

STORMWATER MANAGEMENT OPERATION AND MAINTENANCE MANUAL

**Carlisle Subdivision
Tax Map 33 Lot 26
Watson Road
Exeter, NH**

Prepared for:

**Scott W. Carlisle, III
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Prepared by:

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December 22, 2020
JBE Project No. 19102**

Inspection and Maintenance of Facilities and Property

A. Maintenance of Common Facilities or Property

1. The Property Owner is responsible for maintenance of all stormwater infrastructure associated with this site, until such time that the town of Exeter take ownership of said infrastructure.

B. General Inspection and Maintenance Requirements

1. The Owner shall perform all inspections and maintenance with greater than annual frequency as required by this report.
2. Inspection reports must be provided to the DES upon request.
3. Permanent stormwater and sediment and erosion control facilities to be maintained on the site include, but are not limited to, the following:
 - a. Culverts
 - b. Erosion
 - c. Vegetation and landscaping
 - d. Catch basins and drain manholes
 - e. Riprap inlet and outlet protection aprons
 - f. Infiltration Basin

2. Maintenance of permanent measures shall follow the following schedule:
- a. **Culverts: Inspection** of culvert inlets and outlets at least **once per month during the rainy season** (March to November). Any debris is to be removed and disposed of properly.
 - b. **Erosion: Annual inspection** of the site for erosion, destabilization, settling, and sloughing. Any needed repairs are to be conducted immediately.
 - c. **Vegetation and Landscaping: Annual inspection** of site's vegetation and landscaping. Any areas that are bare shall be reseeded and mulched with hay or, if the case is extreme, loamed and seeded or sodded to ensure adequate vegetative cover. Landscape specimens shall be replaced in kind, if they are found to be dead or dying.
 - d. **Catch basins and Drain Manholes: Annual inspection** of catch basins and drain manholes to determine if they need to be cleaned. Catch basins are to be cleaned if the depth of deposits is greater than one-third the depth from the basin bottom to the invert of the lowest pipe or opening into or out of the basin. If a catch basin significantly exceeds the one-third depth standard during the inspection, then it should be cleaned more frequently. If woody debris or trash accumulates in a catch basin, then it should be cleaned on a weekly basis. Manholes should be cleaned of any material upon inspection. Catch basins and manholes can be cleaned either manually or by specially designed equipment including, but not limited to, bucket loaders and vacuum pumps. Before any materials can be disposed, it is necessary to perform a detailed chemical analysis to determine if the materials meet the EPA criteria for hazardous waste. This will help determine how the materials should be stored, treated, and disposed.
 - e. **Riprap:** Rock riprap should be **inspected annually** and after every major storm event in order to ensure that it has not been displaced, undermined, or otherwise damaged. Displaced rock should be replaced, or additional rock added in order to maintain the structure(s) in their undamaged state. Woody vegetation should not be allowed to become established in riprap areas, and/or any debris removed from the void spaces between the rocks. If the riprap is adjacent to a stream or other waterbody, the water should be kept clear of obstructions, debris, and sediment deposits.
 - f. **Infiltration Basin:**
 - Removal of debris from inlet and outlet structures
 - Removal of accumulated sediment
 - Inspection and repair of outlet structures and appurtenances
 - Inspection of infiltration components at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24 hour period,

with maintenance or rehabilitation conducted as warranted by such inspection.

- Inspection of pretreatment measures at least twice annually, and removal of accumulated sediment as warranted by inspection, but no less than once annually.
- Periodic mowing of embankments
- Removal of woody vegetation from embankments
- Inspection and repair of embankments and spillways
- If an infiltration system does not drain within 72-hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore infiltration function, including but not limited to removal of accumulated sediments or reconstruction of the infiltration trench.

C. Invasive Species

An invasive plant is a non-native plant that is able to persist and proliferate outside of cultivation, resulting in ecological and/or economic harm. These plants readily colonize disturbed areas and habitat edges, such as transportation and river corridors. Once established in these areas, invasive plants often continue to spread to adjacent habitats. All invasive plant species are aggressive competitors with the ability to significantly reduce diversity of native plant and animal species.

For additional information refer to the "New Hampshire Department of Transportation: *Best Management Practices for Roadside Invasive Plants*"

1. Invasive Plant Prevention:

Invasive plants spread by a variety of mechanisms, including birds, wind, and water. Human activities are also a major factor in the spread of these plants, from gardening and transport of nursery stock to erosion control and wildlife plantings. Routine maintenance and construction activities along transportation corridors can also play a significant role in the spread of invasive plants by dispersing or introducing seeds and other viable plant materials.

Eliminating or reducing the spread and establishment of invasive plants requires a proactive approach, in which there are two key elements. First, new introductions, especially those that occur due to human activities, must be avoided to the maximum extent possible. Second, there must be an emphasis on early detection and eradication of new populations. Control measures are far more likely to be successful, as well as

significantly less expensive, on small, young populations rather than on larger, more established populations, as shown in Figure 1.

