Rhode Island:
Coastal Resources Management Council
Department of Environmental Management
Division of Planning, Statewide Planning Program

RI State Guide Plan Update:
Water Quality Management Plan Advisory Committee Meeting

Tuesday, January 28, 2013
10:00 AM – 12:00 PM

Room 300
Department of Environmental Management
235 Promenade Street, Providence

Agenda

1. Agenda Overview

2. Feedback on Draft Goals & Policies for Stormwater Management from 12.17.13

3. Subject Topics and Technical Presentations:

    a. Setting Resource Based Priorities for Protection and or Restoration
        i. General Overview
        ii. Priority categories
        iii. Priority Setting - Interactive Exercise –*DEM & ALL*

    b. *Road Salt / Sand Application in RI – Technical Paper – Paul Gonsalves, DOP –For Information*

4. Discussion & Feedback – *All - moderated by Sue Kiernan*

5. Looking ahead -
    a. Next Meeting Date – February 25, 2014
    b. Committee Homework

6. Adjourn 12:00 PM

Background on Prioritization In Water Quality Management Programs

Faced with limited resources, federal and state managers agree there is a need for prioritization within clean water programs. The Environmental Protection Agency requires or is encouraging frameworks for prioritization within the programs associated with administration of the federal Clean Water Act. Prioritization does ***not*** mean changes to long-term goals for water quality; e.g. the level of protection afforded a given waterbody. However, it is an acknowledgement that to be strategic in utilization of the limited resources currently available that certain geographic areas may receive greater focus and attention than others within a given time period. Even within our admittedly small state, the capacity of the state to support work on a statewide basis in all watersheds at the same time simply does not exist. Accordingly, it is appropriate, working within the context of our long-term goals for water quality, to set short-term priorities as a means of advancing progress toward those goals.

Existing Prioritization Activities:

The DEM Office of Water Resources programs have for some time reflected the following general priorities in its protection and restoration programs: drinking water supplies (surface water and groundwater), shellfish growing areas and beaches. In addition, as more TMDLs have been completed, DEM has prioritized implementation of TMDL recommended actions in certain funding programs; e.g. 319 and BWRF.

Examples of existing applications of prioritization:

- ***DEM 303(d) List*** – In the schedule of TMDLs development, the DEM-OWR reflected an initial emphasis on water supplies and shellfishing areas; e.g. Stafford Pond was the first TMDL completed.

- ***DEM Project Priority List (PPL)*** – a formal scoring system is used to rate and rank all projects proposed for inclusion on the Project Priority List. The PPL is associated with the administration of the Clean Water State Revolving Fund (CWSRF). It is limited to governmental projects of a size appropriate for a potential SRF loan.

- ***DEM Nonpoint Source (319) Grants and Narragansett Bay and Watershed Restoration Fund (BWRF)***- The scoring system for these competitive grant programs gives weight to TMDL implementation and public health uses (drinking water, shellfishing and beaches) among other factors such as readiness to proceed.

- ***Natural Resource Conservation Service (NRCS) – National Water Quality Initiative***: Under a federal initiative coordinated by NRCS with EPA, certain watersheds were selected for targeted activities to advance protection and restoration. In RI, the NWQI watersheds are: 1) "Sakonnet River" -- East side of Aquidneck Island, including Maidford River, and that part of Tiverton and Little Compton draining to Sakonnet; 2) "Upper East Passage" – focus on northwest portion of Aquidneck Island, including Lawton Valley; 3) Tomaquag Brook in the Pawcatuck watershed.

- ***DEM Annual PPG/Workplan***: Upon request from EPA, DEM has identified certain watersheds as areas of focus within the documents governing the award of EPA funding to the DEM Office of Water Resources. These are developed as part of an annual workplan process.

Recent EPA Directives on Prioritization:

In recent years, EPA has been advocating for prioritization of watersheds as part of strategic planning in clean water programs. The federal 319 program provides the following guidance and will require, as a condition of continued federal funding, that the State articulate a means for prioritizing watersheds as part of its state water quality management plan.

From EPA 319 Guidance (2013) Appendix A NPS Management Plan:

#3 The state NPS management program emphasizes a watershed management approach and includes an explanation of the state's approach to prioritizing waters and watersheds to achieve water quality restoration and protection.

#4 With limited resources, the state will likely need to make choices about the relative emphasis on restoring impaired waters and protecting high quality waters. The state's program describes how it will approach setting priorities and aligning resources between these two areas of emphasis based on their water quality challenges and circumstances.

#5 The state establishes a process to assign priority and to progressively address identified waters and watersheds by conducting more detailed watershed assessments, developing watershed-based plans, and implementing the plans. Factors used by the state to assign priority to waters and watersheds may include a variety of considerations, for example:

- *human health considerations including source water protection for drinking water;*
- *ecosystem integrity, including ecological risk and stressors;*
- *beneficial uses of the water;*
- *value of the watershed or ground water area to the public;*
- *vulnerability of surface or ground water to additional environmental degradation;*
- *likelihood of achieving demonstrable environmental results;*
- *degree of understanding of the causes of impairment and solutions capable of restoring the water;*
- *implementability (site-specific technical feasibility);*
- *adequacy of existing water quality monitoring data or future monitoring commitments;*
- *degree to which TMDL allocations made to point sources are dependent on NPS reductions being achieved;*
- *extent of partnerships with other federal agencies, states, local public and private agencies/organizations and other stakeholders to coordinate resources and actions;*
- *availability and access of funding sources other than section 319(h); and*
- *readiness to proceed among stakeholders and project partners.*

The state links its prioritization and implementation strategy to other programs and efforts such as those listed under component #3. In establishing priorities for ground water activities, the state considers wellhead protection areas, ground water recharge areas, and zones of significant ground water/surface water interaction, including drinking water sources.

States may wish to consider the following scenarios for prioritizing the protection of unimpaired/high quality waters:

Watersheds or portions of watersheds with unique, valuable, or threatened species or critical aquatic habitats of these species;
Waters and watershed areas (including groundwaters where appropriate) that serve as source water for a public drinking water supply;

Protection of high quality waters in watersheds that contain some impairments;
Waters near geographic areas where rapid land use development is occurring;
Waters where data trends indicate water quality degradation is occurring;
Restored waters requiring continued water quality assessment and maintenance of BMPs to assure unimpaired status;
Outstanding Natural Resource Waters or other state-defined categories of high quality waters;
Watersheds contributing high nutrient loads to downstream waters.

