

Salt Management Strategy (SaMS) Toolkit: Steering Committee Review

Response to the 1st and 2nd Round of Comments

September 1, 2020

All responses by DEQ to comments from Steering Committee members have been summarized below. DEQ responses are provided in *italics* nested under the applicable comment(s). The first round of Steering Committee review extended from May 18, 2020 through July 8, 2020 and consisted of a cover-to-cover review of the SaMS Toolkit. The second review period extended from July 20, 2020 through August 12, 2020 and focused on the responses to first round comments and the edits made to address those comments. Second round comments and responses are contained below in **bold text**. Here again, DEQ responses are provided in *italics*. The comments and responses are grouped into the following sections, which are mostly reflective of the sections of the SaMS Toolkit. You can click on the text below to jump to those sections.

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Formatting/Style

1. Comment that the “SaMS Goals” on page iii is in white and does not appear well against the background.
 - a. *Response: The intended format was for the SaMS Goals to appear on a separate page. This has been corrected.*
2. Comment that “i.e.” or “e.g.” should be always followed by a comma.
 - a. *Response: As recommended, this change has been made.*
3. Recommended that “n” in “northern Virginia” be capitalized throughout the document.
 - a. *Response: As recommended, this suggestion will be reflected in a future revised version.*
4. Capitalize “Toolkit” throughout the document.
 - a. *Response: As recommended, this suggestion will be reflected in a future the revised version.*
5. Question of what will be the process in the future ensure that links, especially external to VA DEQ, remain useable and/or alternative information is substituted.
 - a. *Response: This is a good point and one to be aware of. At this time, there is no process outlined in the toolkit. Recommend that the future implementing body of SaMS, as part of the anticipated updates to the toolkit, consider also verifying that the web links are still valid.*
6. Comments received that the document is large and may be overwhelming to a reader:
 - a. Recommendation to separate the Toolkit into two separate volumes, such as “General” and “Specific,” due to the length of the document and its potential to overwhelm the reader. Commented that the Table of Contents alone is enough to overwhelm a reader.
 - b. Comment that a 406-page document is hard to read. Question what parts are they talking about, that a short information card is needed (comment provided on Education and Outreach chapter, but appears to apply to the toolkit as a whole).
 - c. Overall I think the document is very technically heavy and I feel that only a portion of the document would be helpful to the average resident or NGO. I think that the toolkit could be improved on by adding a task to the future SaMS goals to distill this document into one focused more on these users, or even splitting the current document into volumes to achieve the same. I am concerned that people will simply not be inclined to go through this very large document to get pertinent information from it. Since we are asking for a voluntary action, I think that easily accessible information is important. On the other hand, I do realize that it is our job (as a locality) to educate our citizens with this information and inspire change.
 - i. *Response to comments a-c: Good recommendations to enable the document to be more easily digestible. We believe this is a comment to pose to the entire Steering Committee for their consideration. Specifically, 1) if the document should be separated into sections and 2) if there is support for a future recommendation to pull out material specific to certain audiences.*
 - A. Comments received that it would be beneficial to reorganize the document now to make it more user-friendly. Several suggestions were provided, such as splitting the main body from the Appendices and reducing the detail of Appendices in the table of contents (TOC). Other suggestions were to split the document per audience, such as homeowner, applicator, then references and appendices. The TOC was recommended to include hyperlinks to each specific section to make it easier to navigate and possibly tags to identify which may interest a particular stakeholder. Another recommendation pertained to how the document is presented on the website, to be split out as**

sections instead of one large document. A recommendation for future revisions was to create documents for specific groups, developed with the benefit received from feedback on the current document.

- ***Response: The comments received provided a number of ways to make the Toolkit more user friendly. While it is a large document now, until we have a website to host it on, it is important to keep the pieces together so that it can function as a one-stop-shop. The final version will be a PDF with bookmarks that will display in the PDF viewer to improve navigation. To preview this, in the draft MS word Toolkit, readers can open document navigation to see the existing bookmarks. In the interest of time, we propose to pursue the recommendations that do not require a complete rework of the document but still enables the large document to be less cumbersome and simpler to comprehend.***

The table of contents that accompanies the main body will be shortened as it pertains to the appendices. The appendices will only be listed by their title. A separate table of contents for the appendices will move to a section that precedes the appendices, and this section will be noted in the primary table of contents at the beginning of the document. Additionally, since the general public was seen as the audience that will have the hardest time with the SaMS Toolkit, we propose the creation of a public friendly executive summary-like document. This will include a brief description of the Toolkit, its purpose, a summary of its contents, and a basic table of contents that recommends the applicable audiences for each section. This public friendly summary will be a stand-alone document that will help us debut the Toolkit to the public. Ultimately, we envision most users will interact with this document in an electronic format on the webpage where it resides. Therefore, we recommend that the Toolkit be shared on a webpage in one of two ways. Either with each chapter and appendix listed separately with hyperlinks to that section or the webpage set up such that the main body sections provide the content for the webpage with links to the appendices referenced in that section. This will be the decision of the entity leading implementation due to the effort needed to pursue the second option.

7. Table of Contents (TOC):

- a. Section 8 does not have subsections listed in this TOC (8.1., 8.2, 8.3, etc.) as the other sections do. Recommended that when editing is finished, to re-run the TOC app to update page numbers.
 - i. ***Response: Thank you for pointing out this error. It will be corrected in a future revised version.***
- b. Seems to be an issue with the Table of Contents. Chapter for Inter-Governmental shows as 9 in TOC, but is Section 8 in the document. Same issue for the Future Recommendations chapter.
 - i. ***Response: Thank you for pointing out this error. It will be corrected in a future revised version.***

8. Appendices:

- a. Each TOC for individual Appendices is overwhelming. Space and use bold text for chapter titles.
 - i. ***Response: The TOC will be reviewed to incorporate these suggestions to make it easier to read.***

- b. TOC for the Appendices: Add a space between each Appendix to give the reader's eyes a break. Content, as noted, is visually overwhelming and a disincentive to read on.
 - i. *Response: The TOC will be reviewed to incorporate these suggestions to make it easier to read.*