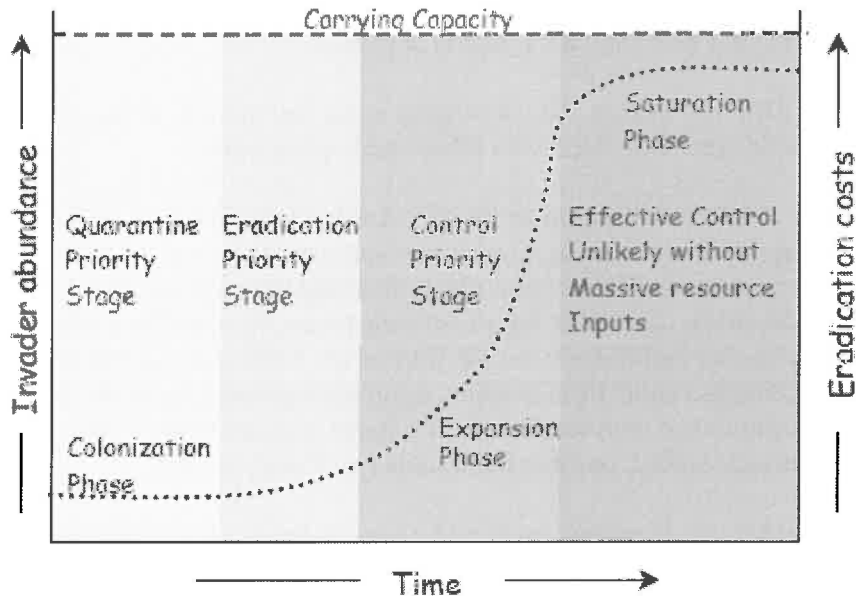


Figure 1. Typical invasive species population curve (from the University of Arizona and USGS Desert Laboratory <http://www.pazten.wr.usgs.gov>)

2. Best Management Practices

Soil Disturbance and Stabilization:

- **BMP #1:** Minimize soil disturbance whenever possible. Invasive plants readily colonize areas of disturbed soil. Monitor recent work sites for the emergence of invasive plants for a minimum of two years after project completion.
- **BMP #2:** Stabilize disturbed soils as soon as possible by seeding and/or using mulch, hay, rip-rap, or gravel that is free of invasive plant material. Seeds of native species should be used whenever possible. Species on the prohibited invasive plant list should never be planted.
- **BMP #3:** Materials such as fill, loam, mulch, hay, rip-rap, and gravel should not be brought into project areas from sites where invasive plants are known to occur. If the absence of invasive plant parts in these materials cannot be guaranteed, recent work sites should be monitored for the emergence of invasive plants for a minimum of two years after project completion.

Movement and Maintenance of Equipment:

- BMP #4: If work in areas containing invasive plants cannot be avoided, then the movement of maintenance and construction equipment should be from areas not infested by invasive plants to areas infested by invasive plants whenever possible. This is especially important during ditch cleaning and shoulder scraping activities.
- BMP #5: Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts.
- BMP #6: If equipment must be used in areas where invasive plants occur, all equipment, machinery, and hand tools should be cleaned of all visible soil and plant material before leaving the project site. Equipment should be cleaned at the site of infestation. Acceptable methods of cleaning include, but are not limited to: *f* Portable wash station that contains runoff from washing equipment (containment must be in compliance with wastewater discharge regulations); *f* High pressure air; Brush, broom, or other hand tools (used without water).
- BMP #7: If equipment must be used in areas containing Japanese knotweed, phragmites, or purple loosestrife, aboveground plant material should be cut and properly disposed of (see BMP #11) prior to the start of work. If excavation occurs in these areas, see BMPs #13-16.

Mowing:

- BMP #8: These invasive plants have the ability to sprout from stem and root fragments: purple loosestrife, phragmites, and Japanese knotweed. Mowing these plants should be avoided whenever possible. Staking roadside populations of these plants as “do not mow” is one way to accomplish this. If these plants are cut, all plant material must be rendered nonviable and extra care should be taken to avoid spreading plant fragments (see BMP #11).
- BMP #9: In areas where invasive plants occur and the plants listed in BMP #8 (purple loosestrife, phragmites, and Japanese knotweed) are not present, an attempt should be made to mow the right-of-way prior to seed maturation (approximately August 1st). This could be accomplished by identifying specific roads that are either heavily infested with invasive plants or roads that are in sensitive habitat areas, and making those roads a priority in the mowing schedule.
- BMP #10: Mowing equipment should be cleaned at least daily, as well as prior to transport (see BMP #6). This is particularly important if mowing occurs after seed maturation (after August 1st).

Disposal of Plants:

- **BMP #11:** When invasive plants are cut or removed for roadside maintenance, construction, or control of plants, the spread of viable plant material must be avoided by rendering plant material nonviable. The following methods can be used to destroy plant material:
 - **Drying/Liquefying:** For large amounts of plant material or for plants with rigid stems, place the material on asphalt, tarps, or heavy plastic, and cover with tarps or heavy plastic to prevent the material from blowing away. For smaller amounts of plant material or for plants with pliable stems, bag the material in heavyduty (3-mil or thicker) garbage bags. Keep plant material covered or bagged for at least one month. Material is nonviable when it is partially decomposed, very slimy, or brittle. Once material is nonviable, it can be disposed of in a landfill or brush pile. Recommended for: Japanese knotweed, purple loosestrife, phragmites.
 - **Brush Piles:** Plant material from most invasive plants can be piled on site to dry out. However, when piling purple loosestrife, phragmites, and Japanese knotweed, care must be taken to pile stems so that cut surfaces are not in contact with the soil. Recommended for: Woody shrubs, trees, and vines; spotted knapweed; large quantities of purple loosestrife, phragmites, and Japanese knotweed. NOT recommended for: any invasive plant with seeds or fruit attached, unless plants can be piled within the limits of the infestation.
 - **Burying:** Plant material from most invasive plants can be buried a minimum of three feet below grade. This method is best used on a job site that already has disturbed soils. Recommended for: any invasive plant. NOT recommended for: Japanese knotweed, unless other options are not feasible and knotweed can be buried at the site of infestation at least five feet below grade. *f*
 - **Burning:** Plant material should be taken to a designated burn pile. (All necessary permits must be obtained before burning.) Recommended for: any invasive plant, especially purple loosestrife, phragmites, Japanese knotweed.
 - **Herbicide:** Herbicide applications must be carried out by a licensed applicator with a permit from the NH Department of Agriculture Division of Pesticide Control. Recommended for: any invasive plant, especially purple loosestrife, phragmites, Japanese knotweed.
- **BMP #12:** Invasive plant material must be covered during transport.

