand” gradation specification provided in Appendix S) and compacted and graded to promote sheet flow and infiltration of precipitation.

GSL will continue to monitor groundwater levels until construction of new cells is imminent and, if warranted, either implement additional surface water swales or raise landfill base grades to provide the required 6-foot liner groundwater separation distance. As designed the liner system is at least 7 feet above seasonal high groundwater levels based on groundwater level data collected to date, with additional separation in most mapped wetland areas. GSL will employ wetlands specialists, presumed to be B.H. Keith Associates, Normandeau Associates and /or Horizons Engineering to observe the wetlands filling operations and to provide

guidance and input on field modifications to ensure that the filling operations are occurring in compliance with approved permits and with minimal impact to surrounding wetland resources.

A key component of the Stage II wetland filling will be to divert stormwater away from existing wetland areas to limit the opportunity for them to recharge. Stage I wetland fills are expected to be completed during cell development. To accomplish this, the design diverts surface water from upland areas away from filled wetlands to stormwater infrastructure with berms and swales. Internal swales to the Stage II area may also be necessary for stormwater removal. Note the wetlands are primarily recharged by groundwater flow. There is no surface water flow in or emanating from these wetlands. Runoff coefficients from filled wetland areas will be less than that of a capped landfill, having much flatter slopes, and will generate less stormwater runoff as evidenced by the enclosed stormwater calculations.

FEMA FLOOD PLAIN MAPPING

Appendix Q includes the FEMA flood plain map for the project. The mapping shows that the landfill and infrastructure area is over 2,000 feet away from the 100-year floodplain of a tributary to the Hatch Brook. There is limited filling associated with the new acceleration lane on Route 116, which is adjacent to the Ammonoosuc River, but not within its 100-year flood plain. We note that the flood plain mapping depicts the flood plain below the railroad tracks and all the proposed grading is above the tracks.

SENSITIVE SPECIES REVIEW

Enclosed as Appendix D is information provided by Barry Keith of B. H. Keith Associates of Freedom, NH in support of the project's Standard Dredge and Fill Wetland Permit application. Barry Keith is the project wetland scientist and is supported by Normandeau Associates of Bedford, NH. The enclosed document includes:

- A 4-page handout for the project's pre-application meeting with the NHDES Wetlands Bureau and the U.S. Army Corps of Engineers
- Wetland meeting project chronology
- NH Fish and Game Department Pre-Consultation Meeting notes
- Summary of Wetlands Functions and Values
- U.S. Fish and Wildlife Service Official Species List
- New Hampshire Natural Heritage Bureau (NHB) Datacheck Results Letter

The NHB Datacheck letter identified the common loon (threatened), northern white cedar seepage forest, and the marsh horsetail (endangered) in the search for rare species and exemplary natural communities. The locations of the observed species are shown on the map provided with the NHB report. None have been observed on the proposed project properties. The common loon and northern white cedar seepage forest were observed along Forest Lake, last reported in 2015 and 1983, respectively. The marsh horsetail was observed in Forest Lake State Park in 2021 near the northeastern corner of the proposed properties.

The U.S. Fish and Wildlife Service Official Species List identified the Canada lynx (threatened), the northern long-eared bat (endangered), and the monarch butterfly (candidate) as being in the project area.

The project will continue to work with the NH Natural Heritage Bureau and the NH Fish and Game through the AoT and wetland permitting process.

NHDES WEB GIS SCREENING

CMA Engineers completed a search of the NHDES OneStop Web GIS Data Mapper database for this project including a review of surface water impairments and AoT screening layers. Figures for each search are provided in Appendices A and B, respectively. The Ammonoosuc River, located over 1 mile to the south of the proposed landfill, is not impaired near the site. According to the mapper, the river is impaired for aluminum and E. coli approximately 4 miles upstream of Douglas Drive (east towards Whitefield) and is impaired for aluminum approximately 3.5 miles downstream of Douglas Drive (west towards Littleton). The Cushman Brook, located to the north of the site and out of the watershed of the project, is impaired for Fish bioassessments.

The NHDES OneStop mapper lists Chick's Sand & Gravel (Remediation Site No. 201806023), but no online records were listed under this number. A request for additional files was made to NHDES, and NHDES provided two electronic records (see copies in Appendix C):

- An undated, handwritten anonymous complaint, signed "Whistle Blower," and stamped as received by NHDES on May 7, 2018. The complaint alleged dumping of construction and demolition debris, out-of-use underground storage tanks, and potentially contaminated soil at Chick's Sand and Gravel Site in Dalton, NH. The complaint alleged the material was derived from the Sunoco Gas Station on Meadow Street in Littleton, NH.

- A June 13, 2018, NHDES "Site Investigation Summary Report" authored by Christopher Wood describing his site visit and meeting with Mr. Douglas Ingerson (owner of Chick's Sand & Gravel) on that date to investigate the anonymous complaint. Photographs were included in the NHDES Report. NHDES' Report indicated the following materials:

    - Two 10,000-gallon capacity steel USTs (cut open and cleaned as part of their removal). No vapors were detected in photoionization detector [PID] screening performed by NHDES.
    - Several steel I-beams.
    - Ten small piles of sandy gravel, which contained several pieces of asphalt and three 3-foot sections of 4-inch diameter piping that the NHDES inspector interpreted as potentially asbestos-containing material (ACM).
    - Five dump truck loads of unscreened loam with no obvious debris.

    PID screening of samples from the soil stockpiles by NHDES did not indicate the presence of organic vapors.

    According to NHDES' report, the inspector collected a sample of the suspected

ACM for further inspection by NHDES' Air Resources Division, and asked Mr. Ingerson to separate the suspected ACM, and not to move or use the stockpiles or pipes until the suspected ACM could be further evaluated.

In an email dated June 16, 2021, NHDES' Public Information and Permitting Office confirmed case number 201806023 is still open. NHDES provided no additional information regarding Remediation Site No. 201806023.