Over-arching Themes or Comments

- 9. Revise term "winter maintenance professionals" to "winter pavement maintenance professionals"
 - a. *Response: "winter maintenance professionals" seems to be a standard term in the industry. The use of the term "winter pavement maintenance professionals" does not seem to be found in the literature.*
- 10. While the toolkit contains a wealth of information, it does not appear to provide a lot of content that will be useful when development individual TMDL action plans. Requests the toolkit include suggested templates and language that could be used to create these action plans.
 - a. *Response: The SaMS Stakeholder Advisory Committee never envisioned the SaMS Toolkit to include templates and suggested language for MS4 permittees. Instead, this is a resource that serves a multitude of audiences to help those who desire to improve their winter storm operations. There is no regulatory requirement associated with the toolkit and therefore, it is voluntary. This toolkit may or may not be used as a resource by MS4 Permit holders, it is their choice to do so or not, to help develop their local action plans to address the Accotink Creek chloride TMDLs. MS4 Permit holders subject to the Accotink Creek TMDLs will need to develop local action plans for chloride that are unique to their individual situations in accordance with the requirements of their permit.*
- 11. There should be clear understanding this toolkit is just that, tools to use if needed to enhance their current program and is NOT MANDATORY at this time although if partner's should need to bring their current snow operations up to a standard, what are the standards?
 - a. *Response: Currently, there are no standards for salt application and snow and ice operations. However, there is information on best practices and this is what the toolkit identifies, while also acknowledging that every operation is different and every storm is different. We believe the toolkit clearly identifies that it is not mandatory but voluntary.*
- 12. I suggest that in whatever VDOT proactive communications efforts to get VDOT out in front of this from a PR perspective, it will be important to shine a light on the fact that, in Section 3 of the SaMS Toolkit document, DEQ refers to the Roadway Snow and Ice Control section of VDOT's Maintenance Best Practices Manual as the example of what winter maintenance plans might/should address. That section of our Manual includes most or all of the "Fundamental 5" practices that SaMS recommends as well as half or more of the "Second 6" practices they recommend (pg. 111 of the document - SaMS Operational BMPs - Pros and Cons). Another important point is that VDOT is ultimately constrained by (1) the nature of the winter weather in any particular year, and (2) the budget we have to manage that in any particular year.
 - a. *Response: Thank you for your comment. As it appears the comment pertains to VDOT's operations and not on the content of the SaMS Toolkit, no revisions to the toolkit were made in response to this comment.*
- 13. Multiple roadways such as the Interstates will have various layers of salt over the event. The salt application is only one level but the road way attempts to get the roadway to "black pavement" for safety of the public. Tracking can take place but is different depending on the storm. Need to adjust VDOT program that bare pavement is required, if that is what we are looking at that roads will not be bare.

- a. *Response: Thank you for your comment. As it appears the comment pertains to VDOT's operations and not on the content of the SaMS Toolkit, no revisions to the toolkit were made in response to this comment.*
14. Salt brine does not hold more than 45 minutes and starts to decrease depending on the timing, temperature as well as the overall accumulation rates and how much the accumulation rates have (1 inch per hour vs 1 inch over 24 hours).
 - a. *Response: Thank you for your comment. The use of brines is discussed in a number of ways in Appendix B. Specifically, the two BMPs related to brine application include anti-icing and direct liquid application. The intention behind anti-icing is not to burn through the snow as it accumulates, but instead to prevent or significantly reduce "the bonding of snow and ice to pavement, which makes plowing/shoveling much more efficient and complete." On the other hand, direct liquid application is described as applying the brine "directly to the surface during or after a storm to deice immediately." All of these practices assume that plowing is involved since the goal is not to burn off the snow with deicer, but instead to prevent the bond from forming with the surface so that it can plow easily and to keep a reasonable pace between passes of the plow.*
15. VDOT can implement training of salt to our contracts but to say they need a Certificate Training is well beyond our budgets. Too many Truck Operators that do the operations come and go throughout the contract.
 - a. *Response: Adding certification training as a component to their operations was identified as a difficult challenge in the near term by the Non-Traditional BMP workgroup. Therefore, the workgroup recommended solely providing information on certification programs with no recommendation that operations should consider adding such a program. However, the workgroup also felt that this topic should be revisited in the future as it is a best practice to train staff on salt application best practices.*

Introducing the SaMS Toolkit

16. Recommendation that the opening paragraph be reworded, that the Toolkit's Introduction needs to be shorter and punchier.
 - a. *Response: We received a lot of feedback on this section that helped streamline the content. However, we are open to additional suggestions on how to make it shorter and punchier.*
17. 1st paragraph: What is meant here? (referring to "environment" in the last part of the first sentence).
 - a. *Response: We used the term "environment" to be broadly descriptive of the impacts salt can have on vegetation, animals, etc.*
 - i. **Suggestion that it would be clearer to refer more specifically to flora and fauna or plants and animals, e.g., as in item 23b below.**
 - A. ***Response: The language has been edited to read as follows, "Those benefits, unfortunately, come with a number of negative consequences, including a decrease in water quality (specifically our drinking water), negative impacts to plants and animals, along with corrosion and damage to infrastructure and vehicles."***
18. 3rd paragraph: In a comment to the sentence "This document does not establish or identify any regulatory requirements", asked how will this document be reflected in MS4 permits?
 - a. *Response: MS4 permits will not refer to the SaMS Toolkit as this is a resource such as any other resources a permittee may draw upon when developing their TMDL local action plan. As such, it may or may not be used as a resource by MS4 Permit holders to help develop their local action plans to address the Accotink*

Creek chloride TMDLs. MS4 Permit holders subject to the Accotink Creek TMDLs will need to develop local action plans for chloride that are unique to their individual situations in accordance with the requirements of their permit. Additionally, a set of updated requirements are being worked into the Arlington MS4 Permit in the Roadways, Training, and Public Education sections of the permit. These requirements are reflective of an individual permit and would be specific to each permittee. DEQ anticipates including provisions for other MS4 permits where it may be appropriate. Again, the Toolkit may or may not be used as a resource to help address these developing requirements.

19. 4th paragraph: Comment that the following paragraph seems repetitious in the section: “The SaMS Toolkit is designed to have summary level information in the main body of the document to help all audiences identify the resources or recommendations that will work best for them. These resources and recommendations are then fully described in the appendices. Because of the variety of audiences it addresses, and because of differences among organizations within the same audience, no recommendation is expected to be used by all. Instead, this toolkit is designed to easily and quickly direct readers to the resources or recommendations contained within that are most applicable and may work best for them.”
- a. *Response: The paragraph has been revised to read as follows, “The SaMS Toolkit is designed to direct readers to the resources or recommendations contained within that are the most applicable and may work best for them. The main body has summary level information to help all audiences identify the resources or recommendations that will work best for them. The appendices contain the fully described resources and /recommendations.”*
20. Last paragraph: Comment that “approved” in the following sentence “The stakeholder organizations that comprised the SaMS SAC have developed and approved the contents of this document with the aim to implement, review, revise, and improve them into the future” seems like a stretch because the commenter stated they did not approve everything and doubted others did.
- a. *Response: This is currently an aspirational statement. After the Steering Committee has a chance to review and approve a revised version of the toolkit, the SAC will have an opportunity to review and approve the toolkit as a whole.*

Acknowledgements

21. 1st paragraph: Noted in the text it mentioned SAC member logos and none were seen in the document.
- a. *Response: DEQ considered including SAC member logos in the document. However, due to low number received in response to several requests, chose not to include those logos. The text was remnant from when we mean to include logos and has now been deleted.*

Chapter 1: Why it Matters

22. Comment that sweeping operations should help in most salt applications. The use of sweeping can reduce what goes down the drains. Cannot effectively re-use salt from sweeping (Too much debris/other chemicals). Can only do when weather permits between treatments.
- a. *Response: We appreciate the perspective that this comment provides.*
23. 1st paragraph:
- a. Comment on reference in first sentence, if the second reference is right and recommendation to combine into the same parenthesis.
- i. *Response: We are looking into this with ICPRB. A revision or response is forthcoming.*