Excavated Material:

- **BMP #13:** Excavated material taken from sites that contain invasive plants cannot be used away from the site of infestation until all viable

plant material is destroyed. Excavated material from areas containing invasive plants may be reused within the exact limits of the infestation.

- BMP #14: Any excavated material that contains viable plant material and is not reused within the limits of the infestation must be stockpiled on an impervious surface until viable plant material is destroyed OR the material must be disposed of by burying a minimum of three feet below grade. Japanese knotweed must be buried at least five feet below grade.
- BMP #15: Whenever possible, excavation should be avoided in areas containing Japanese knotweed, purple loosestrife, and phragmites. If excavation does occur in these areas, the BMPs described in Section II must be followed.
- BMP #16: Soil and other materials containing invasive plants must be covered during transport.

D. Threatened Plant Species

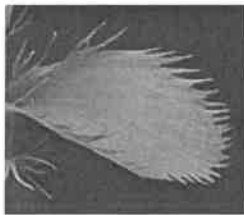
1. Greater Fringed-Gentian (Gentianopsis Crinita)





2. Plant Description

Flower:



Blooms are singular on slender, 2 to 7 inch stalks at the end of the main stem and arising from side branches. The trumpet shaped, royal blue to blue-violet flowers are 1½ to 2 inches long, with 4 rounded petal lobes that have long, delicate fringes around the edges. The broad white and blue striped throat is enclosed by 4 green or red-tinged sepals, broad at the base tapering to slender tips that reach the base of the spreading lobes. The mid-rib of the sepals is strongly ridged, making the closed buds appear square with a sharp point at the top. Inside the tube are 4 yellow to orangish stamens and a creamy white style. Flowers open on sunny days.

Leaves and stems:



Leaves are 1 to 2½ inches long, ¼ to ¾ inch wide, toothless, hairless with a glossy surface, opposite, stalkless or clasping the stem, the lower leaves broadly egg-lance shaped, rounded at the base, becoming narrower higher on the stem. The erect stems are hairless, slightly 4-

angled and leafy, the few to numerous side branches narrowly angled to the main stem.

3. Best Management Practices

Following NHB review there is a possibility Greater Fringed-Gentian is located on site. Contractor shall survey areas for this plant species prior to large earth disturbing activities take place. Should a possible specimen be located the contractor should notify the project engineer of its location on site.

If Greater Fringed-Gentian be confirmed onsite the project engineer will review the location and determine if reasonable modifications to the design can be made to avoid the location. If avoidance of the area cannot be accomplished, replanting of the specimen to the rear field in an ideal area should be undertaken. This replanting process should be done with the guidance of the project engineer to ensure the success of the replanting.

See attached sample forms as a guideline.

Any inquiries in regards to the design, function, and/or maintenance of any one of the above-mentioned facilities or tasks shall be directed to the project engineer:

Jones & Beach Engineers, Inc.
85 Portsmouth Avenue
P.O. Box 219
Stratham, NH 03885

T#: (603) 772-4746
F#: (603) 772-0227

STORM WATER POLLUTION PREVENTION PLAN
INSPECTION PERIOD AND CRITERIA
 Tax Map 33 Lot 26
 Carlisle Subdivision
 Exeter, NH

Stormwater Component	Inspection Period	Inspection Criteria/Methods
Culverts	Once per month	Inspect inlet/outlet. Remove debris.
Erosion	Annually	Repair site erosion.
Vegetation	Annually	Repair bare unvegetated areas.
Catch Basins and Drain Manholes	Annually (or more as required)	Remove trash and debris. Inspect for sediment. Remove if sediment greater than 1/3 sump depth.
Riprap	Annually	Relocate displaced rocks, remove woody vegetation and debris.
Infiltration Basin	Bi-annually	Inspect for sediment/debris collection, inspect inlets/outlets, inspection for erosion.

**STORM WATER OPERATIONS AND MAINTENANCE PLAN
INSPECTION REPORT**

Tax Map 33 Lot 26
Carlisle Subdivision
Exeter, NH

Yearly Inspection Form			
Inspected Component	Date of Inspection	Inspector	Issue Detected / Action Taken
Culverts			
Erosion			
Vegetation			
Catch Basins and Drain Manholes			
Riprap			
Infiltration Basin			

SALT MINIMIZATION PLAN

**Carlisle Subdivision
Tax Map 33, Lot 26
19 Watson Road
Exeter, NH 03833**

Prepared for:

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**Prepared by:
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(603) 772-4746
August 30, 2021
JBE Project No. 19102**

Inspection and Maintenance of Facilities and Property

A. Maintenance of Common Facilities or Property

1. The Property Owner or their designees are responsible for maintenance of all salt minimization measures associated with this site. This includes all temporary and permanent stormwater and erosion control facilities both during and after construction.