Other remediation sites include the Team O'Neill Rally School abutting the project to the north, which had an open file in 2008 to address a floor drain in a vehicle maintenance area – this remediation site was closed out in 2008. There are also four remediation sites around Forest Lake that appear residential in nature – all are closed out.

CONSTRUCTION SEQUENCE

The project proposes the following construction sequence for the early-stage development of the GSL facilities. This sequence will be modified and adjusted with subsequent construction efforts and with changes in regulation. We added these notes to the enclosed permitting plan set:

1. Prepare Stormwater Pollution Prevention Plan (SWPPP) and establish coverage under EPA's Construction General Permit and implement SWPPP training.
2. Complete DigSafe notifications (811 or 888-DIG-SAFE).
3. Establish horizontal and vertical control.
4. Reflag wetlands in project area.
5. Site mobilization.
6. Install perimeter erosion controls including silt fencing, compost sock, and erosion control berms. Erosion controls shall be maintained throughout construction.
7. Construct stormwater infiltration basins, stormwater ponds, forebays, and swales. Clearing to be kept to the minimum area practical. Anytime that greater than 5-acres of soil is exposed, an Environmental Monitor (EM) shall be utilized to monitor the site and complete the required reporting in compliance with Section Env-Wq 1505.03(d) of the AoT Rules.
8. Construct improvements at site entrance and Route 116.
9. Construct improvements to Douglas Drive.
10. Construct internal landfill roads, infrastructure area, Stage 1, Cell 1 lined landfill and berm construction.
11. Install leachate and landfill gas conveyance and other utilities.
12. Once Engineer has determined the site to be stabilized in compliance with AoT Rules, remove erosion controls and sediment to a location designated by the Owner.
13. Site demobilization and termination of EPA CGP coverage.

STORMWATER MODELLING

The drainage analysis for this project assumes a watershed area of 585 acres, which includes the 148-acre development area plus upland areas that drain to the site. Four stormwater models are presented in this application: A pre-development model which models current site conditions, a post-development model which considers full buildout and closure of the landfill, and two intermediate-development models which look at landfill development at intermediate operation sequences.

The peak stormwater runoff flows were calculated for the 2-year, 10-year, 25-year, and 50-year Type II, 24-hour storm events and are summarized in this report. The method used for all analyses was SCS TR55: Urban Hydrology for Small Watersheds and performed with HydroCAD Version 10.20-2g modeling software. Appendix J includes these drainage analysis results at the end of the report.

We obtained the precipitation values for storm events used in the modelling from the Extreme Precipitation Estimates published by the Northeast Regional Climate Center (see Appendix J). The results of the analyses are summarized in the following sections.

Five study points are evaluated in the stormwater models:

Out-A: Models an unnamed stream on the north side of the site (north of the proposed landfill location) which includes drainage from upland areas and the property owner's active gravel pits. The unnamed stream ultimately drains westward to the Alder Brook wetland complex. The total pre-development drainage area for the Out-A watershed is 182 acres. The Out-A watershed is comprised of predominantly HSG B and C soils.

Out-B: Considers flow draining to an unnamed stream to the south of the Out-A watershed in the future northern and central landfill areas. The unnamed stream ultimately drains westward to the Alder Brook wetland complex. The total pre-development drainage area for the Out-B watershed is 113 acres. The Out-B watershed is comprised of predominantly HSG A and B soils.

Out-C: Considers stormwater flow from future southern landfill areas, the site infrastructure area, and upland areas including the property owner's rock quarry operations and woodland. Drainage is to an unnamed stream to the south of the proposed landfill footprint, which drains to the Alder Brook wetlands complex. The total pre-development drainage area for the Out-C watershed is 237 acres. The Out-C watershed is comprised of predominantly HSG B and C soils.

Out-D: Evaluates stormwater flow from the north end of Douglas Drive which drains west to the Alder Brook wetland complex. This model only includes improved areas of Douglas Drive for determining changes in pre- and post-development stormwater flows. The stormwater model considers drainage from upland areas to the Douglas Drive culverts for the purpose of confirming adequacy of the roadway culverts. The total pre-development drainage area for the Out-D watershed is 25 acres.

Out-E: Considers stormwater flow from the south end of Douglas Drive which drains south to Route 116 and ultimately the Ammonoosuc River. Similar to Out-D, this model only includes improved areas of Douglas Drive for determining changes in pre- and post-development stormwater flows. The total pre-development drainage area for the Out-E watershed is 28 acres. The Out-E watershed is comprised of predominantly HSG C soils.

See the watershed plans in Appendix J for study point locations. A description of the pre, post, and intermediate development stormwater models and design assumptions are presented in the subsequent sections of this report.

SITE SPECIFIC SOIL SURVEY

A site-specific soil survey was completed for the 148-acre project footprint in compliance with Env-Wq 1504.09. In areas outside limits of proposed disturbance which contribute surface water to the project, the NRCS soil mapping was utilized for soil classifications. The NRCS soil survey is provided in Appendix E. The site-specific soil survey was completed by Mike Cuomo (NH CSS #6), Joe Noel (NH CSS #17), and Marc Jacobs (NH CSS #90) from September 13, 2021, through October 9, 2021, and May 16, 2022, through June 22, 2022.

The Site-Specific Soil Map and Report, stamped by Mike Cuomo, is provided in Appendix L. Soils across the site are generally characterized by the soil survey as hydrologic soil groups (HSG) B, C, and D. The primary soil groups identified by the soil scientist team were Becket and Skerry soils, which are both HSG C soils and described as well drained and moderately well drained respectively. Appendix J provides color-coded soil plans for the project along with the drainage analyses. The interface between the site specific and NRCS mapping is also shown on the color-coded soil plans.