303(d) Water Quality Restoration and Protection:
The EPA 303(d) Program has recently issued document articulating a long-term vision for assessing, restoring and protecting surface waters. This program is associated with the water quality assessment process that results in the statewide integrated report and list of impaired waters as well as TMDL development. The vision document establishes the following goal for prioritization:

For the 2016 integrated reporting cycle and beyond, States review, systematically prioritize, and report priority watersheds or waters for restoration and protection in their biennial integrated reports to facilitate State strategic planning for achieving water quality goals.

The intent if the Prioritization Goal is for States to express CWA 303(d) program priorities in the context of the State's broader, overall water quality goals. The CWA 303(d) program provides an integrating function because it translates state water quality standards into pollution reduction targets for the point and non-point sources management programs as well as other programs outside the CWA…Establishing CWA program priorities will lead to more efficient and effective program management, yielding faster progress toward water quality improvement and protection.

Discussion Points:

1. Is there agreement that there is a need to prioritize watersheds in order to be strategic in water resource management – both protection and restoration?

2. What are benefits or advantages of prioritizing?

   Positive:
   - Focused effort, build on previous efforts, synergistic effect with partners,
   - More likely to achieve water quality results than widely scattered actions ("random acts of BMPs").
   - By articulating areas of focus, easier to align partners to work collaboratively.

3. What are the drawbacks?

   Negative:
   - Certain resources are not addressed for long periods.
   - Potential loss or erosion of public support in those watersheds not designated for immediate attention.
   - Missed opportunities to capitalize on local interest.

4. What is the appropriate balance between protection and restoration activities? Has Rhode Island struck the correct balance?

5. Should the urban services boundary be reflected in the prioritization framework?

6. How well are the priorities with respect to protection and restoration within a given watershed articulated?

7. What does it mean in terms of implementation of our state programs to establish priorities?
   - Grants/loans
   - Implementation efforts
   - Deployment of state staff

OVERARCHING POLICIES

These policies set the framework for water quality management in RI. They cut across all of the topics (and their strategies) that are discussed in more detail later in the Plan.

Water Quality Management Policies/Principles

- Protection and restoration are equally important to achieving RI's goals for water quality.
- Water pollution should be prevented whenever possible as it is a more cost-effective strategy than source control and restoration.
- Watersheds are the appropriate unit for managing water quality and water resources.
- Water quality management is based on sound science and integrates new information, including information on changing climate conditions, into policies and decision-making.
- New technologies are adopted for use in water pollution management where beneficial.
- Monitoring is an essential component of water quality management that yields information necessary for effective adaptive management.
- Indicators of environmental conditions and performance as well as analytical tools are used to evaluate and report on progress toward water quality goals and objectives.
- Through public outreach, Rhode Island citizens are informed and aware of water quality management priorities and support efforts to prevent and abate water pollution problems.
- A collaborative effort is necessary across all governmental jurisdictions, agencies and programs to ensure success in protecting and restoring RI's water resources.

Roles and Responsibilities

- All levels of government (federal, state, local), non-governmental organizations (NGOs) including watershed organizations, private entities and individuals share in the responsibility and duty to protect and restore RI's water resources.
- State and quasi-state facilities demonstrate leadership in adopting effective water quality management practices.
- The State develops and maintains the capacity to respond to new issues (e.g., emerging contaminants) impacting water quality or water quality management in a responsible, scientifically defensible and timely manner.
- Compliance with applicable federal, state and local regulatory programs is necessary for water quality protection and restoration.
- The State and other partners provide technical assistance/training to practitioners and local governments to facilitate implementation of water quality management strategies.

- The Federal and State governments continue to provide financial assistance to manage water quality and abate water pollution.

- Local government capacity is increased to advance implementation of strategies to improve water quality and to integrate wastewater and stormwater planning and management in municipal operations.

- Implementation of management at a regional scale is pursued where demonstrated to be most effective.

- An active watershed organization exists in each major RI watershed and serves to engage citizens in activities to protect and restore their watershed.

- Each of RI citizens contributes to improving water quality by being aware of our water resources and taking steps (often simple) to protect these resources.

1/21/14

Resource Protection and Restoration Priorities – DRAFT

The table below contains a list of water quality management objectives tied to the primary uses of our water resources.

Please review the table in advance of the discussion and be prepared to add or clarify any objectives you feel are missing from consideration. We will be discussing the prioritization and running an exercise to assess consensus on the highest priorities within water quality management. Please give thought to which of the objectives merit highest priority: those priorities which should be a focus within our state and local water quality management programs and activities. (We want your feedback on what should be a priority regardless of how well our current management system is effectively addressing that objective.)

Public health (consumption)	**Recreation (exposure)**	**Ecosystem**
Prevent public drinking water sources from becoming impaired– surface water & groundwater	Prevent water quality degradation that would cause new closures of beaches	Prevent degradation of high quality waters and aquatic habitats
Restore shellfishing by reducing shellfish closures	Restore water quality to reduce number of beach closures – coastal beaches	Restore ecological conditions in the Bay by improving DO levels in the upper bay
Restore source waters by reducing algal blooms in reservoirs or remediating groundwater in WHPAs	Restore water quality to reduce beach closures – freshwater beaches	Prevent loss of coldwater fisheries in rivers; restore where feasible
Prevent groundwater that supplies private well areas from becoming impaired	Restore water quality by reducing cyanobacteria blooms on waterbodies with public access; e.g. recreational facilities, access points	Manage aquatic invasive plants in lakes
Restore water quality to reduce fish tissue contamination over time	Prevent new impairments of surface waters that support public recreation – coastal waters, lakes and non-	Prevent degradation in freshwaters outside urban services boundaries

	wadeable rivers	
Restore groundwater that supplies private wells	Restore water quality to reduce cyanobacteria blooms (other waterbodies)	Restore water quality by reducing eutrophication in other coastal waters including the coastal ponds
Groundwater restoration – other GAA and GA areas	Prevent new impairments in other less accessible waters - private lakes, wadeable streams	Restore anadromous fish runs – priority projects
Other groundwater restoration -GB		Restore saltmarshes – priority projects
		Restore riparian buffers in flood prone areas on rivers
		Protect wetlands, including riparian buffers, and minimize loss
		Restore water quality to improve ecosystem conditions in rivers and streams
		Restore stream connectivity
		Prevent further degradation (maintain) and improve as practicable waters within the urban services boundaries.
		Restore eutrophic lakes and ponds
		Restore riparian buffers & wetlands
		Restore water quality to improve ecosystem conditions

		in rivers and streams

Rhode Island:
Coastal Resources Management Council
Department of Environmental Management
Division of Planning, Statewide Planning Program