B. Introduction/Background

1. This document is for the Carlisle Subdivision located at 19 Watson Road. This project includes an approximately 11+14 linear feet cul-de-sac.

C. Operational Guidelines

1. This is a living document and should be updated and modified as needed to keep up to date, and be the most effective in reducing salt amounts. See the attached *Amendment Log* and keep updated to any changes made to this document.

Training is an effectual part of effective use of salt to promote motorist safety, as well as reducing the impact of excess salt use on the surrounding water resources. Any training that takes place must be documented using *Salt Minimization Plan Training Log*.

2. **Winter Operator Certification Requirements:** Contractors responsible for snow removal and maintenance are to undergo "Green SnowPro Training".

The University of New Hampshire Technology Transfer Center (UNH T 2) offers a full day Green SnowPro Training course focused on efficient, more environmentally friendly winter maintenance practices that do not compromise road, parking lot and sidewalk safety. The course covers the basics of salt reduction methods including equipment calibration and rate applications, pre-treatment methods, effective plowing and planning, salt accounting management and environmental impacts of salting. The course is offered several times a year. For more information, visit the UNH T 2 webpage at: <http://t2.unh.edu/green-snowpro-trainingand-nhdes-certification>.

Individuals who attend the Green SnowPro Training and pass the exam are eligible to apply for voluntary NHDES Salt Applicator Certification. The NHDES Salt Applicator Certification program aims to improve efficiency in salt use and reduce the amount of salt used by commercial applicators. The NHDES salt applicator certificate carries the responsibility of annually reporting salt use to NHDES and attending a refresher training course every two years. The Salt Applicator Certificate has proven valuable to the private contractors as well as to

their clients and their insurance carriers. To date, 800 individuals have become Certified Salt Applicators. For more information on how to become a NH Certified Salt Applicator or to find a list of Certified Salt Applicators refer to the NHDES webpage at: <http://des.nh.gov/organization/divisions/water/wmb/was/saltreduction-initiative/salt-applicator-certification.htm>

3. **Pre-season Preparation:** Take some time before the season to plan your routes and learn the plowing policies. A little planning up-front can help you do a more efficient job in keeping the roads safe. The attached *Salt Minimization Checklist* document is to be filled out prior to each winter season to review the overall readiness for the coming season, and prepare materials and treatment plan prior to first snow fall to maximize the plans effectiveness.
4. **Weather:** Weather information is to be gathered on a regular basis to make informed decisions as to when and to what extent materials are applied.

Pavement temperatures are to be acquired using the NHDOT Road Weather Information System, a hand-held infrared sensor, or truck-mounted sensor.

Weather Information Sources:

- National Weather Service
- NHDOT Road Weather Information System (RWIS)
- University of New Hampshire Weather Services

5. **Equipment Calibration Requirements:** Calibration is an essential procedure to measure the amount of material applied to the roadway at various auger settings in relation to truck speed. No matter how sophisticated or simplified your operations, always calibrate or verify calibration yearly.
 - Because spreaders vary, calibrate each truck. Re-calibration is required if changes are made to the hydraulic system, if the augers have extensive wear or are resurfaced or replaced, or a different material is used.
 - Follow the manufacturer's guidelines for calibration, and contact the manufacturer for training.
 - Calibrate separately for salt/sand mix vs. salt or sand only.
 - Determine flow rate or calibrate liquid application systems at the same time as the dry systems.
 - Remember: The auger plate must be in place during calibration. You are not calibrating the truck properly if the material is gravity-flowing.
 - For manual sander controls, place a chart in your truck to see how much material is applied at each setting, at various speeds.

- There are two types of automatic sander controllers. Open loop controllers monitor only truck speed during operation; closed-loop controllers monitor both truck speed and spreader discharge.

6. Mechanical Removal:

a) Effective use of Plows:

- Plow first before applying deicers to avoid dilution of the salt.
- Coordinate plowing activities to eliminate windrows at intersections and prevent plowing off another operator's material.
- Remove snow from roads as quickly as possible to reduce compaction; use of underbody blades helps remove compacted or slushy snow.
- Make use of carbide, flexible, or rubber-encapsulated plow blade edges.
- Adjust blade angle to maximize cutting efficiency or snow throwing capabilities.

b) Loading and Hauling

- Set up and load under cover and on a level surface wherever possible.
- Maintain loading area. Keep it clear and smooth.
- Don't overload. Avoid spilling on units.
- Watch for co-workers/pedestrians in or near the loading area.

7. Salt Usage Evaluation and Monitoring:

- a) **Anti-icing:** Anti-icing can be a cost-effective strategy that optimizes chemical usage. It is a proactive approach that should be first in a series of strategies for most winter storms. By applying chemical freeze-point-depressant materials before a storm, you can prevent snow and ice from bonding to the pavement.

Guidelines for anti-icing:

- Anti-icing is often effective for heavy frosts.
- Anti-icing works best when combined with accurate road weather information.
- Because motorists have difficulty perceiving how slippery light freezing drizzle and light frost can be, early application is important in these conditions.
- Liquids are the most efficient and may be applied days in advance of an event, but the closer to the event start time, the better, as tire action and wind wear away material.
- Similar applications of pretreated salts will also work. Use the lowest possible setting, less than 100 lbs/two-lane mile; apply as close to the start of event as possible.

- b) **Pre-treating and Pre-wetting Salt and Sand:** Dry material bounces or blows off the road, so everyone should be either pre-treating or pre-wetting dry material. Liquids also increase salt's effectiveness by jump-starting the melting process. Depending on the liquid used, it may lower salt's effective working temperature. Because pre-treating and pre-wetting cause material to stick to the road, 20 to 30 percent less material is used—saving money and reducing environmental impacts.