By comparison, the NRCS soil mapping indicated soils within the landfill footprint are primarily Berkshire (HSG B) and Hermon (HSG A). The NRCS soil mapping was used for undisturbed upland areas that drain to the site, which primarily consist of HSG B and C soils including Sunapee (HSG B), Monadnock (HSG B), and Moosilauke (HSG C).

PRE-DEVELOPMENT CONDITIONS

The existing properties are currently being utilized for industrial purposes including a rock quarry and gravel pit mining operations. Mr. Ingerson's single-family residence is also sited on the property, which totals approximately 1,850 acres of land over several parcels. Outside of these developed areas, the site is wooded. The site is accessed from Route 116 by Douglas Drive, which is a 2.5-mile-long private gravel road, 20 to 24-feet wide, that is utilized by Mr. Ingerson to access the gravel pits at the rear of the site. Some culverts throughout the road alignment are not sized/designed to handle required storm events.

Stormwater and groundwater flows across the site from east to west to a wetland complex and Alder Brook to the west of the proposed landfill area. A ridgeline approximately 800 feet to the east of the landfill limit is a groundwater and surface water divide that separates the Alder Brook watershed including the GSL site from the Forest Lake watershed to the east.

The northern portion of the site consists primarily of wooded uplands with limited wooded wetlands. Grades are generally steep (15%) to very steep grades (>25%) that drain overland into existing ditches that drain westward toward Douglas Drive. Runoff crosses under Douglas Drive via culverts and continues westward towards Alder Brook via intermittent and perennial streams with large bordering wetlands.

The southern portion of the site consists largely of wooded uplands having moderate (>7%) to very steep (>25%) grades and some wetlands having flat to moderate grades. This area drains towards an unnamed stream that begins in the eastern portion of the property and flows westward to Alder Brook. A rock quarry operation is located on the southern side of the stream.

The pre-development stormwater model includes 23 subbasins that total 585 acres and evaluates five outlet locations. These outlet locations consider:

- Northern Landfill Area to Alder Brook wetland complex
- Central Landfill Area to Alder Brook wetland complex
- Southern Landfill and Infrastructure Area to Alder Brook wetland complex
- North end of Douglas Drive Drainage to Alder Brook wetland complex
- South end of Douglas Drive Drainage to Ammonoosuc River

For each subbasin, the flow path time of concentration (Tc) analysis begins as sheet flow (Manning's n of 0.8 for forests with heavy underbrush) and a length (≤100 feet) dependent on the slope. The flow transitions to shallow concentrated flow under forest conditions before transitioning to channel flow. Channel Flow characteristics were estimated using the existing conditions survey and high-resolution aerial imagery. To determine SCS curve numbers (CN), all vegetated cover types were assumed to be "good condition," consistent with AoT requirements. Assumed curve numbers also take into consideration soil types from the Site-Specific Soil Survey (see Appendix L) for project areas to be disturbed and the NRCS soil mapping (Appendix E) for watershed areas outside of the developed area that contribute drainage to the site. See the Pre-development Watershed plan in Appendix J.1 for detailed information on drainage basins, Tc flow path, and study point locations.

A summary of peak run-off flows for the pre-development condition is presented in the following **Table 1**, and a summary table of the runoff volumes is presented in **Table 2**.

POST-DEVELOPMENT CONDITIONS

The stormwater management strategy at the site is to replicate current conditions to the largest extent practical in terms of off-site peak flows, volume, and infiltration to groundwater. The site will utilize the proposed infiltration basins, rain gardens and stormwater ponds to reduce the increased peak stormwater flows generated by replacing wooded areas with surfaces that generate higher amounts of runoff such as grassed areas and impervious surfaces such as gravel and paved roads and buildings and to mimic existing groundwater recharge as much as practical. The proposed stormwater system depicted on the plans and described in this report will reduce the post development peak flows to pre-development flow rates at the five evaluated study points except as described below and

provide groundwater recharge and treatment utilizing infiltration practices and swales as allowed by the NHDES Alteration of Terrain Rules (Env-Sw 1500).

In general, the following stormwater systems are proposed:

Landfill perimeter: Sedimentation forebay (pretreatment) followed by infiltration basin

Infrastructure Area: Deep sump catch basin (pretreatment) followed by infiltration basin

Douglas Drive: Sedimentation forebay (pretreatment) followed by lined rain garden

Each of the infiltration basins and rain gardens have outlet control structures and spillways incorporated into the design. The proposed layout of the pond system is configured to infiltrate stormwater around the perimeter of the landfill to maximize the groundwater recharge to the downgradient areas. Stormwater treatment will be provided primarily via infiltration basins which also provide groundwater recharge. Pretreatment is provided by sedimentation forebays, or deep sump catch basins.

At closure, the top slopes of the landfill will be graded to a mild slope (5%) and transition to steeper side slopes (2.5:1). Sideslope swales are spaced at a horizontal distance of 100 feet. Perimeter road backslopes will be graded to 2.5:1 and vegetated. Slopes with a steepness of 2:1 will be armored with NHDOT Type C stone (6”).

The infrastructure area also includes a lined detention basin that accepts stormwater from the leachate loadout area which has a drainage area of less than one half acre. The detention basin is sized for the 50-year storm event and would allow for GSL operations staff to capture and remove a spill from the infrastructure area before it is released offsite. During normal operations, GSL operations staff will use water from this detention basin for dust suppression.

Improvements are proposed along the length of Douglas Drive from the intersection with Route 116 (south) to the landfill (north), approximately 1.5 miles. Primary improvements include replacement of gravel surfaces with pavement and widening the road from approximately 24 feet to 32 feet throughout the alignment to allow two semi-trucks to safely pass side-by-side. Further widening is necessary in the turns to accommodate vehicle turning motions.