RI State Guide Plan Update:
Water Quality Management Plan Advisory Committee Meeting

Tuesday, December 17, 2013

10:00 AM – 12:00 PM

Room 300
Department of Environmental Management
235 Promenade Street, Providence

Meeting Notes

Committee Members in attendance were: Jane Austin (Save The Bay), Janine Burke (NWPCA), Kathy Crawley (WRB), Rachel Calabro (RIRC), Ames Colt (BRWCT), David Everett (Providence), Peter Healey (RIDOT), Eugenia Marks (RI Audubon), Vincent Murray (SK Planning Dept.), Jennifer Paquet (Town of West Greenwich), Margharita Pryor (EPA), Marilyn Shellman (Town of Westerly), June Swallow (RIDOH), Nicole Rohr (URI). DEM/CRMC/Statewide Planning staff in attendance included: Sue Kiernan, Erinie Panciera, Elizabeth Scott, Alisa Richardson, Eric Beck and Scott Millar of RIDEM, Jeff Willis of CRMC and Paul Gonsalves of Statewide Planning.

Introduction and Agenda Overview

Sue Kiernan started the meeting with a brief overview of the agenda, including key subject areas and contributions from several speakers.

Feedback on Draft Wastewater Goals

Several clarifications in the meeting notes of the previous meeting were made. Specifically, human waste was identified as the largest source of pollution in the bay. Additional discussion included the consequences of expanding

agriculture in the state and how there are fewer regulations in reporting water use in agriculture compared to other sectors.

Stormwater in RI

Sue kicked off the stormwater discussion with quick intro to the topic. Elizabeth, Alisa and Scott from DEM laid out the basics of watershed specific stormwater requirements. 95% of TMDL's in the state have stormwater requirements. Municipalities are encouraged to develop low impact development techniques (LID) geared towards protecting water quality. Ernie then went on to relate the impervious cover map to the Land Use 2025 Urban Services Boundary map. The major goal of reducing impervious cover remains.

Several programs/techniques/manuals geared towards addressing stormwater were discussed (see DRAFT Strategies handout). The Erosion and Sediment Control Handbook is a set of standards dealing with stormwater. These standards then became part of several regulatory programs such as the DEM and CRMC Freshwater Wetlands Programs, CRMC Coastal Management Program, DEM Water Quality Certification Program, and the DEM Groundwater Discharge Elimination Program.

The concept of "green infrastructure" was then mentioned and several in the group discussed the different definitions of the term. There was general agreement that going forward, green infrastructure should be specifically defined when used in storm water/water quality discussions.

Low-Impact Design (LID) was then discussed in further detail. The group talked about the lack of an explicit policy on LID. Several municipalities have LID ordinances, but many cases are granted waivers and exceptions. The State authority for stormwater requirements only applies to DEM reviewed projects. Municipals representatives agreed that there is really no mechanism driving LID and no worthwhile incentive to reduce impervious cover. Also, it was stated that there needs to be a policy to also address retro-fits and redevelopment, as most of the current regulations only look at new development. Incorporating LID as a requirement at the State level may require changes to the zoning enabling, but existing regulations, the State Guide Plan(SGP), etc. should be used as fully as possible to promote LID. It was also suggested that the SGP should set general state policies, but should not be dictatorial as there are already several layers of

regulations to meet largely with limited resources to implement them.

The discussion transitioned back to reducing impervious cover, as it was suggested that there should be a way to set local goals based on current levels of impervious cover. Sue suggested that RI is small enough to track how well we are doing, and then set goals based on progress. Scott then suggested that we could have a policy for impervious cover outside of the Urban Services Boundary, such as compact mixed use development which can reduce impervious cover by 60%. Also, it should be connected to the Rhode Map initiative going forward.

The need for integrated planning was introduced at this point, as EPA is continually looking for ways to work with local officials. The example of the "Excellence in Bay Management" project was mentioned as an instance where enhanced cooperation was achieved. This concept can be replicated in other areas around the state. It was also suggested that municipalities and the state can set up stormwater utilities. Communication is key, but many of these initiatives lack the resources, political will and public support currently.

Among other topics, the need to refine the Draft goals and strategies needs to be fleshed out and must eventually fit into the SGP template for "Goals, Policies and Objectives". Other closing remarks from group included the suggestion to think about transfer of development rights between municipalities and connecting water quality initiatives to flood mitigation.

Next Meeting Date

The group agreed upon a date of January 28th for the next meeting.

DRAFT Strategies for Stormwater Management

Water Quality State Guide Plan Element

12/12/13

Goal: Stormwater is managed to protect and restore the state's water resources

Primary Issue Topics

- LID implementation
- Maintenance/Asset Management; including upgrading and replacing as necessary
- Existing Sources – retrofitting public and private systems
- Funding and Local Capacity

Policy: Ensure stormwater management is consistent with water quality goals.

Actions:

- Implement the requirements of the 2010 RI Stormwater Design and Installation Standards Manual and the updated Erosion and Sediment Control Handbook (2013/14) by means of the regulatory programs that have incorporated these standards. Programs include the DEM and CRMC Freshwater Wetlands Programs, CRMC Coastal Management Program, DEM Water Quality Certification Program, DEM Groundwater Discharge Program, and the DEM RI Pollutant Discharge Elimination Program.
- Evaluate and update the RI Stormwater Manual and the Erosion and Sediment Control Handbook as appropriate.
- Require self-certification of compliance with the construction site requirements issued by the stormwater permitting programs.
- Continue management of the DEM Industrial Activity Multi-Sector General Permit.

Policy: Use low impact design techniques and green infrastructure BMPs as the primary method of stormwater management to maintain and restore pre-development hydrology of the state's watersheds.

Actions:

- Evaluate and implement strategies to more fully implement LID in state and local programs.
- Provide training and education opportunities for design professionals (engineers, landscape architects, contractors) and municipal officials. Consider development of training/certification program.
- Municipalities adopt local ordinances to implement LID.

Policy: Protect high quality waters from degradation caused by stormwater by limiting effective impervious cover in these watersheds.

Actions:
- Identify water resources warranting further protection than currently in place under existing regulatory programs.
- Develop a strategy to protect these waters (e.g., increased emphasis on LID, more stringent standards).

Policy: Stormwater management at the local level is an essential service that must be integrated into all relevant aspects of local government, including planning, engineering and public works. Local governments must effectively manage, maintain and upgrade their stormwater systems to minimize adverse impacts to water resources.