Pre-treating is mixing a liquid into the stockpile of salt or sand before it is applied. Unlike pre-wetting, it does not require equipment changes and requires no new capital investment for equipment. You can also switch from dry application to wet application immediately—just turn down the application rate.

Salt stockpile:

- Treat the salt stockpile with a liquid deicing chemical. It may be purchased pretreated or mixed on site by the vendor or your crew.
- When treating the stockpile at the shop, apply at 4 to 6 gallons/ton. Salt must be very dry for the chemical to stick.
- Because leach risk at a stockpile is increased, store it covered on an impervious pad.

Sand stockpile:

- Pretreat the stockpile to keep it flowable.
- Apply to stockpile at 4 gallons of salt brine/ton sand.
- Store the stockpile under cover.

Guidelines for Pre-wetting: Pre-wetting is adding a liquid to the salt as it is being applied— either at the spinner or through a soaker pipe in the auger box—to help it stick to the road better. Although pre-wetting requires some equipment changes, it provides flexibility to switch the chemical makeup depending on conditions.

- Salt brine, calcium, magnesium chlorides, and acetates may be used as pre-wetting agents.
- The usual application rate is 8 to 14 gallons/ton for salt brine.
- Pre-wetting with other chemicals at the spinner can help reduce the application rate.
- Below 15° F, salt brine becomes less effective; below 0° F, it may freeze hoses and valves.
- Salt brine should be mixed at 23.3%.

- Verify concentration of liquids you're using: Salt brine: 23.3% CaCl₂: 29.8% MgCl₂: 21.6% CMA: 32.5% KAC: 49%.

c) **Deicing:** Deicing is a reactive operation in which a deicer is applied to the top of an accumulation of snow, ice, or frost that is already bonded to the pavement surface. Removing ice that has already bonded to the pavement can be difficult, and removing it mechanically can damage equipment and roads. Generally, enough ice must be melted chemically to break the bond between the ice and the pavement, which requires larger quantities of chemical than anti-icing.

- Use an appropriate amount of salt. Most oversalting can be prevented by using calibrated, speed-synchronized spreaders and good judgment in selecting application rates and truck speed.
- It is not necessary to melt all the snow or ice on the road with salt. This is an overuse of materials. Apply just enough to loosen the bond between the road and the ice so it can be plowed off.

d) **Using Abrasives:** Use winter sand and other abrasives when temperatures are too cold for deicing chemicals to be effective. But be aware that sand does not melt anything. It provides temporary traction, and only when it is on top. Sand also clogs sewers, ditches, and streams. As a result, avoid sand use as much as possible. A salt/sand mix is generally not recommended. Salt reduces the effectiveness of sand, and sand reduces the effectiveness of salt. However, a salt/sand mix may be helpful in limited situations such as a freezing rain event where the salt is washed away quickly. A 25 to 50 percent sand/salt mix has been documented as effective in increasing friction by sticking the sand to the surface, like sandpaper.

- Use abrasives in slow-moving traffic areas such as intersections and curves.
- If your purpose is melting, use salt only.
- Salt is ineffective in cold weather, so use sand or an alternative chemical.
- Sand is not cheap when you consider the handling, cleanup, and disposal costs.
- Sweep up sand frequently, after each event if feasible.

e) **Standard Practices**

- Know the pavement temperatures and trends to help you use the right application at the right time. Generally use

less chemical when temperatures are rising and more when they are falling.

- Don't apply dry salt(sodium chloride) at below 15° F pavement temperature. It will not melt fast enough to help and it will blow off the road into the ditch.
- Below 20° F, switch to other tools like CaCl₂ and MgCl₂ at curves, hills, and intersections to obtain maximum melting. If unavailable, use sand for traction.
- Adjust your spinner speed to the lowest setting possible, except at intersections.
- Don't let the traffic dictate your speed. Drive at the slowest possible speed—17 to 25 mph—to keep material on the road.
- On high-speed roads, apply deicers in the center of the road or high side of the curve.

f) Documenting and Charting: Good documentation helps you use less material, reduce costs and environmental impacts, and run a more effective snow and ice control program. Unless you document and chart, you can't measure what you are doing. The attached *Anti-icing Route Data Event Report* document is to be filled out prior to each snow event to monitor the chemical usage on site, and provide a record for review to make future adjustments to maximize the effectiveness of the Salt Implementation Plan.

- Track your material use.
- Understand the storm conditions and the target level of service for each route.
- Refine your procedures and material use based on observations.
- Share observations to improve operations and learn from each other.
- Use forms like those shown in the appendix of this field handbook to record and track your work and observations.
- Complete forms at the end of your shift.
- Turn in documentation forms to your supervisor.

g) Guidelines for Determining Applications Rates:

To determine the amount of material needed, take the application rate parking lot area/1000 sq. ft. (See attached application rate tables)

Example: Given 300,000 sq. ft. parking lot and application rate of 1.5 lbs/1000 sq. ft. (1.5x300,000) = 450,000 450,000/1000 = 450 lbs

- Sand/salt mix isn't advised but may help in some situations such as freezing rain.

- Always plow before applying chemical.
- Generally the first pass will require an application rate at the higher end of the range, with subsequent passes requiring less and less.
- On long routes where you'll only be able to make one pass, you may have to apply more material than what's recommended in the charts.
- High traffic volume will work salt into the snow and aid in melting—so use a lower rate.
- Higher traffic speeds will blow salt off the road and hinder melting—so increase use of pre-wetted materials.
- Use sand for short-term traction only. It will never melt anything.
- It is usually not cost-efficient to apply salt (sodium chloride) at pavement temperatures below 15° F.