All the existing culverts along Douglas Drive are proposed to be upgraded to a minimum of 18” diameter, HDPE smooth bore culvert pipes. These culverts are provided at low points for wetland water conveyance and are not considered stream crossings. Wetland impacts are proposed to be minimized by utilizing retaining walls and headwalls in place of grading, as depicted on the plans. GSL also intends to restore an original wetland crossing on Douglas Drive which does not currently have a culvert, shown on the plans at Station 82+50 and detailed on the plan set. The proposed box culvert crossing utilizes an open-bottom design. A second box culvert is proposed at location 86+50 to replace an existing 15-inch culvert.

In compliance with the requirements of the NHDES Alteration of Terrain Rules (Env-Wq 1500), flow attenuation and treatment practices will be necessary in select locations of the Douglas Drive improvements due to the increase in runoff curve number (CN) caused by creating a wider road surface. Geomembrane-lined bioretention practices (rain gardens) are proposed along Douglas Drive at low points in the roadway profile that have shallower depth to groundwater. Locations of rain gardens are depicted on the proposed plans. The proposed road surface will be crowned in most places, with a cross pitch of 2% to roadside swales, some of which will drain to the rain gardens and others to existing discharge points.

Additionally, to accommodate truck traffic off Route 116, an acceleration lane (north to Whitefield) and a deceleration lane (south from Whitefield) are proposed. The new lanes are expected to add 24 feet of width to the road as shown on the plans. The deceleration lane will require a cut into the existing slope to create space for the lane. An NHDES Shoreland Permit will be required for impacts associated with the Route 116/driveway entrance, which are partially within the protected shoreland of the Ammonoosuc River. All impacts are between 150 feet and 250 feet of the river, which are outside of the designated 50-foot waterfront buffer and 150-foot natural woodland buffer setbacks under the Shoreland Rules.

The stormwater model for post development conditions assumes full buildout of the landfill (through Stage 2 Cell 3) including all the proposed stormwater improvements. Full buildout represents the highest volume of stormwater to be managed as there will be no active areas of the landfill being operated. Stormwater is distributed to the perimeter stormwater infiltration basins via conventional benched intermediate swales on the side slopes of the landfill which are spaced every 100 feet horizontally to minimize erosive flows. These swales drain to stormwater drop chutes down the 2.5:1V slopes to riprap-lined toe swales along the perimeter of the landfill, discharging to the proposed stormwater infrastructure as depicted on the enclosed plans. These stormwater practices at landfill sites have proven effective and are a common strategy employed for these facilities. Accordingly, swales and dropchutes are sized to accommodate the 100-year, 24-hour storm event (5.51 inches). To accommodate this storm event, bench swales have been kept to a length of under 2,500 linear feet. The longest run of swale in an exposed geomembrane will be kept under 1,700 linear feet.

Post-development conditions in drainage areas within the landfill perimeter road will consist predominately of grass cover (CN of 74) and gravel (CN of 96). Embankment slopes and cut slopes will generally have meadow cover with CN of 58 (HSG B) or 71 (HSG C).

Cover types for areas undisturbed by the proposed development are largely the same as the predevelopment conditions. The former asphalt processing facility area and rock quarry east of the infrastructure area is modeled largely as fallow, bare soil, as it is in the pre-development subcatchments. The gravel pits also remain the same in the post-development model.

Drainage Area Time of concentrations (Tc) over landfill surfaces are modeled as sheet flow over grass cover with a Manning's n of 0.24 and change to channel flow with Manning's

n of 0.069 for the riprap bench swales and mild to medium sloped toe swales. All riprap lined swales have an estimated Manning's n of 0.069. Any grass swales have an estimated Manning's n of 0.022. See the Post-Development Watershed plan in Appendix J.2 for detailed drainage basin, Tc flow path, and study point locations.

The post-development stormwater model includes 54 subbasins that total 585 acres and evaluates four outlet locations. Similar to the pre-development model, these outlet locations consider:

- Northern Landfill Area to Alder Brook wetland complex
- Southern Landfill and Infrastructure Area to Alder Brook wetland complex
- Quarry area to Alder Brook wetland complex
- North end of Douglas Drive Drainage to Alder Brook wetland complex
- South end of Douglas Drive Drainage to Ammonoosuc River

INTERMEDIATE-DEVELOPMENT CONDITIONS

The intermediate development models consider stormwater flow conditions for the operating period of the landfill. Two intermediate condition models have been prepared to model landfill development sequences. Each development assumes that Douglas Drive and the infrastructure area have been developed. The following intermediate-development scenarios are considered:

- Intermediate Condition 1 (Appendix J.3): Stage 1, Cell 2
- Intermediate Condition 2 (Appendix J.4): Stage 2, Cell 1

The grading plans provided in the enclosed plan set depict the sequential development of the landfill.

As shown on the plans, stormwater improvements are constructed sequentially as the landfill expands to manage additional stormwater generated by new development. In each development, stormwater from upland areas to the east is diverted away from the landfill by perimeter swales to stormwater basins for flow attenuation. When wetland areas are filled (in compliance with the approval conditions of the wetlands permit), temporary swales and berms may be constructed within and around the landfill footprint to divert surface water away from filled areas to limit them from recharging.

Operating conditions for the landfill, such as what has been presented in the intermediate development models, will generate less stormwater than what has been presented in the post development model which considers full buildout of the site for two primary reasons. First, the landfill's active filling area, which will occupy approximately 10 acres, will drain internally to the landfill's leachate collection system. These 10 acres are removed from the intermediate development stormwater models as stormwater contributors. Second, undeveloped areas within future landfill footprint, which include woodlands and filled wetlands, will have lower runoff coefficients and flatter slopes than that of a developed landfill. As the stormwater

infrastructure has been sized for the full buildout, components are oversized to manage operational conditions.

GSL may deploy an exposed temporary geomembrane cover on interim graded slopes. The exposed geomembrane is an engineered temporary landfill cover that is installed on landfills to minimize erosion, help keep run-off clean, aid in the recovery of landfill gas collection, reduce leachate generation, and allow for waste settlement to occur so additional layers of waste can be placed efficiently. As previously stated, GSL is proposing to use white geomembrane instead of the conventional black geomembrane to reduce temperature increases to surface water. Proposed areas for exposed geomembrane are depicted on the intermediate development drainage plans in Appendix J.