Actions:
- Continue implementation of DEM MS4 General Permit Program; evaluate compliance and effectiveness.
- System operators adequately maintain their systems to increase longevity and maximize performance.
- Incorporate TMDL implementation actions into the Stormwater Management Plan and implement priority actions.
- Establish sustainable funding mechanisms.
- Establish regional stormwater management approaches where practical.
- Provide technical assistance and training to municipal governments for stormwater management.
- Prioritize drainage systems for retrofitting (coordinate with TMDLs).
- Strengthen/enforce requirements for retrofitting under TMDL implementation.

Policy: State agencies must effectively manage, maintain and upgrade their stormwater systems to minimize adverse impacts to water resources.

Actions:
- System operators adequately maintain their systems to increase longevity and maximize performance.
- Establish sustainable funding mechanisms.
- Incorporate green infrastructure into state funded projects.
- Prioritize drainage systems for retrofitting (coordinate with TMDLs).
- State agencies and quasi-state agencies demonstrate leadership in adopting effective and innovative stormwater management.

Policy: Ongoing training of public officials and private contractors is an important element to ensure proper stormwater management to protect and restore water resources.

Action:
- Establish an integrated and continual training program for stormwater management professionals that addresses LID, BMP design and installation, road salting and other aspects of stormwater management.

Policy: Support the development of dedicated funding mechanisms (e.g., "stormwater utility") to manage local, regional and state stormwater programs.

Actions:

- Provide technical and financial assistance to local governments to establish the appropriate mechanisms.

Policy: Ensure that stormwater from significant areas of impervious cover on private properties is properly managed on-site.

Actions:

- Develop effective tools to encourage and incentivize management of stormwater from private property.
- Evaluate regulatory options for requiring management of stormwater from private property.

Policy: Ensure that approved BMPs available for stormwater management are effective in meeting water quality goals.

Actions:

- Evaluate the performance of approved stormwater BMPs, as necessary.
- Support the development of new technologies/BMPs for stormwater management.

Policy: Improving source reduction is an effective means to mitigate stormwater impacts.

Actions:

- Investigate strategies for source reduction (e.g., improve/increase street sweeping, prohibit coal tar based pavement sealants…)

Policy: Reduce the amount of road salt and sand applied to state and local roads.

Actions:

- DOT and towns adopt innovative road salting techniques and alternative products.
- Evaluate training and certification mechanisms for road salt/sand applicators.
- Establish minimal equipment standards for use by road salt/sand applicators.
- Identify areas that should be designated "no/reduced salt" zones.
- Ensure that all salt piles are covered (public and private).

Policy: Stormwater management must adapt to climate change impacts.

Actions:

- Evaluate the impact on existing stormwater management systemes of increased intensity of precipitation events, rising sea level and rising water tables.
- Evaluate stormwater management design standards to ensure that they incorporate new data on climate change in order to adequately protect water resources.

Terminology:

LID (from RI Stormwater Manual) – "Low impact development is a site planning and design strategy intended to maintain or replicate predevelopment hydrology through the use of site planning, source

control, and small-scale practices integrated throughout the site to prevent, infiltrate and manage runoff as close to its source as possible."

Green Infrastructure (GI) -- Utilizes infiltration, evapotranspiration, storage and reuse to either prevent runoff from occurring or treating it as close to the source as possible. These are the physical BMPs -- not just "green" (plant-based) BMPs (includes permeable pavement, subsurface infiltration systems).

Gray Infrastructure – stormwater collected and conveyed in closed systems to an off-site where it is discharged without treatment to surface waters.

In short: LID = planning principles; GI = the physical BMPs

January 17, 2014

STATEWIDE PLANNING TECHNICAL PAPER Number: #000

ROAD SALT/SAND APPLICATION IN RHODE ISLAND

RHODE ISLAND DIVISION OF PLANNING

Rhode Island Department of Administration
Division of Planning
Statewide Planning Program
One Capitol Hill
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The Rhode Island Statewide Planning Program, Division of Planning, Department of Administration is established by Rhode Island General Law Chapter 42-11 as the central planning agency for state government. The State Planning Council is comprised of state, local, and public representatives. Federal and other advisors, guide the work of the Program. The objectives of the Program are:

(1) to prepare strategic and systems plans for the State

(2) to coordinate activities of the public and private sectors within this framework of policies and programs
(3) to assist local governments in management, and

(4) to advise the Governor and others concerned on physical, social, and economic topics.

Further, the Division of Planning is authorized by RI General Law 42-11-10 entitled**,** Statewide Planning Program, to study and evaluate the needs of the State for current and future energy supply and shall have the following powers:

(1) To adopt, amend and maintain as an element of the State Guide Plan or as an amendment to an existing element of the State Guide Plan, guidelines for the location of eligible renewable energy resources and renewable energy facilities in Rhode Island with due consideration for the location of such resources and facilities in commercial and industrial areas, agricultural areas, areas occupied by public and private institutions, and property of the State and its agencies and corporations, provided such areas are of sufficient size, and in other areas of the State as appropriate.

(2) State Guide Plan. The State Guide Plan is comprised of functional elements or plans dealing with land use, physical development and environmental concerns, economic development, housing production, energy supply (including the development of renewable energy resources in Rhode Island), energy access, use, and conservation, human services, and other factors.

ABSTRACT

TITLE: Road Salt/Sand Application in Rhode Island

SUBJECT: Water Quality

DATE: January 14, 2014

AGENCY: Rhode Island Department of Administration
Division of Planning
Statewide Planning Program
One Capitol Hill
Providence, RI 02908
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PROJECT: Work Task # 2040, Fiscal Years 2013-14

SERIES: Technical Report Number **XX**

NUMBER OF PAGES: 18

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ABSTRACT: This report documents the current state and local policies related to salt and sand application to Rhode Island's roads and highways during winter weather events. The effects on water quality are described. Current data, application rates and ratios along with new and proposed policies are explored in this report.

ACKNOWLEDGEMENTS: This paper contains data and information provided by individuals from several key State Agencies.

Special thanks to:

Joseph Baker, Administrator of RI Department of Transportation's Division of Highway and Bridge Maintenance

Clayton Common, Senior Environmental Scientist, RI Department of Health

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WATER QUALITY MANAGEMENT STATE GUIDE PLAN UPDATE ADVISORY COMMITTEE (2013 – 2014)

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(Plow trucks, RIDOT)

INTRODUCTION

This paper summarizes the current policies related to the application of salt and salt-related products and chemicals on Rhode Island roads and highways. Application ratios and amounts will be explored. The report will attempt to describe the fiscal and environmental impacts of road salting. It will be conducted through data collection from Federal, state, municipal, out-of-state entities. The information on "current policies and usage" is based on information obtained through the RI Department of Transportation (RIDOT) and municipal Public Works Departments.