- b. Comment on the last part of the last part “especially in local streams” of the sentence “Salts pollute drinking water sources and are very costly to remove. Salts can wreak havoc on local plants and animals, especially in local streams.” This Intro seems disjointed to me. I’d suggest that a connection with the Accotink Creek TMDL be made right here in the text, to introduce the fact that monitoring has revealed violations of state water quality standards for chlorides and, briefly, the environmental risks of that to potable water supplies and stream/ecosystem health. The TMDL is, after all, the prime motivation for developing this strategy/toolkit.
 - i. *Response: The “especially in local streams” portion of the sentence was deleted and wasn’t intended to be part of that sentence.*
 - c. Comment that the sentence “Northern Virginia stakeholders aim to do just that through the implementation of this Salt Management Strategy (SaMS).” statement may be biased, if document is meant to be used as “general” resource tool.
 - i. *Response: The sentence has been revised to replace “Northern Virginia” with “SaMS.” Additionally, it is important to note that while the SaMS Toolkit does not prescribe actions and is voluntary, the SAC developed and approved goals do support the quoted text above. Goal #1 reads, “The aim of this effort is to develop a salt management strategy for Northern Virginia that uses a stakeholder-driven process to proactively address salt loads in the region and address the Accotink Creek chloride (salt) TMDLs.”*
24. 2nd paragraph: Comment that the TMDL and background for SaMS needs to be upfront and expanded. Requests it be explained why this is being done and how impaired NoVA’s streams are.
 - a. *Response: While the Accotink Creek was the primary driver for starting this effort, it’s no longer the only one. We feel the level of attention that Section 1 provides for the reasons for its development, which includes not only the Accotink Creek TMDLs but also the concerns by stakeholders that expand further than water quality, in addition to Appendix A, provides sufficient groundwork.*
25. Section 1.1., 2nd paragraph: Comment questioning if we can make the following statement: “All salts applied to **impervious surfaces** (i.e. walkways, parking lots, and roads) ultimately enter the environment including surface water and groundwater. “ Questioned if there any closed systems (likely on parking lots or possibly airports) that capture some meaningful percent of the salt.
 - a. *Response: There are potential situations where there is some level of capture to runoff. For instance, Dulles Airport revised their deicing practices to specific areas that collect the runoff. Revised language as recommended to “The vast majority of salts applied....”*
26. Section 1.1., third paragraph: Question over what type of mining can lead to elevated chloride levels.
 - a. *Response: This statement was intentionally left broad since it is a broad category of mining that can lead to elevated salt levels. It depends a lot on the local geology. For example, a lot of mined commodities lay in geology that was previously marine, and thus, there is a lot of chloride in the waste.*
27. Section 1.1, 4th paragraph: Recommendation to further explain the differences between chloride and salt. Suggested one idea would be to add an introductory glossary section to clarify common terms used throughout the document.
 - a. *Response: We believe that the language in the paragraph above concisely addresses this. Additionally these terms are included in the glossary.*
28. Section 1.1., last paragraph: Question if should also mention people on a low salt diet.

- a. *Response: The sentence has been revised to include "...impacts to customers on low-salt diets..."*

29. Section 1.2, 1st paragraph:

- a. Comment that "\$8.3 billion" should be footnoted (each of the estimates). "The annual cost of corrosion for highway bridges has been estimated at \$8.3 billion for replacing deficient bridges, bridge maintenance, painting, and capital costs."

- i. *Response: We decided to not overly reference this section to keep it easier to read. That's why footnote 2 on the previous page (applying to this section) notes the primary references, and directs readers to Appendix A for more information. If Steering Committee members feel strongly, we could also reference them in Chapter 1. It is worth noting that the approach used throughout the document uses parenthetical references, which can be dense. Footnotes are for more information.*

- A. **Comments received that it is important to maintain simplicity and readability in the introductory chapter. Commented that the general footnote to reference Appendix A is a good approach.**

- o ***Response: There is agreement in the comments received and therefore no changes will be made.***

- b. Comment that vehicles need to be cleaned to eliminate salt and other chlorides from corroding the vehicles, that cost will always be practical. Wash cars/bridges.

- i. *Response: Thank you for your comment. This practical point on what can be done to minimize corrosion to cars and bridges is appreciated. It important to also be aware that the wash water will likely make its way into waterways, carrying along the chloride with it, unless additional actions are taken to capture and treat that water.*

- A. **Comment that care should be taken in how personal vehicle washing is addressed because this shouldn't be much of a concern if overall salt usage is reduced with implementation of SaMS.**

- o ***Response: While all opportunities to reduce salt should be considered, we agree that reductions in salt applications will ultimately reduce what makes it onto vehicles.***

30. Section 1.2, last paragraph:

- a. Comment on the "costs of environmental damage from salt use". What about costs related to public water sources and supplies? Should at least be touched on here.

- i. *Response: This comment will be coordinated with Fairfax Water and Loudoun Water for their recommendation on how best to address the comment due to their intimate knowledge of those costs.*

- b. Comment that a sentence is needed that explains how salt degraded natural resources which provide ecological services.

- i. *Response: Currently we believe the available information has been presented, which does make this point generally. However, we are reviewing new information to see if this point can be bolstered in a future revised version of the Toolkit.*

- c. Comment that VDOT has not experienced the result with brine as indicated: 32-75% reduction in salt usage. In this region brine typically delays accumulation 30-45 minutes; however, they have not experienced a significant reduction in the need for salt application. This comment is in response to the

sentence: “Salt reduction estimates in the Twin Cities Metro Area have been documented to be between 32% and 70%, in some cases those reductions occurred a single year.”

- i. *Response: The experience of organizations in Northern Virginia may be different. However, this information was pulled from an available summary in section “3.5 Success Stories” from the [Twin Cities Metro Area Chloride Management Plan](#). The range in reduction represented the different experiences of different organizations. These factors can be influenced by best practices already in place, the timing of plowing to utilize the anti-icing, the extent/size of the surfaces treated, and the severity of the winters used in the comparison, among many other potential factors.*

- A. In response to the last sentence above: **Comment that the concern noted seemed to be the risk of projecting unrealistic expectations to the public. Minnesota DOT has an order-of-magnitude different mobilization for winter storms due to their climate and geographical location. Budgets and levels of effort in Virginia are lower because of a lower risk based on historic weather trends.**

- o *Response: The examples (32-70%) came from different local government DOTs in the Twin Cities Metro Area, which are some of the best-documented salt reduction estimates that we are aware of. The reductions related to anti-icing (32-75%) include the locality in Minnesota (32%) and a Clear Roads Best Management Practice Manual statistic (75%). The statement in Section 1.2 and the reported anti-icing reductions in Appendix B are meant to present the possible range of reductions based on empirical evidence. With regards to the regional applicability, we hope that the opening phrase in Section 1.2 that reads, “Salt reduction estimates in the Twin Cities Metro Area have been documented to be...” should serve to acknowledge the potential for regional differences. Additionally, in Appendix B, the 32% reduction is related to “Six cities in the Rice Creek Watershed (MN)...” The Clear Roads statistic does not have a location attributed to the reduction. For both the Minnesota and Clear Roads examples, the reference is provided on the same page as the Anti-icing BMP.*

31. Section 1.3, 1st paragraph: Comment that they find it easier to follow the discussion when figures/tables/photos, etc. are located within the text close to where they are being discussed. Noted, the map is in Figure 2, not 3, currently two pages further on.