The Intermediate-development stormwater models are provided in Appendices J.3 and J.4. Similar to the previous models, these outlet locations consider:

- Northern Landfill Area to Alder Brook wetland complex
- Southern Landfill and Infrastructure Area to Alder Brook wetland complex
- Quarry area to Alder Brook wetland complex
- North end of Douglas Drive Drainage to Alder Brook wetland complex
- South end of Douglas Drive Drainage to Ammonoosuc River

STORMWATER CONTROL PRACTICES

Proposed primary stormwater flow controls include forebays, infiltration basins, and rain gardens with concrete outlet control structures. These are sized to keep post-development peak flow rates to be equal to or below pre-development conditions for the 2-year, 10-year, 25-year, and 50-year storm event in compliance with NHDES AoT and Waste Management Division Rules.

The 2-year volume calculations are provided to demonstrate compliance with the channel protection requirements, 10-year calculations are the required design case for AoT, 25-year calculations are required for NHDES-WMD, and the 50-year calculations are provided per AoT requirements.

Absent stormwater improvements, the proposed development of the site would increase total off-site stormwater peak flows when compared to pre-development conditions. NHDES-AoT requires stormwater flow control practices to reduce peak flows by detention or infiltration or both. Stormwater infiltration basins were designed to detain runoff from the development and attenuate the peak flows to predevelopment conditions or below. At study points Out-D and Out-E along Douglas Drive, the model shows the 50-year post-development flows being slightly higher than pre-development flows. Despite modeling 8 stormwater treatment and control practices along Douglas Drive, peak stormwater flows for the 50-year event increase due to the upsizing of culverts at wetlands crossings. The existing culverts are 8”, 10”, or 12” HDPE or CMP pipes. The project proposes 18” HDPE pipes or greater to replace them. For storm events larger than the 25-year storm, the existing, undersized culverts restrict flow. Increasing the size of the culverts to

accommodate these storms, as well as replacing several existing CMP pipes (manning's n=0.025) with HDPE pipes (Manning's n=0.013), increases the overall peak flow for Out-4. It is believed that upsizing the pipes to accommodate the 50-year storm is an improved condition both hydraulically and environmentally as originally intended flow conditions can be restored. Alternatively, these culverts could be replaced in kind to maintain current flows. A summary comparison of peak flows and volumes between pre-, post-development, and intermediate flows is provided in **Table 1 and 2** below.

Table 1: Pre-, Post-, and Intermediate Development Peak Flow Comparison

Analysis Point	Pre- and Post-Development Peak Flows (cfs)							
	2-year		10-year		25-year		50-year	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Out-A	8.4	6.5	35.8	29.4	65.8	55.0	97.7	82.2
Out-B	8.0	1.0	30.6	10.2	56.5	21.8	85.2	33.4
Out-C	20.0	13.5	86.5	60.8	157.3	131.7	230.0	219.7
Out-D	2.8	2.1	6.0	4.3	8.8	9.8	11.6	14.7
Out-E	3.9	3.6	7.7	5.9	10.9	9.0	14.1	12.6

Analysis Point	Intermediate Development Peak Flows (cfs)							
	2-year		10-year		25-year		50-year	
	S1	S2	S1	S2	S1	S2	S1	S2
	C2	C1	C2	C1	C2	C1	C2	C1
Out-A	8.4	8.4	35.8	35.8	65.8	65.8	97.7	97.7
Out-B	6.4	5.5	24.8	20.1	47.3	32.6	71.8	45.8
Out-C	13.7	13.5	62.7	58.1	124.8	120.9	190.6	196.3
Out-D	2.1	2.1	4.3	4.3	9.8	9.8	14.7	14.7
Out-E	3.6	3.6	5.9	5.9	9.6	9.6	12.6	12.6

Table 2: Pre-, Post-, and Intermediate Development Volume Comparison

Analysis Point	Pre- and Post-Development Volumes (af)							
	2-year		10-year		25-year		50-year	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Out-A	3.2	2.6	9.3	7.8	15.3	12.9	21.4	18.1
Out-B	1.8	0.3	5.1	1.4	8.4	2.8	11.8	4.3
Out-C	5.8	3.9	15.1	11.1	23.8	19.3	32.4	28.3
Out-D	0.3	0.4	1.0	1.0	1.7	1.7	2.5	2.4
Out-E	0.3	0.4	0.8	0.9	1.5	1.5	2.2	2.2

Analysis Point	Intermediate Development Volume (af)							
	2-year		10-year		25-year		50-year	
	S1	S2	S1	S2	S1	S2	S1	S2
	C2	C1	C2	C1	C2	C1	C2	C1
Out-A	3.2	3.2	9.3	9.3	15.3	15.3	21.4	21.4
Out-B	1.5	0.7	4.2	2.6	7.0	4.6	10.0	6.7
Out-C	3.9	3.9	10.8	10.6	17.8	17.8	25.4	26.0
Out-D	0.4	0.4	1.0	1.0	1.7	1.7	2.4	2.4
Out-E	0.4	0.4	0.9	0.9	1.5	1.5	2.2	2.2

Infiltration basins and stormwater ponds have been designed such that they do not overtop through at least the 50-year, 24-hour storm event in compliance with Section Env-Wq 1508.06. **Table 3** below, summarizes the top of berm heights versus the maximum pond elevation for the 50-year storm.