Road Salt Application Policies in Rhode Island

The State of Rhode Island is responsible for the safety of Federal and State Highways. The RI Department of Transportation's (RIDOT) Highway and Bridge Maintenance Division has the main duties of maintaining the road surfaces during ice and snow events. On average, the State of RI receives about 37 inches of snow each year, but snowfall totals can vary significantly from town to town, even given Rhode Island's relatively small area. For example, North Foster averages about 57 inches per year while New Shoreham sees about half of that. The number of snow events per year varies widely from year to year. The RIDOT staff and private contractors, carry out these ice/snow removal activities. Various technologies are used to guide drivers with updates on weather, pavement and traffic conditions. Pavement temperature information is provided by RIDOT's Roadway Weather Information Systems (RWIS). These systems can help RIDOT staff make determinations when icy conditions may be present and helps in the selection and application of materials for the Department's roadway treatment actions. RIDOT Highway and Bridge Maintenance uses three techniques to inhibit ice formation and improve the roadway surface for plowing including anti-icing, pre-wetting, and de-icing. These three methods will be discussed in more detail later in this report.

State/RIDOT Road Salting/Sanding Practices

As more roads are built and as more vehicles are added to our roads, the need for road, bridge and highway maintenance increases. When looking at the history of road maintenance in Rhode Island in regards to snow and icing, we have to look back to the 1930's-40's when abrasives like sand were used in addition to plowing. After World War II, the use of salt on roads became more common and it grew substantially in the

50's and 60's. As of 2013, the State spends about $10 million per year on road salting on an annual basis, which is about 25% of RIDOT's winter maintenance budget.

Currently, both salt and sand are used on Rhode Island's roads. There are two types of mixes used on Rhode Island roads. The first type is a 1:1 mixture of salt and sand. The sand is used only to provide traction on slick surfaces, while the salt part of the mixture provides the ice and snow melting power. The other formula consists of salt only, but is applied using what is called a "closed loop spreader control system". This new technology will be discussed later in this document. Aside from the mixture types used, there are generally three methods of snow/ice road maintenance practiced and they are:

(Brine (saltwater) being applied to road surface, Jerry McCrea/The Star-Ledger)

1. *Anti-Icing (Brine)*

Anti-icing prevents the formation of frost and bonding between snow and ice and pavement. Anti-icing chemicals are primarily liquids applied before or early in a snowfall. This practice has only been in wide use since February of 2012. A solution of salt brine (water diluted with 23% salt) is applied to highways before a predicted major snow event. The pavement appears wet temporarily, but as the water evaporates, a layer of salt bonds to the semi-porous road surface, preventing the snow from bonding to the road. The brine can be still be effective if applied up to 72 hours before snowfall. The use of brine is effective in reducing the amount of salt used during snow storms.

2. *Pre-wetting*

Pre-wetting adds chemical solutions to the salt and sand mixture, causing the mixture to stick to the road instead of blowing off to the shoulder.

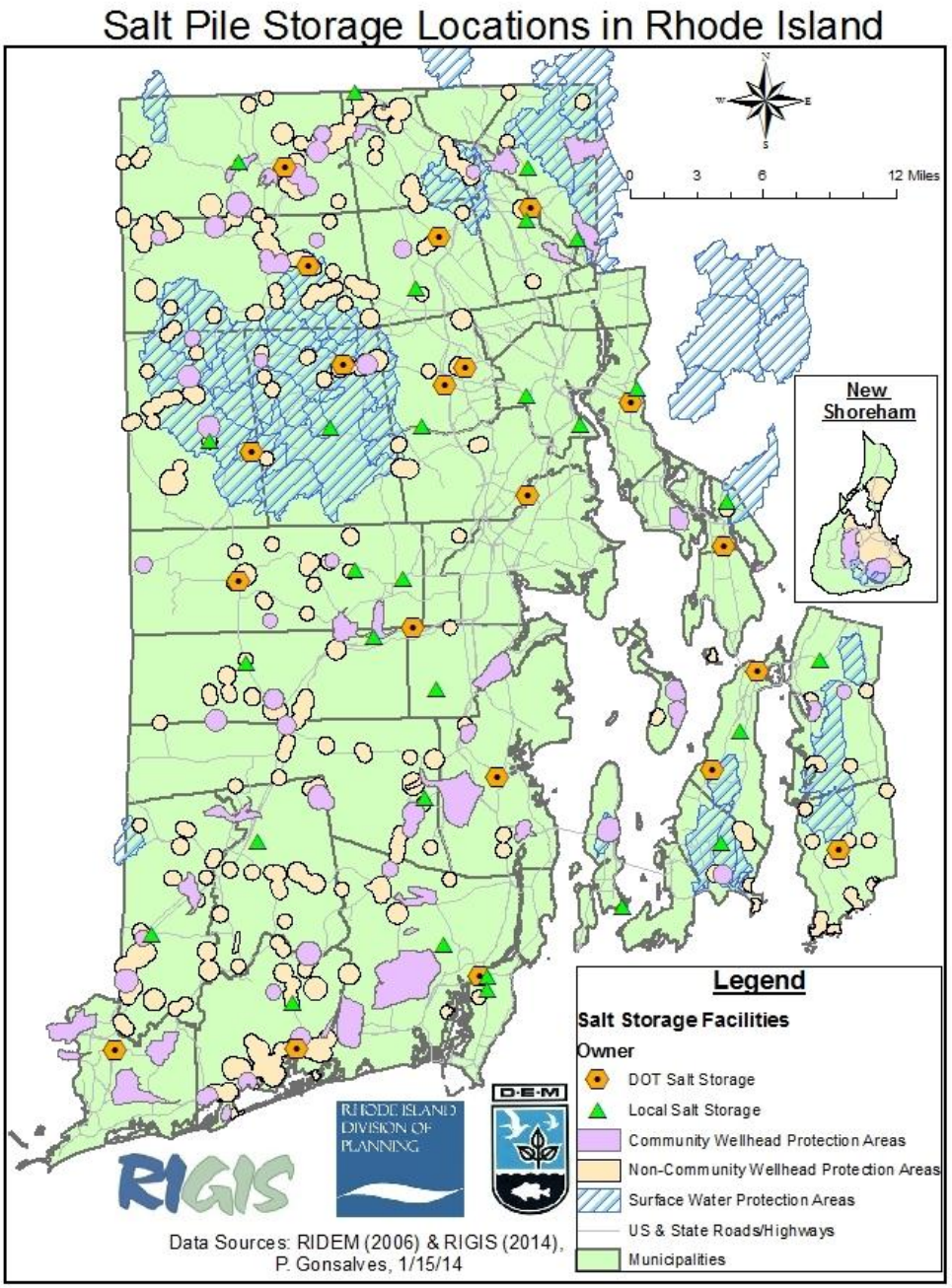
3. *De-icing*

De-icing uses chemical or mechanical means to separate ice and pavement. Plowing is the most common practice of mechanical snow/ice removal.