8. Analysis Alternative De-icing Materials and Practices

- Be aware. Find out what the salt loading reduction goals are within the watershed and town where work generally occurs or where the specific project is located.
- Re-evaluate current practices. Source reduction is identified as the most effective method for reducing chloride loading.
- Consider alternative de-icing materials such as calcium magnesium acetate (CMA) and limited use of abrasives (sand, sawdust, cat litter).
- Pre-wet salt with brine to reduce the loss of salt from bounce and scatter (up to a 30% reduction in loss) and increase melting times.
- Be proactive for storm events and anti-ice by applying a small amount of liquid chemical to pavements and overpasses before a storm to prevent ice from bonding with the surface.
- If applicable, keep pavement free of potholes and cracks which both minimize the ability for water to pond and/or infiltrate into the ground where ultimately they could end up in groundwater resources. In addition, pavement that is in good condition allows for snow and or ice to be mechanically removed.
- Consider future maintenance needs in project planning.
 - o Include development amenities/features such as heated sidewalks or parking garages.
 - o Limit the amount of impervious surfaces that require winter maintenance activities. Some options to achieve this are only including sidewalks on one side of the street, the use of porous paving materials and limited use of curb cuts.
 - o Properly design parking lots or designated parking areas with appropriate winter maintenance and snow storage practices. This includes considering where plowed snow will be piled, avoiding melt drainage to flow back across cleared areas (freeze/thaw cycle).
 - o Consider landscape vegetation that is more salt tolerant and that doesn't shade out sidewalks or parking areas from the sun during the winter.

- Share information with the town and other landowners in the watershed to help track where salt is being applied, what quantity, and how often or the level of service based on the winter management plan. Track what BMPs are being applied to help determine effectiveness.
- Spread the word and encourage co-workers and colleagues to become a New Hampshire Certified Green SnowPro. Educate clients about the benefits of hiring a New Hampshire Certified Green SnowPro. The NHDES has developed a flyer for businesses to share with their colleagues - 4 - or clients available on the NHDES website. A link for this flyer and other helpful information is included below.
- Attend the annual New Hampshire Salt Symposium. The event counts toward the continuing education requirement of the New Hampshire Salt Applicator Certificate and as T2 Road Scholar Program contact hours.

Every year the NHDES hosts an annual NH Salt Symposium. Attendees are updated with the latest snow industry technologies and BMPs. The event counts toward continuing education credits for the NH Certified Green SnowPro Certificate, the New Hampshire Salt Applicator Certificate and T2 Roads Scholar Program Contact Hours. People interested in attending can learn more about the event or register online at <http://www.sima.org/newhampshire-salt-symposium>.

E. Relevant/Helpful Tables:

Table A: Treatment Amount

RECOMMENDED SNOW AND ICE TREATMENTS PER LANE MILE					
Conditions	Temperature	Type 1A & 1B		TYPE 2 & 3	
		Lane Length	Area	Lane Length	Area
Sleet & Freezing Rain	Variable	Salt 300 lbs. per lane mile and/or abrasive as needed.	Salt 207 lb per acre and/or abrasive as needed.(4)	Salt 300 lbs. per lane mile and/or abrasive as needed. (2)	Salt 207 lb per acre and/or abrasive as needed.(4)
Snow	20° and up	Salt 250 lbs. per lane mile. (1)	Salt 172 lb per acre (4)	Salt 250 lbs. per lane mile. (2)	Salt 172 lb per acre (4)
Snow	Below 20°	Salt 250 lbs. per lane mile.(2&3)	Salt 172 lb per acre (4)	Abrasive-Chemical Mix	Abrasive-Chemical Mix

(1) For exceptionally high volume roads where traffic will enhance the action of the salt, this rate may be decreased to 200 lbs. per lane mile.

(2) Abrasive – chemical mix may be needed at extremely low temperatures or on very lightly traveled highways.

(3) An alternative low temperature treatment is to use a chemical mix of 2 parts salt to 1 part calcium chloride at 200 lbs. per lane mile.

(4) Area amount extrapolated using the area of 1 mile x 12' lane.

NHDOT Roadway Classification:

Type 1 A - Highways on the Interstate and Turnpike Systems and those highways carrying 15,000 vehicles or more daily (green) should have full width bare pavement as soon as practical after a winter storm terminates.

Type 1 B - Highways on the State system and carrying 5,000 to 15,000 vehicles daily (blue) should have full width bare pavement as soon as practical after a winter storm terminates.

Type 2 - Highways on the State system carrying 1,000 to 5,000 vehicles daily (orange) should have some bare pavement as soon as practical after a winter storm terminates.

Type 3 - Highways on the State highway system carrying less than 1,000 vehicles daily (red) should have bare pavement in left wheel tracks near the center of the highway as soon as practical after the winter storm. Included in this classification are highways carrying less than 500 vehicles daily for which snow-covered pavement is deemed acceptable.