- a. *Response: As recommended, this suggestion will be reflected in a future revised version where feasible.*

32. Section 1.3, last paragraph: Comment questioned if there was only one TMDL developed due to noting the plural used in the following sentence: “The SaMS Toolkit was developed with the fundamental principle that public safety is the highest priority for winter maintenance, while recognizing that the water quality concerns identified through the chloride TMDLs can be addressed without harm to public safety during winter weather events.”

- a. *Response: The sentence is referring to the number of TMDL equations that were developed to address the benthic impairments in the Accotink Creek watershed. There were three TMDL equations that address three stream segments: Long Branch, Accotink above Lake Accotink and Accotink Creek below Lake Accotink. Those equations comprise one TMDL report.*

33. Section 1.4, 4th paragraph:

- a. Questioned if in the last sentence, if there should be a referenced included in the footnote to reference a 2001 dataset: “Land use in northern Virginia, as indicated by the 2016 National Land Cover Dataset (NLCD), is 39% developed land, 36% forest, 20% crops, 3% wetlands, and 1% open water.¹ Average impervious cover as of 2016 was nearly 26%, an 11% increase since 2001.² “
 - i. *Response: Thank you for pointing this out. It will be looked into and corrected, as appropriate, in a future revised version.*
- b. Comment questioning if the statement “found significant hydrologic impacts when impervious cover in a watershed increases above 2%” is correct. Commented that they recalled a higher percentage in DEQ literature but wasn’t sure where that was viewed (training guide?).
 - i. *Response: Thank you for your comment. It is being looked into and we may need to modify the language to better clarify the point.*

A. The Impervious Cover Model created by the Center for Watershed Protection and updated about 10 years ago, based on numerous small watershed monitoring studies across the nation, indicates general stream health begins to decline from Excellent or Good to Fair with somewhere between 5-10% impervious cover in the small watershed. There is a chart that shows the further decline of stream health – not restricted to just hydrological changes – as imperviousness increases. I can provide that document if DEQ is interested.

- o *Response: We appreciate the offer and were able to locate the reference. We spoke with one of the authors of the study, which was based upon 361 HUC-12 watersheds in the non-tidal Potomac River watershed and confirmed their findings found 2% as a threshold. However, given the attention to this statistic, it may be helpful to include reference to the Center for Watershed Protection. The following language has been added before the sentence on ICPRB’s work, “A nationwide study on small watersheds from the Center for Watershed Protection (add reference) documents a shift from sensitive to impacted general stream health, which occurs within impervious cover proportions of 5-10%.”*

34. Section 1.4, 5th paragraph: Comments on the following “Water quality trends in northern Virginia from three different analyses at multiple locations illustrate a pattern that suggests freshwater salinization is increasing in the region. While each of these analyses should be used cautiously, the watershed specific data indicates potential regional water quality patterns that all point to an increasing trend in freshwater salinization in northern Virginia.”

- a. Comment that the two sentences are somewhat redundant, that the second sentence is simply bit more detailed.
 - i. *Response: the language has been revised as follows, “Analyses from three different studies at multiple locations all point to an increasing trend in freshwater salinization in northern Virginia.*

¹ NLCD land use categories were aggregated for simplification. The following land use classes were included in each category. Forest: Deciduous Forest, Evergreen Forest, Mixed Forest, Shrub/scrub, and Herbaceous. Crops: Hay/Pasture and Cultivated Crops. Developed: Developed Open Space, Developed Low Intensity, Developed Medium Intensity, Developed High Intensity, and Barren Land. Wetlands: Woody Wetlands and Emergent Herbaceous Wetlands.

² Source: 2016 and 2011 NLCD urban imperviousness layers.

Although it is important to interpret watershed specific trends cautiously, there is an amounting weight of evidence.”

- b. Question why says “suggests” a pattern of freshwater salinization. Has it not been confirmed?
 - i. *Response: The text has been revised and provided below the comment above. However, to provide some context, the workgroup preferred that “The observed trends can speak cautiously to patterns in the region, while speaking confidently to trends within the evaluated watersheds.” The term “suggests” was used intentionally to be in line with that workgroup preference. In other words, the patterns are certainly showing signs of freshwater salinization, which would suggest that that may be the case throughout the region.*

35. Section 1.4, 6th paragraph: Comment that Fairfax Water’s drinking water intake in the Occoquan Reservoir, which is included as an indication of freshwater salinization, is not representative of NoVA. The reason given is that this is due to the “downzoning” of the surrounding area which is intended to protect the reservoir’s water quality. Requests a more representative waterbody be found.

- a. *Response: The Occoquan Policy is aimed at protecting the reservoir from point source pollution and establishes wastewater treatment performance requirements for regional treatment plant(s) and associated sewage collection systems in the Occoquan River watershed. While portions of the watershed were ‘downzoned’ in order to provide additional water quality protections, this large watershed contains a variety of land uses, from agricultural, suburban, urban, commercial and industrial and has experienced tremendous growth and development in recent decades. While we do have data on other streams in Northern Virginia, we chose a waterbody that is a public water supply source contained within the region and because of its rich history of water quality monitoring data. While there are unique protections associated with this reservoir, it does provide a good representation of impacts associated with the development occurring in Northern Virginia.*

36. Section 1.4, 7th paragraph: Comment (from Fairfax Water) that the following sentence needs to be re-written: “The major drinking water utilities in northern Virginia, in terms of population served, are Fairfax Water, Loudoun Water, and Washington Aqueduct (as a wholesale distributor to Fairfax Water, Arlington County and Vienna).” Questioned if it is meant to capture those entities that produce water only? For instance, PWCSA serves a greater population than Loudoun water, but LW treats a portion of its distributed water itself while PWCSA does not. Vienna is a wholesale customer of Fairfax Water, not the Washington Aqueduct. Fairfax water is a wholesale customer of Washington Aqueduct (for a portion of all overall water supplied). Therefore, need to understand what the objective is and it can be re-written accordingly and reviewed by FW and others mentioned for accuracy. Suggested that may want to say “part of Fairfax County” instead of “distributor to Fairfax Water” which may make it seem that all of our water comes from WA.

- a. *Response: We will coordinate with Fairfax Water on revised language to accurately portray in the sentence those water purveyors that produce potable water from raw water supply sources. These are the entities of interest and which are intended to be captured in that section as it is expected that they would be the most impacted by water quality changes in their source water.*

Chapter 2: How SaMS is Addressing the Issue

37. Recommendation to relocate the Goals Box. Readers read Left to Right and the goals need to catch the eye first after the first two paragraphs.