State Storage Facilities

The RIDOT currently has twenty stock piles of salt and sand throughout the state, covering seven maintenance districts.(see Figure 1, Locations of Salt/Sand Stockpiles Five of these locations are "uncovered", meaning that there is no permanent structure at these locations. The state also operates the facility that makes the salt brine solution. The facility is located off of exit 7 of Interstate 95. Up to 5,000 gallons of brine per hour can be produced there.

FIGURE 1



Vehicles and Equipment

The RIDOT currently has a fleet of 100 snow plow/spreader trucks. Sixty-one of these vehicles are equipped with "closed loop spreader control systems". These automated additions allow the drivers to accurately administer and monitor the exact amount of salt applied. The equipment also tracks and reports the application ratio in pounds per lane mile (lbs/LM). The Department has seen a significant drop in lbs/LM since the introduction of the closed loop system. As of September 2013, there are seven new closed loop systems being installed on existing trucks. These additions will bring the total number up to sixty eight. That will be just under 70% of the total RIDOT fleet.

New Pavement Technologies

The State of RIDOT currently uses real-time information systems capable of monitoring road temperatures. This technology is especially useful in spots such as the Newport Bridge where air temperatures may significantly vary from road surface temperatures.

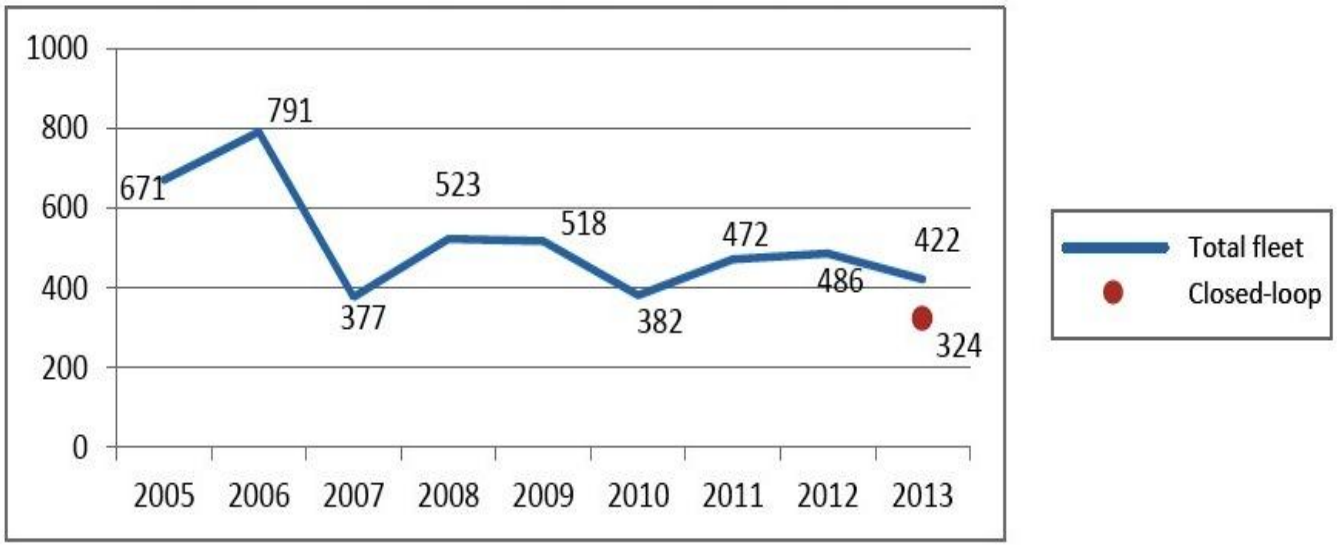
Roads and Highways Covered

The RIDOT has the primary responsibility to plow and salt/sand all Interstate Highway surfaces, as well as State Roads. The Interstate Highways include I-95, I-195 and I-295. Municipalities are generally responsible for their own local roads and side streets.

Historical Salt Use

With annual differences in snowfall totals, annual salt and sand application totals vary. Based on available state and municipal data, there is no indication that total salt and sand applied to roadways will decrease year to year. A more useful metric of salt and sand application rates is the ratio of "pounds per lane mile" (lb/LM). See Figure 2 below for RIDOT salt applications rates from 2005-2012.

Figure 2: Average Number of Pounds of Salt per Lane Mile



Average Number of Pounds of Salt per Lane Mile, *RIDOT Performance Update*, (RI Office of Management and Budget, March 2013)

Current Use of Salt

With difference in snowfall totals and storm events, the total salt used does fluctuate from year to year, but when we look at the average lbs/LM applied by the closed loop equipped trucks vs. the total fleet, the number is approximately 25% lower for the trucks with closed loop systems. Overall, the Department has reduced salt application by more than 27% over the past seven years. There are several types of salt that are used on RI roadways, highways and bridges.

Sodium Chloride (NaCl)
Commonly known as "table salt", is by far the most commonly used road salt. Sodium Chloride is the main salt used in highway and road maintenance and it can only effectively melt snow and ice down to 20 degrees Fahrenheit. Although it is the same chemical composition as basic table salt, the NaCl used on roads is in a "rock salt" form. The granules are much larger than table salt. This salt is often viewed as the most corrosive, but most cost-effective type as it is one of the most abundant minerals on Earth.

Calcium Chloride (CaCl)-
More expensive than NaCl, but is safer for the natural environment. Calcium Chloride has several advantages over sodium chloride. It is generally seen as a safer alternative to sodium chloride because c chloride generally does not have the chemical additives that are sometimes found in sodium chloride like phosphorus, nitrogen, copper and cyanide. CaCl is also effective at much lower temperatures than NaCl. The major drawback to CaCl is the cost, which can be up to three times more than NaCl. In 1991, The Providence Water Supply Board started an agreement with RIDOT to use CaCl in the Scituate Reservoir watershed. Upon further studies in conjunction with USGS, it was found that using CaCl instead of NaCl did not lead to decreased *chloride levels*. Currently, the most common application of CaCl in RI is seen on bridges as it has a much lower freezing point than rock salt.