Table B: Minimum/Maximum Accumulation

SNOW AND ICE MANAGEMENT PLANNING CRITERIA			
HIGHWAY TYPE	PLANNED PLOWING FREQUENCY	PLANNED ALLOWABLE SNOW ACCUMULATION	AVE. MAX. ALLOWABLE ACCUMULATION
Type 1A	1 1/2 hours	1 1/2"	3"
TYPE 1B	2 hours	2"	4"
Type 2,4	2 1/2 hours	2 1/2"	5"
Type 3,5	3 1/2 hours	3 1/2"	6"

Table C: lbs per two-lane mile

Deicing Application Rate Guidelines

24' of pavement (typical two-lane road)

These rates are not fixed values, but rather the middle of a range to be selected and adjusted by an agency according to its local conditions and experience.

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Pounds per two-lane mile			
			Salt Prewetted / Pretreated with Salt Brine	Salt Prewetted / Pretreated with Other Blends	Dry Salt*	Winter Sand (abrasives)
> 30° ↑	Snow	Plow, treat Intersections only	80	70	100*	Not recommended
	Freezing Rain	Apply Chemical	80 - 160	70 - 140	100 - 200*	Not recommended
30° ↓	Snow	Plow and apply chemical	80 - 160	70 - 140	100 - 200*	Not recommended
	Freezing Rain	Apply Chemical	150 - 200	130 - 180	180 - 240*	Not recommended
25° - 30° ↑	Snow	Plow and apply chemical	120 - 160	100 - 140	150 - 200*	Not recommended
	Freezing Rain	Apply Chemical	150 - 200	130 - 180	180 - 240*	Not recommended
25° - 30° ↓	Snow	Plow and apply chemical	120 - 160	100 - 140	150 - 200*	Not recommended
	Freezing Rain	Apply Chemical	160 - 240	140 - 210	200 - 300*	400
20° - 25° ↑	Snow or Freezing Rain	Plow and apply chemical	160 - 240	140 - 210	200 - 300*	400
20° - 25° ↓	Snow	Plow and apply chemical	200 - 280	175 - 250	250 - 350*	Not recommended
	Freezing Rain	Apply Chemical	240 - 320	210 - 280	300 - 400*	400
15° - 20° ↑	Snow	Plow and apply chemical	200 - 280	175 - 250	250 - 350*	Not recommended
	Freezing Rain	Apply Chemical	240 - 320	210 - 280	300 - 400*	400
15° - 20° ↓	Snow or Freezing Rain	Plow and apply chemical	240 - 320	210 - 280	300 - 400*	500 for freezing rain
0° - 15° ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300 - 400	Not recommended	500 - 750 spot treatment as needed
< 0°	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	400 - 600**	Not recommended	500 - 750 spot treatment as needed

* Dry salt is not recommended. It is likely to blow off the road before it melts ice.

** A blend of 6 - 8 gal/ton MgCl₂ or CaCl₂ added to NaCl can melt ice as low as -10°.

Figure 4-1. Deicing Application Rate Guidelines

Table D: Salt Application Rate: lbs per 1000 sq. ft.

Deicing Application Rate Guidelines for Parking Lots and Sidewalks

These rates are adapted from road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2006-1). Develop your own application rates using the guidelines as a starting point and modify them incrementally over time to fit your needs. The area should first be cleared of snow prior to applying chemical.

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate in lbs. per 1000 square foot area			
			Salt Prewetted/ Pretreated With Salt Brine	Salt Prewetted/ Pretreated With Other Blends	Dry Salt	Winter Sand (abrasives)
>30° ↑	Snow	Plow, treat intersections only	0.75	0.5	0.75	not recommended
	Frz. Rain	Apply chemical	1.25	1.0	1.5	not recommended
30° ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75	not recommended
25 - 30° ↑	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75	not recommended
25 - 30° ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.75	1.5	2.25	3.25
20 - 25° ↑	Snow or Frz. Rain	Plow & apply chemical	1.75	1.5	2.25	3.25 for frz. rain
	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
20 - 25° ↓	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.25
	15° to 20° ↑	Snow	Plow & apply chemical	2.0	2.0	2.75
Frz. Rain		Apply chemical	2.5	2.0	3.0	3.2
15° to 20° ↓	Snow or Frz. Rain	Plow & apply chemical	2.5	2.0	3.0	3.25 for frz. rain
	0 to 15° ↑	Snow	Plow, treat with blends, sand hazardous areas	not recommended	3.0	not recommended
Plow, treat with blends, sand hazardous areas			not recommended	4.5	not recommended	5.0 spot treat as needed
< 0°	Snow	Plow, treat with blends, sand hazardous areas	not recommended	4.5	not recommended	5.0 spot treat as needed

Table E: Gallons per Lane Mile

Anti-icing Application Rate Guidelines

Anti-icing Guidelines			
These are a starting point only. Adjust based on your experience.			
Condition	Gallons/1000 sq. ft.		Other Products
	MgCl ₂	Salt Brine	
1. Regularly scheduled applications	0.2 - 0.4	0.3 - 0.6	Follow manufacturers' recommendations
2. Prior to frost or black ice event	0.2 - 0.4	0.3 - 0.6	
3. Prior to light or moderate snow	0.2 - 0.4	0.3 - 0.8	

CAUTION: Too high an application rate may result in slippery conditions or tracking.

ice event			
3. Prior to light or moderate snow	15 - 25	15 - 25	20 - 50

Table F: Gallons per 1000 sq. ft.

Table F

Pounds of Ice Melted Per Pound of Salt

Pavement Temp. °F	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	4.9 lbs of ice	Dry salt is ineffective and will blow away before it melts anything.
5	4.1 lbs of ice	
0	3.7 lbs of ice	
-6	3.2 lbs of ice	

At temps below 15 degrees, it may be more cost-effective to use a chemical other than NaCl.