Table 3: Pond Elevation Summary

Pond ID	Post Development 50-year, 24-hour event	
	Berm Elev. (ft)	Max. Water Elev.
Rain Garden - Pond DD1	999.00	998.38
Detention Basin – Pond DD1A	989.00	988.21
Rain Garden - Pond DD2	1,049.00	1,048.38
Rain Garden - Pond DD3	1,075.00	1,074.51
Rain Garden - Pond DD3A	1,096.00	1,095.38
Rain Garden - Pond DD4	1,101.00	1,100.64
Rain Garden - Pond DD5	1,139.00	1,138.45
Infiltration Basin - Pond DD6	1,148.00	1,147.28
Lined Detention - Pond 1	1,138.00	1,136.46
Infiltration Basin - Pond 2	1,111.00	1,109.75
Infiltration Basin - Pond 3	1,122.00	1,120.69
Infiltration Basin - Pond 4	1,142.00	1,139.35
Infiltration Basin - Pond 5	1,134.00	1,132.59
Rain Garden - Pond 6	1,126.00	1,124.60
Infiltration Basin - Pond 7	1,142.00	1,140.75
Infiltration Basin - Pond 8	1,150.00	1,148.73
Infiltration Basin - Pond 9	1,177.00	1,175.55
Infiltration Basin - Pond 10	1,211.00	1,209.61
Infiltration Basin - Pond 11	1,144.00	1,142.58
Infiltration Basin - Pond 12	1,136.00	1,134.75
Infiltration Basin - Pond 13	1,167.00	1,165.30

STORMWATER TREATMENT PRACTICES

The proposed development will include the construction of impervious pavement, gravel, and building roofs which will create runoff that will be treated according to the NHDES AoT Rules which were promulgated to prevent the degradation of wetlands, streams, and other surface waters through treating the minimum water quality volume (WQV). Stormwater will be treated to meet or exceed NHDES AoT requirements through multiple treatment BMPs which include sediment forebays, detention basins, bioretention systems (rain gardens), deep sump catch basins, and infiltration basins. The locations of these practices are shown on the enclosed plans. BMP worksheets for each of the treatment practices are provided in Appendix I which demonstrate criteria for water quality treatment are met.

Horizons Engineering of Littleton, NH completed infiltration testing between October 25, 2021, and November 8, 2022, using test pits and borings to collect the information. An infiltration feasibility report, which meets the criteria of Env-Wq 1504.13 is provided in Appendix M. Data from the infiltration testing is incorporated into the stormwater model for the infiltration basins. Infiltration rates obtained from the testing were observed to be high, with many greater than 24 inches per hour. GSL is proposing to replace the top 24-inches of the pond with soils that will restrict flow to 5 inches per hour to meet AoT infiltration rate requirements.

We note that there are five pond locations that do not currently have infiltration test data due to reconfiguring some of the ponds since the tests were completed. The remaining infiltration tests will be completed in 2024. Based on the consistency of the data reviewed to date, test results greater than 5 inches per hour are expected, consistent with the minimum design criteria for the infiltration basins.

CHANNEL PROTECTION REQUIREMENTS

In accordance with Section Env-Wq 1507.05 of the Rules, CMA Engineers reviewed the stormwater infrastructure for conformance with the Channel Protection Requirements. This section requires the 2-year post-development peak flow to be less than the 2-year pre-development peak flow and other considerations. The most practical for the proposed site is that the 2-year post-development volume cannot increase over 0.1 ac-ft over predevelopment volume. As shown in the **Table 1**, post-development flow rates from developed areas are less than the pre-development conditions, and **Table 2** shows that post-development runoff volumes for the 2-year storm were less than the pre-development conditions or within the allowed increase.

GROUNDWATER RECHARGE PRACTICES

Proposed development will include the double-lined landfill, pavements and gravels, and buildings which will reduce the volume of rainwater infiltrating the soil which could potentially impact the water table, wetlands, and stream base flows. To inhibit negative impacts of new impervious areas, the NHDES AoT promulgated the Groundwater Recharge Volume (GRV) Rule which requires new developments to provide the GRV to mimic pre-development conditions. To meet this rule, AoT adopted Env-Wq 1504.12 which contains the calculation for the minimum GRV for new developments. Infiltration practices will utilize an engineered 24-inch base that will reduce the infiltration rate to 5-inches per hour. Most

of the infiltration tests completed at the site in the location of the proposed infiltration basin are more than 24-inches per hour (Appendix M).

As seen in the following **Table 4**, the proposed recharge volume potential by the proposed infiltration basins for the entire project exceeds the minimum required per NHDES AoT rules. See Appendix I.

Table 4: Summary of Groundwater Recharge Volume, GRV

GRV Required (af)	GRV Provided (af)
0.701	8.417

SECONDARY IMPACTS

The regulations require GSL to obtain a Section 401 Water Quality Certification (WQC) for the proposed GSL development. The purpose of the WQC program is to protect surface water quality and uses (such as swimming and aquatic life) by ensuring compliance with New Hampshire surface water quality standards. Examples of surface waters include lakes, ponds, rivers, streams, wetlands, and tidal waters. Surface water discharges from the GSL drain west to the Alder Brook wetland complex.

The WQC program is authorized by New Hampshire RSA 485-A:12, III and IV. Water Quality Certifications typically include enforceable conditions, including monitoring requirements, to ensure compliance with surface water quality standards.

The WQC will address secondary impacts to stormwater which will include a detailed sampling and analysis plan, including parameters identified under Section Env-Wq 1703 of the Surface Water Quality Rules. GSL has identified temperature as a secondary impact requiring further evaluation as much of the landfill and infrastructure areas will be in direct sunlight. GSL is currently evaluating alternatives for the site to reduce stormwater temperatures prior to discharge to the Alder Brook wetland complex including:

- Deployment of white geomembrane in place of black geomembrane which generates cooler temperatures in direct sunlight.
- Conveyance of stormwater in pipes where practical instead of swales which are open to the sunlight.
- Planting tree species native to the site wetlands on the pond bottoms on a maximum 50-foot center-to-center spacing to shade standing water in the ponds
    - Tree species shall include northern conifer (spruce, fir) and swamp hardwood (white birch, quaking aspen).