Magnesium Chloride (MgCl)
When compared to calcium chloride, magnesium chloride has similar properties. Although about twice the amount per lane mile is needed, MgCl is generally seen as being safer for the environment than both NaCl and CaCl. It is rarely used in Rhode Island as it could lead to slippery road surfaces, since it does not bond to the road surface as well as NaCl and CaCl.

Brine/Pre-Mix
The RIDOT has a brine mixing facility off of exit 7 of I-95, which is close to the halfway point of I-95 between the Connecticut and Massachusetts borders. The facility has the capability to mix up to 5,000 gallons per hour.

Sand
Sand is commonly used with rock salt in a 1:1 ratio on Rhode Island's highways and roads. The sand does not have any melting properties, as it is only applied to provide increased traction. Most of the sand used in RI is imported from nearby states like Connecticut. Because sand does not melt, it will remain on the pavement until removed either by manual sweeping, or as runoff into catch basins, sewers, shoulders and adjacent water bodies.

Municipal Road Salt Practices

For the purposes of acquiring information on local salt and sand application practices, a short survey was sent to municipal public works departments. About 25% of municipalities replied to the survey. In general, the practices at the local level involved applying only sodium chloride rock salt and sand. Only one municipality reported the use of saltwater brine. The on-board technology used at the State level tends to be more advanced than the municipal counterparts, as there were no reported installations of the "closed-loop" system on municipal trucks. RIDEM is not aware of any municipal trucks with that system. At the local level, the amount of salt/sand applied per lane mile varies from 250 to 450. Not all municipalities have the equipment to track this info.

ENVIRONMENTAL IMPACTS AND CONCERNS

Even though salt (sodium chloride) and sand are natural substances the application of tons of these materials is not without environmental consequences. As of just a few years ago, the State of RI reached a peak in annual salt application of about one hundred tons/year. Although it is spread throughout the state and diluted, the cumulative effects of salt additions at this rate can have significant environmental consequences. Sand removal is a major issue in the state, as only a small fraction (as low as 5% by RIDOT estimates), is swept up due to staff and budget constraints. With each spring/rainy season, the salt and sand that was applied during the winter slowly makes its way to adjacent water bodies and catch basins, making localized flooding more likely to occur. Also, excess sand accumulation at the bottom of adjacent streams and ponds can lead to the smothering of aquatic life. Normal traffic can act as a grinding agent turning the sand particles in to a dust which can lead to aggravate certain respiratory problems such as asthma.

Effects on Drinking Water Supply

As stated in *State Guide Plan Element 721: RR Water 2030*, "..road salt [can] interrupt natural watershed drainage patterns and degrade water quality." (p.2-9). Sodium Chloride can enter the water supply by either direct contact with surface waters or by infiltration to groundwater which can contaminate public and private wells. Increased sodium levels in drinking water can have negative effects for people sensitive to sodium, such as those who suffer from high-blood pressure. Increased sodium levels may be present in drinking water without a noticeable difference in taste, but chloride levels do affect taste. Several private wells have been discovered to contain levels of chloride above the EPA secondary standard of 250 mg/l. ***mg/l]*** Sodium Chloride is also known to be corrosive to metals, especially those related to plumbing.

Sodium Levels in Wells (from DOH)

Potential Impacts on Wildlife

The salt and sand can affect aquatic and non-aquatic plants and animals living in or nearby surface waters. If sand is not recovered in the spring, it can clog catch basins and fill streambeds. Increased salt content in and around roadside vegetation could also attract deer and other mammals to roadsides creating a dangerous situation for the animals and drivers.

Potential Freshwater Aquatic Impacts

Salt and sand can affect microorganism growth by clouding the water. Levels of chloride in water bodies have been increasing and road salting is a major contributor, especially in built-up areas and heavy

traffic roadways. Not only salt use on major roads, but also salt use on secondary roads and parking lots are contributing to these increased chloride levels. Some researchers such as those from the University of Dayton in Ohio conclude that sand is worse than salt for some aquatic systems.

Federal Guidelines Water Quality (Chloride Levels)

The US Environmental Protection Agency in 1988 released a document titled: "*AMBIENT AQUATIC LIFE WATER QUALITY CRITERIA FOR CHLORIDE*". The report addresses water quality by looking at acute and chronic toxicity to animals and toxicity to aquatic plants. The data showed that different species of plants and animals had a wide range of chloride tolerances. The acute sensitivities in freshwater animals ranged from 1,470 milligrams per liter (mg/L) to 11,940 mg/L. Plants had an even wider variation in sensitivities ranging from 71 to 36,400 mg/L. Ultimately, the report concludes that aquatic organisms should not be adversely effected if,

> *"the four-day average concentration of dissolved chloride, when associated with sodium, does not exceed 230 mg/L more than once every three years on the average and if the one-hour average concentration does not exceed 860 mg/L more than once every three years on the average."* [1]

Potential Impacts on Vegetation

Along the shoulders of roadways, salt and sand can degrade vegetation and soil, leading to erosion. In high concentrations, salt can kill certain types of vegetation. It is important for roadside vegetation to be chosen based on several factors including salt tolerance. Healthy roadside vegetation can combat erosion by increasing the integrity of the soil.

In 2011, the RIDOT in conjunction with The University of Rhode Island, conducted a study and submitted a report to the FHWA on salt tolerant vegetation. The report, *Development of Salt Tolerant Grasses for Roadside Use*, aimed to address the issue of dying turf grasses along roadways and what alternatives existed. The report concludes with specific recommendations for grass types, soil ratios and best practices. An underlying assumption of the report is that the recommendations can be achieved on existing maintenance budgets. The inclusion of the grasses and shrubbery identified in the study could lead to more robust roadside vegetation, which will reduce runoff into nearby water bodies. The image below is from the project which found that the inclusion of biosolid materials into roadside vegetation significantly increases the quality and persistence of turf by over 50%, when compared to just soil alone.

Inclusion of Biosolids on Roadside Turf, I-295, (R. Brown, URI, 2011)

[1] U.S. EPA (1988), Ambient Water Quality Criteria for Chloride, Office of Water Regulations and Standards, Publication 440588001

Impaired Waterbodies in RI

According to the 2012 *RI Integrated Water Quality and Monitoring Assessment Report,* two waterbodies in the state have not met water quality standards for their intended uses because of chloride levels. Those waterbodies are Print Works Pond (Cranston) and the Pocasset River and tributaries from the headwaters to the inlet of Printworks Pond (Cranston, Johnston). There were a total of 96 named waterbodies which were found to have an impairment. Although the majority of impaired waterbodies are impaired for reasons other than chloride levels, it is an important to reduce chloride levels in areas where salt runoff may be a problem.