- a. *Response: As recommended, the goals box was shifted to the left side of the page.*
38. Section 2.1, 3rd paragraph: Comment on the sentence “Various studies have documented that anti-icing alone can reduce salt use by **32-75 percent**.³” This is a significant range which may be tied to prediction accuracy and condition tracking: would like to see more discussion on planning, storm prediction adjustments, and condition tracking in the Appendices.
- a. *Response: This information comes from the different success stories of different organizations in the Minnesota Twin Cities Metro Area. The range in reduction represented the different experiences of different organizations. These factors can be influenced by best practices already in place, the timing of plowing to utilize the anti-icing, the extent/size of the surfaces treated, and the severity of the winters used in the comparison, among many other potential factors. As to the recommendation for additional resources that delve into planning, storm prediction adjustments and condition tracking, there is not sufficient time during this development process to compile this information. However, we propose to put before the Steering Committee for their consideration a future recommendation to compile and provide this information in a future iteration of the document.*
- i. **Comments received support publishing additional information on the effectiveness of pre-treating, specifically for this region. An additional comment indicated support for the existing response to the comment.**
- A. *Response: Based on these responses, it seems reasonable to provide a future recommendation to compile local studies and information on anti-icing (i.e., pre-treating) as it relates to storm prediction adjustments and condition tracking. This decision will be finalized at the Steering Committee meeting.*
- ii. **This is the same comment/response as No. 30.c.i.A: Comment that the concern noted seemed to be the risk of projecting unrealistic expectations to the public. Minnesota DOT has an order-of-magnitude different mobilization for winter storms due to their climate and geographical location. Budgets and levels of effort in Virginia are lower because of a lower risk based on historic weather trends.**
- A. *Response: The examples (32-70%) came from different local government DOTs in the Twin Cities Metro Area, which are some of the best-documented salt reduction estimates that we are aware of. The reductions related to anti-icing (32-75%) include the locality in Minnesota (32%) and a Clear Roads Best Management Practice Manual statistic (75%). The statement in Section 1.2 and the reported anti-icing reductions in Appendix B are meant to present the possible range of reductions based on empirical evidence. With regards to the regional applicability, we hope that the opening phrase in Section 1.2 that reads, “Salt reduction estimates in the Twin Cities Metro Area have been documented to be...” should serve to acknowledge the potential for regional differences. Additionally, in Appendix B, the 32% reduction is related to “Six cities in the Rice Creek Watershed (MN)...” The Clear Roads statistic does not have a location attributed to the reduction. For both the Minnesota and Clear Roads examples, the reference is provided on the same page as the Anti-icing BMP.*

³ See [Appendix B](#).

Chapter 3: Planning and Application Practices

39. 1st paragraph:

- a. Comment to revise “increasing salinity in surface waters” to “detrimental impacts of road salts” in the following sentence: “The SAC, through the efforts of the smaller workgroups, collected and analyzed available information and evaluated practical solutions to address the increasing salinity in surface waters.”

- i. *Response: Since we have tried to avoid the source-focused term “road salts” the sentence is revised as follows, “...to addressed the detrimental impacts of salts used for winter maintenance.”*

- b. Comment that its unclear what “improvement processes” means in the following sentence: “The term “practices” is used broadly and include: application and planning practices, improvement processes, deicing product options, and a summary of certification and training programs. Note, measuring and tracking of salt use is also a best practice. However, because of the detail of that discussion, it is addressed in it’s own section ([Section 4](#)).”

- i. *Response This refers to the recommendation discussed in Section 3.2.2. To make it more clear, it was revised to “continual program improvement processes.”*

- ### 40. Section 3.2, 1st paragraph: Recommendation to delete the following sentence as its redundant and the commenter expressed the next paragraph stated it better: “Since every organization is different, the practices and processes contained in the sections below will work for many but not every organization. Similarly, a single practice cannot be used under all circumstances.”

- a. *Response: As recommended, this sentence was deleted.*

41. Section 3.2.1, Pg. 17, 1st paragraph:

- a. Question if the following should be included in the Recommendations chapter: “Winter service providers in the public sector are encouraged to develop organization-specific manuals/winter maintenance plans to meet the expectations of their Tier 3 decision makers (for example, VDOT’s BMP Manual...”

- i. *Response: This is a recommendation for “organization-specific” manuals/plans, and therefore should not be a recommendation for Section 9, which consists of recommendations for the SaMS SAC to develop for the overall SaMS initiative.*

- b. Recommendation to remove reference to VDOT BMP Manual.

- i. *Response: The inclusion of VDOT’s BMP manual was agreed upon in the Traditional BMPs workgroup, which included VDOT representation, to both provide a good example of what an organization-specific plan may look like and to ease VDOT’s concerns that the BMP Pros and Cons may be seen as an item that should supersede a developed plan like their BMP manual.*

- c. Requests the VDOT BMP manual receives a proper title. It is assumed this is the Maintenance Best Practices Manual.

- i. *Response: Upon receipt of the updated final document, the appropriate, up to date title will be used.*

A. VDOT responded with a question to clarify DEQ’s need per the manual.

- *Response: DEQ is coordinating directly with VDOT to ensure the manual is accurately referenced and linked to.*

42. Section 3.2.1, Tables 1 and 2:

- a. Comment that Tables 1 and 2, which detail BMP implementation costs and partnership opportunities, do not appear to accurately reflect costs for Fairfax County. Costs can be difficult to assess based upon the priorities and budgets of individual localities. It is our expectation that there will be flexibility when BMPs are included in individual action plans. Please confirm. Additional clarity was offered with the following two examples: 1) “Know the surface temperature” the costs are characterized as “Low” (staff time) and “Medium” (other costs). While these characterizations may be appropriate for a facility or site, it is much more complex to effectively implement this BMP County-wide, including all libraries, schools, police stations, and other government facilities, each with variable local conditions. 2) “Plowing early and often” the costs are characterized as “Medium” (staff time) and “Low” (other costs). When operators are responsible for maintaining multiple sites, de-icers may be used after plowing in order to keep additional snow accumulation from freezing while operators are away working on other facilities. If crews are required to remain on-site to plow more often, additional staff and equipment would be required to cover the large number of sites that need to be maintained. The commenter expressed concern that the public may see this table and request that jurisdictions adopt all “low” and “medium” cost BMPs without understanding the complexity.

- i. *Response: Yes, MS4s have flexibility for the types of BMPs and when to implement them, so long as they are showing continuous improvement to the maximum extent practicable. With regards to the concerns over cost estimates, this highlights how it is hard to highlight specific BMPs with relative costs. For example, “Know the surface temperature” can be accommodated with inexpensive handheld infrared thermometers, or with expensive, stationary or mounted thermometers that are wired into a system like a Road Weather Information System (RWIS). Hence, the “Other Costs” were categorized as “medium.” Similarly, “Plow early and often” is described in detail in Appendix B, and does not suggest crews stay at locations, but instead favor plowing over salt application, or in the very least, to not use salt to burn off snow accumulations. This highlights a potential for this table to be misunderstood since the content of the BMPs are not wholly evident when reading the brief descriptions in table 1 and 2. We request the Steering Committee to share their preference on deleting Table 1 and 2, contextualizing it better (e.g., “see Appendix B for the full BMP description”), or moving it to Appendix B.*

- A. Comment that the BMP tables are appropriate and useful for this section. However, recommended that these tables be better contextualized, otherwise a second option would be to move those tables to Appendix B (noting that would cause some rewriting). One suggestion recommended clearly stating the footnotes with each table and to use Footnote 2 on the header for costs to indicate how cost estimates may vary for all costs.**