Note that we designed the stormwater infiltration basins to capture, treat, and infiltrate the first, and warmest, flush of stormwater. Larger storm events would release cooler water through the pond and basin outlet structures that come later in the event. GSL is also evaluating other locations of the site for plantings, including along the perimeter access road/toe swale and on the landfill surface itself to provide for additional shading and cooling of stormwater. The project expects the WQC application to be submitted mid-2023.

WATER BALANCE

CMA Engineers designed the Granite State Landfill to replicate the current site stormwater distribution to the extent practical including infiltration to groundwater, evaporation/evapotranspiration, and surface water flow to adjacent wetlands and surface water. The double lined landfill footprint will ultimately cover 70 acres of land and will prevent surface water flow to groundwater under its footprint. Impervious roadway areas including access roads and the site infrastructure area also restrict groundwater infiltration.

The stormwater design incorporates infiltration basins around the perimeter of the landfill and infrastructure area and bioretention systems (rain gardens) along Douglas Drive. Infiltration testing (see Appendix M) completed for the basins indicate high infiltration rates, in many cases greater than two feet per hour. GSL is proposing to utilize an engineered pond mix in the top 24-inches of the basin that will restrict infiltration rates to five inches per hour which will provide for treatment in compliance with AoT requirements. Rain gardens are lined with geomembrane and utilize an engineered soil media that will provide treatment as stormwater drains through it before discharging through a perforated pipe at the bottom of the rain garden to its designed outlet location.

Surface water on the landfill cap is routed to the stormwater infiltration basins via intermediate bench stormwater swales and drop chutes. Stormwater generation beyond what can infiltrate will discharge as surface water via the concrete outlet structures and overflow spillways, which will ultimately drain to the Alder Brook wetland complex to the west of the landfill.

Active landfill operations will utilize +/- 10 acres of landfill footprint at any given time. Landfill operators will grade areas where stormwater contacts waste to drain internally to the landfill leachate collection system, and therefore not be managed as stormwater.

This water balance has been prepared to evaluate rainwater distribution at the site over a typical year. We assumed rainwater falling on the grassed landfill is either run off as stormwater, evaporated or absorbed by vegetation (evapotranspiration [ET]), or infiltrated to the ground. The total volume of stormwater considered in this analysis is the projected annual rainfall (40 inches/year). This volume is split into the three categories above to comprise the water balance.

We obtained daily rainfall data (snowfall neglected) from the NCES Landfill in Bethlehem, provided in Appendix W, for the previous 7 years (2016 through 2022). The NCES Landfill is located approximately six miles to the southeast of the proposed Granite State Landfill. Over this time period, the total annual rainfall ranged from 31.0 to 46.5 inches. Most of the rain events recorded at the NCES Landfill are small, significantly smaller than the 2-year, 24-hour storm event of 2.34 in. The data indicates that many of the storm events are around 0.5 inches per day or less. The average daily event, where rainfall was recorded over this time period, was 0.30”. When considering events occurring over multiple days, and discounting single storm events 0.05” or less, the average storm event was 0.70.” Since a 24-hour rain event can occur over two different days, the average 24-hour rain event will be larger than the 0.30” rain event and smaller than the 0.70” storm average since those could occur over a period larger

than 24-hours. GSL is assuming an average rain event of 0.5" for the purposes of this water balance calculation. To achieve the annual estimate of 40 inches per year, there are an assumed 80 storm events per year. Appendix W includes a copy of the HydroCAD printouts for the 0.5" rain event for the pre- and post-development.

The HydroCAD model calculates off site surface water volumes at each of the five modeled study points. By subtracting the total of these five volumes from the total rainfall leaves the remainder to be infiltration and ET. To estimate these components, GSL has prepared Hydrologic Evaluation of Landfill Performance (HELP) models for forested land at an average slope of 10 percent. The HELP model is a useful tool as it is based on an agricultural model that estimates quantities of runoff, infiltration, and ET for farming scenarios. Appendix W includes a copy of the HELP model output for the existing forested land condition.

Pre-Development

As previously described, the HydroCAD model provides surface water output for the Pre-Development condition, leaving the HELP model to provide estimated infiltration and ET rates. For the forest HELP model, 56% of the total water balance is ET and 16% infiltrates, with the rest consisting of stormwater runoff (see Average Annual Totals Summary on page 69 of the HELP model printout). Normalizing to 100%, ET becomes 78% and infiltration becomes 22% of the non-run off portion of the water balance. When factoring in the additional runoff generated by the non-forest components (minor grass and impervious surfaces - by comparison), the ET and infiltration estimates adjust to 80% and 20%. We applied these ratios to the difference between the total volume of water generated and the surface water calculated at the five study points as summarized in **Table 5**, below.

Post-Development

For the post-development model, the water balance assumes different modeling criteria for developed and undeveloped/forested areas. Infiltration quantities in the basins and ponds are taken from the HydroCAD output, which assume an infiltration rate of 5 inches/hour. For these areas, the difference between what falls on the area as stormwater and what is infiltrated in the basins is accounted for as ET. Stormwater within these developed watersheds is assumed to infiltrate at a higher rate than woodland areas since the vegetation of a developed area will take up less water than a forest (trees versus grass). It is also noted that there will be some additional evaporation losses (in the ET number) attributed to tree removal. The project is assuming that loss of water uptake by trees is a greater factor in the remaining ET balance than the added impervious areas and previously described shading factor. Therefore, we are modeling developed areas with a reduced 70/30 ET/infiltration split. Areas outside of the basin and pond watersheds remain primarily woodland and carry an 80/20 split for ET and infiltration, similar to the pre-development model.

Intermediate Development

During landfill operations, approximately 10 acres of the landfill will be open to the leachate collection system and removed from stormwater. The landfill may also deploy exposed geomembrane over the landfill to limit surface water intrusion in non-active areas and to limit landfill gas emissions. Deployment of exposed geomembrane will be implemented on a project-specific basis but preliminary estimates indicate that the surface water infrastructure

can accommodate up to 10 acres of exposed geomembrane at any one time. The intermediate-condition model for the water balance considers the Stage 2 Cell 1 development and up to 10 acres of exposed geomembrane.