BEST MANAGEMENT PRACTICES AND NEW TECHNOLOGIES

A Successful Reduction Policy in New England: New Hampshire Case Study

The State of New Hampshire has made strides recently in the reduction of road salt on its roads and highways. In 2008 New Hampshire listed 19 chloride impaired water bodies under the Clean Water Act. In that same year, Plymouth State University worked with a consultant to produce a report named "*Potential Solutions for Reducing Road Salt Use in New Hampshire: A Report to the I-93 Salt Reduction Workgroup*". The report is part a larger effort called the "New Hampshire Road Salt Reduction Initiative". The report concluded that the only way to prevent chloride from reaching surface and ground water is to reduce the amount applied to our roadways and parking lots without compromising safety. The following recommendations were highlighted by the project's focus group:

☐ Use education initiatives on road salt and its impacts on water quality, directed at the driving public, to change driver habits;
☐ Educational and informational efforts should be presented by NHDOT and NHDES in multiple ways and designed for different audiences;
☐ Provide additional enforcement to reduce speed limits during storm events;
☐ Use technology (cameras, radar, and other devices) to assist with enforcement;
☐ Create "No Salt" areas;
☐ Create additional public transportation alternatives;
☐ Engage employers and delay or cancel work related activities during inclement weather;
☐ Pass a law requiring all drivers to take a winter weather driving course;
☐ Eliminate the legal liability for towns and businesses that reduce their application of salt; and
☐ Require mandatory use of snow tires on New Hampshire roadways.

The report ultimately recommended the following policies:

☐ Training on treatment practices for maintenance professionals (public and private);
☐ Equipment and infrastructure upgrades;
☐ Behavior change programs to assist with voluntary and mandatory approaches;
☐ Lower speed limit during storm events; and
☐ Mandatory use of snow tires for the public

Following the listing of Chloride Impaired Waterbodies along the I-93 Corridor in Southern New Hampshire, NH DES, NH Department of Transportation (DOT), and several municipalities and private contractors are working together to reduce chloride while continuing to provide safe passage for traffic and pedestrians. (2013 NH Road Salt Reduction Initiative).

Bio-degradable, Low(er)-Impact Alternative Formulas

Calcium Magnesium Acetate and Potassium Acetate

Calcium Magnesium Acetate (CMA) is combination of acetic acid and limestone. It generally works at temperatures down to 20°F. Its known to have less of an environmental impact than other salts and chemicals, less corrosive to concrete and steel, less toxic to aquatic organisms, and has limited impact on ground water in comparison to road salt. Although it costs more than rock salt, the potential benefits may justify the increased cost.. It is currently being used in environmentally sensitive areas and on bridges prone to salt corrosion.

Potassium Acetate (KA) generally works at temperatures down to -15°F and is non-corrosive and biodegradable. It can cause slick road conditions if applied in excess and can lower oxygen levels in surface waters. This is a commonly used at airports. At the time of this report, there is no indication that CMA or KA are regularly used in Rhode Island.

Carbohydrate-based Solutions

Byproducts from corn or beets can be blended with magnesium chloride for use an anti-icing agent. Also, this mixture can be effective as a deicer. The mixture is less corrosive to metal equipment and is considered safe for the environment. These "natural" solutions are mostly proprietary to the manufacturer and can be derived from sources such as beets, corn, grain, alcohol, or molasses. These are not particularly good at melting snow and ice, but they do slow down the formation of ice lowering the freezing point.. They are less corrosive than conventional materials and often help with traction on road surfaces. They are not known to have environmental impacts in aquatic systems due to their composition.

RECOMMENDATIONS

Reduction in Road Salt Applications

Based on the best available data over the past five years, the investment in new fleet technologies (closed loop-systems), have significantly reduced the total amount of sand and salt applied to RI roads. Continued/expanded investment in these equipment upgrades will contribute to increased efficiency in winter storm road maintenance procedures, thus reducing application rates and saving the state money in the short and long term. (for Vendors- opportunity to incentivize retro-fitting of closed loop systems?)

Closed-loop Snowplow Control Module used by RIDOT, Photo: mto.gov.on.ca)

Reductions in Sand Application

When salt is applied to roads in a more efficient manner, the need for sand should decrease, as more of the roads will be clear. Some believe that the application of sand has little to no effect on road conditions. When we weigh the clean-up costs and environmental effects, a reduction in the amount of sand applied to roads makes ecological and economic sense.

Expanded Reduced Salt Areas

In areas adjacent to already stressed wellhead protection areas, surface water drinking supplies, and all other drinking water source protection areas, salt use should be reduced in order to protect water quality. *State Guide Plan Element 721: Water 2030* contains recommendations for reduced salt use in the Scituate Reservoir Watershed:

> "Goal WRM-2, Strategy 1-K: Reduce sodium application rates on roadways to reduce sodium loadings in the watershed"[2]

Reduced salt policies already exist in the area of the Scituate Reservoir and in several other places, but should be expanded to areas drinking supply protection areas and areas where chloride or sodium levels exceed the recommended limits. In these areas, alternative methods should be considered, such as the carbohydrate-based solutions.

Increase Sand Recovery Rates in Drinking Water Areas

If sand application levels do not decrease, and recovery levels do not increase, the gradual build up over time may have devastating effects. While salt easily dissolves and can be carried to and through groundwater and freshwater, sand is less likely to travel and tends to accumulate at roadsides, stormwater drainage basins and in adjacent ponds and streams. Currently, only about five to ten percent of sand applied to roads is recovered each

[2] RI Division of Planning, Department of Administration (2012), *Rhode Island Water 2030,* RI Statewide Planning Program

year, priority should be placed on sand recovery in drinking water protection areas. *State Guide Plan Element 721: Water 2030* also contains recommendations for street sweeping in the Scituate Reservoir Watershed:

"Goal WRM-2, Strategy 1-O: Ensure that annual street sweeping is completed in the watershed"[3]

This strategy should be implemented in all drinking water protections areas for sources both public and private. With more efficient technology and equipment overall, sand application rates are likely to decrease. Until these technologies are widespread throughout state, municipal and private fleets, increased sand recovery is a short-term water protection strategy that should be considered.

[3] RI Division of Planning, Department of Administration (2012), *Rhode Island Water 2030,* RI Statewide Planning Program

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