- o *Response: To provide more context, and address the feedback on Footnote 2, the following language was added to the paragraph before the tables, “It is necessary to emphasize that these two tables should be used cautiously as a springboard for further investigation. In some cases, the relative costs or cost savings provided in each table may vary more from organization to organization based on existing equipment, organizational structure, or organizational decisions. Additionally, the BMPs listed in the table are summarized titles for more detailed recommendations in the BMP Pros and Cons menu ([Appendix B](#)). Users should follow up on BMPs of interest in the*

menu to better understand the context for the relative costs and cost savings provided here. The order of BMPs in Error! Reference source not found. and Error! Reference source not found. are the same as the order of BMPs in the menu.” Further context was added to the end of the language preceding Table 1 and Table 2 to acknowledge the limited estimates for opportunities to partner. It reads, “Although opportunities to partner have been identified in Table 1 and Table 2 for a subset of BMPs, organizations are encouraged to look for opportunities to partner in all of their activities.” Additionally, “Cost” in the header has been changed to “Potential Cost” and footnote 2 has now become Footnote 1 and is denoted in the header on “Potential Cost.” Now none of the individual BMP costs have the former Footnote 2 and it applies to all costs. Lastly, the footnotes have been added below Table 1.

- b. Recommended the divisions between the sections (e.g., Winter Operations Planning, Levels of Services) be more visually distinct.
 - i. *Response: As recommended, this suggestion will be reflected in a future revised version.*
 - A. **Recommendation to color Table 1 and 2 differently to better distinguish between Planning BMPs and Storm Related BMPs.**
 - o ***Response: We appreciate this recommendation. The coloring of Table 1 and Table 2 are now different.***
 - c. Suggests, although understanding it’s difficult, effort be made to give some sort of indication about what Low, Medium, High mean in terms of costs. Commented for those looking at the table for the first time, it’d be hard knowing where to start. What are the lowest hanging fruit? Maybe move the tables to Appendix C? Some of the information included in Appendix C, Section 2 might be more helpful here. For example:

“To help illustrate the difference, the Salt Institute’s Fundamental 5 and Second 6 BMPs can provide examples of short-term versus long-term BMPs. Using these examples, the Fundamental 5 BMPs, which include Calibration, Measurement, Accountability, Level of Service, and Training, can be implemented in the short-term with little to no financial investment. On the other hand the Second 6 BMPs, which include Variable Application Rates, Forecasts, Cold Temperature Usage, Liquid Usage, Pre-wetting, and Anti-icing, require equipment, tools, and/or specific training to implement.”

 - i. *Revision: Taking the commenter’s suggestion and modifying it a little bit, the text has been revised to read, “Therefore, costs are presented on a relative scale of high, medium, and low. To help illustrate the difference, BMPs like calibration, accountability at every level, and levels of service can be implemented with little to no financial investment in equipment, infrastructure, or materials (i.e., “Other Costs” in the table below). On the other hand, BMPs such as pre-wetting, anti-icing, and equipment that measures deicer use at the spreader require equipment or tools that come at a medium to high cost.”*
43. Section 3.2.1, Table 1, Commented it would be great to include potential magnitude of impact in this table (that might be covered more effectively elsewhere).
- a. *Response: These are covered for each BMP in the “pros” of Appendix B: BMP Pros and Cons. If the Steering Committee identifies a viable approach to address this, we could attempt to add “high,” “medium,” or “low,” into this table and Table 2, but it may be too much information, hard to fit on the page, and the information may not be available for each BMP.*

- i. Two comments were received. One was in support of adding a magnitude of impact column to these tables to balance the time and costs columns, as this can help users select BMPs to focus on in Appendix B. The other commenter was fine with DEQ’s Response that the information about magnitude is presented in Appendix B.
 - A. *Response: A new field titled “Potential Cost Savings” was added to Tables 1 and 2 and these cost savings are framed on a relative scale of low, medium, and high. Footnote 1 also applies here. These cost savings cover cost savings for deicers, staff time, and avoided damage to equipment. Additionally, language was added to the preceding paragraph to replace text explaining the lack of cost saving information, and reads, “Potential cost savings related to each BMP are also included in Table 1 and Table 2. These savings can include reduced costs associated with reduced deicer use, reduced staff time from operational efficiencies, and reduced equipment damage costs (e.g., from cleaning equipment and containing wastewater).”*

44. Section 3.2.1, Table 2:

- a. Comment on **“Property Management Audiences** - Opportunities to close areas with a small footprint and use the proper tool to remove snow/ice in these areas when you cannot”: Questioned when one cannot *what?* – cannot close those small areas? Clarification needed.
 - i. *Response: Sentenced revised to end “...these areas when you cannot close the area.”*
- b. Comment on **“Property Management Audiences** - Snow is placed in proper places”: Maybe this is addressed later in the document, but there should be some discussion examples of the kinds of locations for snow deposits that should be avoided and the kinds of locations that are preferred.
 - i. *Response: This information is covered in Appendix B on page 112. Table 1 and 2 are intended to outline relative costs associated with the corresponding BMPs that are discussed in more detail in Appendix B.*
- c. Comment on the following “n/a” in below row: Abrasives are not free, even if only rarely used. Commented believes there would be some cost associated with their use, especially since their application may be in addition to earlier applications (anti-icing, plowing, etc.)

Use of abrasives	n/a	n/a	No ⁵
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- i. *Response: The “Other Costs” column has been revised to read “low.”*

45. Section 3.2.2, last paragraph: Comments on the sentence: “For successful implementation, all tiers of influence ([Section 3.1.1](#)) must be on board and in communication. In particular, winter maintenance plans must be discussed with decision-makers, including highlighting the tie between levels of service and the winter maintenance plan.”

- a. Comment that earlier in the paragraph before this sentence, winter maintenance professionals or audience is referred to and suggest using same term in this sentence.
- b. Questions what is meant by “of influence” in the sentence.
- c. *Response to both comments: To provide clarity, the sentence has been revised as follows, “For successful implementation, winter maintenance decision makers, supervisors, and applicators (Section 3.1.1) must be on board and in communication.”*

46. Section 3.3.3:

- a. With the overall budget restrictions, a reasonable amount of chlorides will always be involved but some of the information states we should use other products. Those products may increase our cost, which may not be allowed for current budgets.
 - i. *Response: We appreciate the perspective offered by the commenter. While the use of alternatives is encouraged, SaMS is a voluntary toolkit for stakeholders to use in a fashion that works best for their organization.*
- b. Comment that if going to include the following sentences, need to include if for the salt products too, to be balanced and fair. “Each of these products has a unique set of pros and cons (see [Appendix E](#)), and it is worth noting that all of these alternative products contain cations (sodium, potassium, calcium, and magnesium) that are also contained in many of the traditional products and contribute to freshwater salinization. For example, while acetate-based chemicals are generally considered to have fewer environmental impacts during winter maintenance operations, they have large environmental impacts in their creation (Fay et al. 2015). In addition, acetates and formates are corrosive to certain kinds of metal and both are reactive on concrete. Non-chloride products can exert a high biochemical oxygen demand, creating detrimental conditions for aquatic species (TRS 2017).”
 - i. *Response: To provide the stated balance, the sentence has been revised to remove the note about acetate creation impacts from Fay et al., 2015. Additionally, to help identify “pros” a sentence was added to read, “However, the fact that these compounds can exert a high biochemical oxygen demand is a result of their ability to biodegrade a portion of the compound and not persist entirely in the environment. Additionally, during winter temperatures, the actual ability for the products to depress oxygen levels in aquatic environments may be very low (USGS, 1999).”*
- c. Comment that the following sentence is giving the subject a short shrift: “These materials can be expensive, especially when compared to traditional rock salt.”
 - i. *Response: This is an important drawback that needs to be highlighted, but has been moved earlier in the paragraph to avoid ending on a negative.*