Appendix W provides a detailed summary table presenting the annual water balance analysis. A table summarizing this data is presented in **Table 5** below. These data represent the sum of the five evaluated watersheds.

Table 5: Summary of Water Balance (0.5" rain events)

	Pre-Development	Intermediate-Development	Post-Development (Closure)
Evaporation/Evapotranspiration (acre-ft)	1,560.6	1,475.4	1,507.4
Infiltration (acre-ft)	390.2	417.4	442.4
Surface Water Runoff (acre-ft)	0.2	1.2	1.2
TOTAL (acre-ft)	**1,951.0**	**1,894.0**	**1,951.0**

As displayed in the above table, the stormwater model data for the small 0.5" rain events indicate very minor amounts of surface water generation over the 585-acre watershed. This is attributed to the high infiltration capacity of the soil in the project watershed. Since larger storm events generate a higher percentage of surface water, a second water balance was created assuming all two-inch rain events (1-year storm). This evaluation assumes that there are twenty 2-inch rain events in a year to achieve 40 annual inches of rain. Appendix W provides the HydroCAD model for the 1-year storm event and the detailed water balance calculations, as summarized below in Table 6.

Table 6: Summary of Water Balance (2.0" rain events)

	Pre-Development	Intermediate Development	Post-Development (Closure)
Evaporation/Evapotranspiration (acre-ft)	1,451.3	1,368.0	1,384.3
Infiltration (acre-ft)	362.8	436.5	476.2
Surface Water Runoff (acre-ft)	136.8	89.4	90.5
TOTAL (acre-ft)	**1,951.0**	**1,894.0**	**1,951.0**

Tables 5 and 6 represent the expected range of surface water generation outcomes, and the data concludes that the balance of water from pre-development through post-development is stable. A higher level of infiltration is expected for intermediate and post-development conditions due to the addition of the stormwater infiltration basins and reduction of woodland vegetation. Infiltrated stormwater in the form of groundwater flows from east to west towards the Alder Brook wetland complex where some will re-emerge as surface water.

EROSION CONTROL DURING CONSTRUCTION

The Contractor shall evaluate and implement erosion controls during landfill construction in conformance with the project specifications, including the installation of temporary erosion control devices until the site is fully stabilized. The erosion control devices typically include a stabilized stone construction entrance, compost socks, silt fencing, proper grading, seeding & mulching and erosion control matting. Stormwater infiltration basins will serve as the primary feature for providing sedimentation and erosion control.

Appendix K provides stone outlet protection calculations for stormwater discharge areas. Outlet protection locations are shown on the plans.

A Notice of Intent (NOI) for coverage under the EPA's Construction General Permit (CGP) will be prepared and submitted by the Contractor prior to construction since greater than one acre of land will be disturbed. The Contractor will post a copy of the document on site for the duration of the project. Qualified personnel will perform all stormwater pollution prevention plan (SWPPP) related inspections and maintenance. GCPs require inspections on a bi-weekly basis or after storm events greater than 0.50 inches. Anytime greater than 5-acres of soil are exposed, an Environmental Monitor (EM) approved by NHDES-AoT shall monitor the site and complete the required reporting in compliance with Section Env-Wq 1505.03(d) of the AoT Rules.

EROSION CONTROL DURING OPERATIONS

During operations, the landfill will be subject to EPA's Multi-Sector General Permit (MSGP) which requires establishment of a site-specific SWPPP and monitoring/inspection program. In accordance with the current requirements of the MSGP, each outfall is monitored quarterly for total suspended solids and iron. The MSGP may require effluent limitation sampling if water quality impacts are suspected at potentially affected outfalls. The landfill will have SWPPP-specific weekly inspections to identify and correct operations that may lead to generating contaminated runoff.

We note that EPA updated the MSGP in 2021. The permit is issued for a term of five years. The Granite State Landfill will be subject to the MSGP requirements at the time of operation. Appendix O includes a draft version of the SWPPP to meet AoT's Source Control Plan requirements (Env-Wq 1504.08).

CONCLUSIONS

This Alteration of Terrain permit application has been prepared to document that the development of the Granite State Landfill will not discharge higher stormwater peak flows or volumes to surface water bodies and adjacent properties. AoT-required treatment is provided by the proposed stormwater infiltration basins, ponds, and rain gardens, as well as vegetated buffers to accommodate runoff from impervious surfaces. The proposed infiltration basins will recharge required quantities of treated surface water to the groundwater. The landfill stormwater management system will mimic the current site conditions in terms of off-site flow and infiltration. CMA Engineers provides calculations herein that demonstrate compliance with AoT rules and requirements.

Stormwater infiltration basins and ponds are positioned around the perimeter of the landfill and infrastructure. These stormwater features allow for careful recharge to adjacent wetlands, streams, and drainage features to ensure the post and operating condition development strategies align with the pre-development conditions at the site.

Groundwater quality is monitored at the site by a comprehensive network of monitoring wells that can screen for contaminants in the overburden and bedrock groundwater. The proposed stormwater infrastructure will provide excellent treatment to surface water infiltrating to groundwater. GSL will monitor surface water quality in select locations as part of the site Groundwater Management Permit.

In addition to an AoT permit, this project will require several other permits to be in place prior to operation of the landfill as described in detail herein. These permits will provide for additional protection of environmental resources, which will include an NHDES-WMD Solid Waste Standard Permit, NHDES-Wetlands Standard Dredge and Fill Permit, Army Corps Wetland Permit, NHDES Groundwater Protection Bureau Groundwater Management Permit, NHDES Air Resources Division Temporary Permit, NHDES 401 Water Quality Certification, NHDOT Driveway Permit, EPA Multi-Sector General Permit, and an NHDES Shoreland Permit.