Table G: Chemical Melting Temperatures

Chemical	Lowest Practical Melting Temperature	Concentration
*NaCl (Sodium Chloride)—Delivered as solid rock salt; also can be made into a brine. The basis of most deicing materials. Very corrosive. Inexpensive.	15° F	23.3%
*MgCl ₂ (Magnesium Chloride)—Delivered as flakes, pellets, or liquid. Often used to wet NaCl crystals to increase adherence to road and reduce melting points. Corrosive. Higher cost.	-10° F	27 to 30%
*CaCl ₂ (Calcium Chloride)—Delivered as flakes, pellets, or liquid. Powerful deicer but extremely corrosive. Sometimes used incorrectly to open storm drains. Higher cost.	-20° F	30%
CMA (Calcium Magnesium Acetate)—Delivered as a powder, crystals, pellets, or liquid. Liquid CMA is used mainly on automated bridge deicing systems. Non-corrosive, biodegradable. Sometimes added to sodium chloride as a corrosion inhibitor. Alternative for areas where chloride use must be limited. Higher cost.	20° F	32%
KAc (Potassium Acetate)—Delivered as a liquid. Used on automated bridge deicing systems. Use for anti-icing, deicing, and prewetting. Non-corrosive, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.	-15° F	50%
Winter Sand/Abrasives—Winter sand is sand treated with brine or another blend. It is often used as an abrasive for low-temperature conditions when chemicals are not effective. Sand provides temporary traction and only works when it is on top of the ice.	Never melts—traction only	
Other Blends—Proprietary-purchased blends or blended in-house.	Varies	Varies

*Liquid chlorides are available with corrosion inhibitors.

See attached sample forms as a guideline.

Any inquiries in regards to the design, function, and/or maintenance of any one of the above mentioned facilities or tasks shall be directed to the project engineer:

Jones & Beach Engineers, Inc.
85 Portsmouth Avenue
P.O. Box 219
Stratham, NH 03885

T#: (603) 772-4746
F#: (603) 772-0227

**Salt Minimization Plan
Event Report
Tax Map 33 Lot 26
19 Watson Road
Exeter, NH**

Anti-icing Route Data Event Report				
Applier (Company name):				
Date:				
Air Temperature	Pavement Temperature	Relative Humidity	Dew Point	Sky
Reason for Applying:				
Route:				
Chemical:				
Application Time:				
Application Amount:				
Observation (first day):				
Observation (after event):				
Observation (before next application):				
Name:				

**Salt Minimization Plan
Checklist
Tax Map 33 Lot 26
19 Watson Road
Exeter, NH**

Recommended practice	Check which response applies to current practices and anticipated site maintenance activities for job site.				
	Already do	Will do	Might do	Will not do	If "will not do" Why not?
Use an application rate chart.					
Calibrate equipment each year.					
Learn about the deicer ingredients and use the appropriate one for the condition.					
Look for reasons if and why materials are leaking or spilling from vehicles and fix them (e.g. gaps, overfilling, etc).					
Develop a comprehensive winter maintenance policy. Follow your policy.					
Measure and use pavement temperatures.					
Use anti-icing appropriately prior to the storm.					
Plow before applying deicers.					
Use wet materials (pre-wet or pretreated).					
Don't apply sodium chloride (road salt) for pavement temperatures below 15°F.					
Don't apply deicers for pavement temps under -10° F. It's too cold.					
Separate salt and sand. Use salt for melting. Use sand for traction.					
Apply deicers in the center of the road or on the high side of the curve.					
Store the salt in a building or under secure cover.					
Store salt away from water flow and direct the water away from storage area.					
Store snow away from lakes, ponds and wetlands.					
Sweep up sand, dispose of properly.					
For each event, document what you did and how well it worked. Use this information to make improvements.					

**Salt Minimization Plan
Training Log
Tax Map 33 Lot 26
19 Watson Road
Exeter, NH**

Salt Minimization Plan Training Log

Project Name: _____

Project Location: _____

Instructor's Name(s): _____

Instructor's Title(s): _____

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: *(check as appropriate)*

- Green Snowpro Training**
- New Hampshire Certified Salt Applicator**
- New Hampshire Salt Symposium**
- Inspections/Corrective Actions**
- Pollution Prevention Measures**

Specific Training Objective: _____

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

**Salt Minimization Plan
References
Tax Map 33 Lot 26
19 Watson Road
Exeter, NH**

References:

- **Environmental Fact Sheet: Best Management Practices and Salt-Use Minimization Efforts In Chloride-Impaired Watersheds of New Hampshire**
A Guidance Document for Private Developers and Contractors (WD-WMB-26)
<https://www.des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/documents/wmb-26.pdf>
- **Minnesota Snow and Ice Control** Field Handbook for Snowplow Operators
Second Revision
Minnesota Snow and Ice Control handbook, available at:
<http://www.mnltap.umn.edu/pdf/snowicecontrolhandbook.pdf>
- **NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION** Winter Maintenance Snow Removal And Ice Control Policy.
<https://www.nh.gov/dot/org/operations/highwaymaintenance/documents/wmsrip.pdf>
- **Environmental Fact Sheet: Road Salt AND Water Quality**
<https://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf>
- **Chapter 4 Designing Best Management Practices, 4-2 Source Control BMP's**
https://www.des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20b_4-2.pdf
- **Minnesota Pollution Control Agency: Winter Parking Lot Sidewalk Maintenance** <https://www.pca.state.mn.us/sites/default/files/p-tr1-20.pdf>