47. Section 3.3.4, pg. 23:

- a. Comment on the following sentence questioning what is “new” and who vettes those: “New deicers and mixtures of deicers should be thoroughly vetted prior to on-the-ground application.”
 - i. *Response: The workgroup recommended that this be framed in the Toolkit as a general recommendation. Additionally, the Toolkit does not assign specific roles, but instead provides a framework of recommendations and resources to be handled in implementation. To accommodate the comment in a general sense that is reflective of workgroup discussions, the text is revised as follows: “As the interest for alternative products grows and existing products are combined into engineered mixtures, new deicers and mixtures will be experimented with by winter maintenance organizations. Although this is a progressive endeavour, these new deicers and mixtures should be thoroughly vetted prior to on-the-ground application. Typically, industry practices evaluate deicer performance and impacts to infrastructure before field testing deicers and mixtures of deicers. An evaluation of potential environmental impacts is usually left unaddressed or evaluated the evaluation is done at later stages after deicers are used in the field. Proactively understanding potential impacts to the environment is important prior to field and full scale application. Since industry practices typically miss these vital studies, it is*

recommended that winter maintenance organizations with the resources to run these tests do so, and share their results for other organizations to evaluate.”

- b. Comment that need to clarify who is supposed to do these analysis, such as DEQ, Industry, Users, local governments or VDOT.
 - i. *Response: See the response above.*
- c. Comment on the following sentence: “For both BOD and the two toxicity tests, the eutectic concentrations of the deicers (the maximum concentration expected to be in stormwater) should be determined (e.g., eutectic concentration by mass for NaCl is 23.3%)”: What is this the ideal concentration for the brine mixture, or is this the max concentration expected to be in stormwater? It seemed that the sentence is referring to the latter, then the example should reflect the same.
 - i. *Response: Since a “maximum concentration expected to be in stormwater” needed to be identified for all deicers/mixtures, the assumption is that if deicers are applied appropriately, then the maximum concentration expected to be in stormwater would be the eutectic concentration. The sentence has been revised as follows: “For both BOD and the two toxicity tests, the eutectic concentrations of the deicers (e.g., eutectic concentration by mass for NaCl is 23.3%) should be evaluated in order to establish a consistent and comparable method. The eutectic concentration is used because it is assumed to be the maximum concentration expected in stormwater since that is the most efficient concentration for deicing.”*
- d. Section 3.4: Comment that the photo of a salt pile, if was the commenter’s, should be credited to them.
 - i. *Response: Credit for photos was attributed and summarized under a single section called “Photo Credits” located on pg. xxi for all photos used in the toolkit. The photo in question was correctly attributed to the commenter.*

48. Section 3.5, 1st paragraph:

- a. Commenter voiced confusion over the following sentence as no local jurisdiction nor the state require applicators to be trained or licensed: “While these benefits have been documented in parts of the country where certification and training programs have been implemented to date, northern Virginia does not have experience with all of these benefits.”
 - i. *Response: Based on workgroup discussions, it does not seem like any jurisdictions require applicators to be certified, and thus no benefits have been realized. While most jurisdictions have some form of trainings, and these trainings likely have benefits, the ideas being discussed here are from certification and training programs tailored to efficient use of deicers. Nonetheless, to acknowledge that benefit, the sentence has been revised as follows “While these benefits have been documented in parts of the country where certification and training programs have been implemented to date, northern Virginia does not have experience with all of these benefits.”*
- b. Recommends deleting “by the certifying program” from the sentence “Five of those programs, bolded in the list below, could readily be administered in Virginia by the certifying program.” Commented those are certification programs and the discussion should also point out that a certification program would require State enabling legislation (Virginia is a Dillon Rule State).
 - i. *Response: Since these five certification programs can be offered by the certifying program in Virginia, that language was not deleted. Additionally, these certification programs exist without the need for state legislation. The workgroup did not want to endorse a specific program, but*

instead to share the summary of these as a resource. Lastly, the paragraph addresses the future recommendation to consider the use of certification and training programs in Northern Virginia during implementation. Once more is learned through conversations on the benefits that may come from these programs, such as potential liability relief and marketing changes, the role of certification and training programs in northern Virginia can be considered further. For this stage, while DEQ is leading the initiative, there can be no legislative proposals.

- c. We strongly believe that it would be beneficial to DEQ and all partners if DEQ sponsored or recommended a certification program that can be used by all stakeholders. We feel that a certification program would benefit both public and private applicators and send a unified message encourage consistent and smart salt application by all parties.
 - i. *Response: DEQ does not have the resources to develop and implement a certification program. Additionally, DEQ does not provide recommendations on particular programs or providers.*

49. Section 3.5, last paragraph: Recommended that some understanding on why the 5 programs were selected and also why those could be readily administered in Virginia would be helpful. Also, recommended some discussion of a potential framework for who might need to be involved (what entities) and whether any specific sections of the Virginia Code would need to be changed to allow for administration of such a program.

- a. *Response: To clarify why the 5 programs could be readily administered in Virginia, the sentence has been revised to read “Based on readily available information, five of those programs, bolded in the list below, could readily be administered in Virginia by the certifying program. These programs either host online training, or are known to hold in-person trainings at requested locations, making it viable for applicators in Virginia to access the training.” With regards to developing and implementing a certification program through code, that is not a current SaMS recommendation, although it could be a part of a future recommendation regarding certification and training programs. To help clarify the intent of Appendix F, the following sentence has been added, “The details on these programs are shared as a resource for winter maintenance organizations to consider and to inform future discussions on certification and training programs.”*

- i. **Comment that care is necessary when addressing this topic to be clear and not raise public expectations that certification programs, liability relief and more appropriate application plans for public and private properties are realistic in Virginia anytime soon, and would require passage of enabling legislation. It was noted that Virginian localities do not have authority from the General Assembly to require certification of winter maintenance professionals (Virginia is a Dillon Rule state). The commenter recalled that interest in certification programs was associated with interest in providing liability relief to winter maintenance professionals.**

- A. *Response: To meet the concerns related to liability protections, when this concept is introduced in this section it now reads “Direct benefits seen in other regions of the USA have included reduced materials cost, possible liability protection ...” Additionally, prior to the list of certification programs, the following language was added to more clearly state the intended use of Appendix F, “This information on certification and training programs is provided as a resource for organizations to consider which, if any, would be beneficial to the training and professional development of their staff as part of the effort to improve their organization’s efficiencies.” Lastly, since much of this*

section discusses a future recommendation, it is not necessary to limit what that could be since we do not know at this point. Therefore, the existing language related to the future recommendation was not adjusted.

50. Section 3.6, last paragraph: Comment on the link provided in the following sentence: “Contract terms to encourage greater BMP use is being considered in other parts of the United States, such as the [contract template developed by the City of Edina, Minnesota in late 2018](#).” Should a link like this also be downloaded and maybe have a version hosted on the DEQ site? Or an example included in the toolkit? It seems likely that within the next few years, this link could go dead due to a website reorganization or the taking down of this document.
- a. *Response: While this is a very good point, it is not our resource to own and host. In fact, there was a lot of concern over endorsing this approach in the workgroup discussion, mostly focused on uncertainties for how it would play out. Accordingly, it would not be in line with those concerns to host it.*

Chapter 4: Tracking and Reporting

51. Comments on Figure 5:

- a. Should there be an arrow pointing to Tab 5 below?
 - i. *Response: The Data Dictionary is relevant to all other “tabs” and the figure has been revised to show that, with insertion of new connection rectangles between the Data Dictionary and the other “tabs”.*
- b. Should the core elements in Figure 5 match better with the subsections of Section 4? A data dictionary is Tab 5 but Section 4.2.
 - i. *Response: Each “text box” (section) of Figure 5 has had the opening of its title “Tab #” removed to avoid this potential point of confusion.*
- c. It would be helpful to be more explicit that these “tabs” correspond to tabs in an Excel file.
 - i. *With “Tab #” removed from the text boxes in Figure 5, as noted above, the primary description of the tabs is near the end of Section 4.2, and is explicitly linked to the Excel Spreadsheet.*

52. Section 4.4.: Recommendation that a paragraph be included on how someone can report salt spills, inappropriate applications and storage, to whom or using a website.

- a. *Response: A short paragraph providing existing ways to report such concerns to DEQ and VDOT has been added to Section 5.3, and reads “Members of the public who observe what they believe may be inappropriate storage or use (including spills) of winter salts are encouraged to report their concerns. For most of northern Virginia, VDOT is responsible for winter road maintenance, and issues related to salt used on area roads can be raised to VDOT’s attention at the following site: <https://my.vdot.virginia.gov/>. Roads not maintained by VDOT, and all non-road winter salt issues (including those on commercial properties) are within the purview of local government jurisdictions. To provide more resources to the public, local governments are encouraged to communicate ways that members of the public can bring winter salt concerns within their jurisdictions to their attention for appropriate follow up.” We expect that many local jurisdictions have citizen-reporting protocols, and would like to hear from local jurisdiction Steering Committee members so that we can include them in this section.*

- i. **A comment was received supporting the additional text. Another commenter said that public participation of this nature is important, and they would recommend clarifying that the intent of the information is to avoid leaving the impression that a resident or business owner not following best practices is doing something illegal that should be reported. The commenter suggested it would be helpful to focus on commercial and governmental operations. Another commenter noted that their locality does not have a specific protocol, other than the normal contact number, and noted they have an illicit discharge section that could be encouraged to bring these concerns to DEQ. A final commenter supported the added text.**
 - A. *Response: Based on the feedback received, we will revisit this during the Steering Committee meeting to see if there is a group consensus on what or what not to include. It is recommended that these concerns be received by the locality or transportation authority and not DEQ due to the former's ability to appropriately address the issue. Any concerns of a salt pile or spill reported to DEQ would be shared with the appropriate MS4 permit holder to be addressed locally.*

Chapter 5: Best Practices for the General Public

53. Section 5.1: Question how a person finds a responsible, trained winter maintenance professional.

- a. *Response: The following sentence has been added to offer suggestions, "For example, community leaders responsible for contracting winter maintenance services may want to ask prospective contractors whether or not they implement best practices to efficiently use deicer, and whether or not the contractor's staff are trained or certified."*

Chapter 6: Education and Outreach

54. Recommended that the SaMS Steering Committee should first contact the Virginia Department of Education to determine if SaMS content is suitable for students in grade levels K-12. This comment is in reference to the future recommendation to develop education programs targeted for school ages K-12 are recommended to increase awareness and build understanding of the topic.

- a. *Response: At a conceptual level, water quality is a topic addressed by K-12 educational programs. However, specifics of what exact content and the grades best to target, is currently unknown. Revised the recommendation to include this suggestion be pursued nearer the time that this future recommendation is proposed to be acted on, due to any changes that may occur between now and that future timeframe. The language included in Section 6.7 was "It is recommended that the Virginia Department of Education be engaged to ensure proposed material is suitable."*

55. Section 6.2, 1st paragraph: Comment that the following sentence "Each principle is a key consideration in the use of the SaMS logo on any material, whether print or digital, including social media posts" is unclear. Also asked if this include agency messaging that does not feature the SaMS logo? Two version were provided by different commenters. Suggested revision was: "Any messages which include the SaMS logo or any affiliation with the SaMS program needs to incorporate all of the five principles."

- a. *Response: The text was revised to incorporate a blend of both recommended language changes. Revised language is: "The SaMS logo should only be used with messaging that considers all five principles, whether the messaging is in print or digital formats, including social media posts." The revised language*

clarifies that the intent is that the 5 principles apply to only those messages that use the SaMS logo. It does not apply to agency messaging that does not feature the SaMS logo.

56. Section 6.3 & Appendix I: Recommendation that the logo shown is the one with the slogan tag “Winter Salt Smart.”
- a. *Logo was changed to the version that includes the slogan tag line.*
57. Section 6.3, 2nd to last paragraph:
- a. Comment that the following sentence “Additionally, one of the first orders of business for the subcommittee or other reviewing body is to determine voting rules, which should include considerations for how to deal with no response from voting members to avoid delays in decisions” is confusing. Suggests it’s trying to address whether permission has to be obtained prior to using the SaMS logo. Recommends we entrust any partner agency to use the logo, and if there are concerns about the use, then the subcommittee can convene to try and address the issue. The concern is that seeking permission will be too slow and unwieldy – inhibiting use of the logo, which defeats the goal.
 - i. *Response: As suggested, the sentence has been revised to further clarify the intent. Additionally, the text now identifies those details will be determined during implementation, as we feel it is appropriate for the implementing body to work out how oversight can be best carried out. The sentence now reads: “It is recommended that one of the first orders of business addressed by the subcommittee or other reviewing body is to determine how oversight of the SaMS Logo use guidelines and standards will occur.”*
 - b. Question if the text that says “as approved by voting members of SaMS” should be more specific, such as the SaMS Steering Committee, or the ongoing oversight organization, such as NVRC. Question if the full SAC continue on as a formal body into the future.
 - i. *Response: The “who” was intentionally left non-specific to enable that detail to be sorted out during implementation by the organization that will be leading that effort. At this time, the composition of the implementation stakeholder body is unknown and we provide flexibility in the Toolkit in light of this. It is anticipated that the shape of the formal body that guides implementation will be worked through during its initial meetings.*
 - c. Recommends that the level of detail identified in the following sentence be moved to the Appendix and not in the main text: “Additionally, one of the first orders of business for the subcommittee or other reviewing body is to determine voting rules, which should include considerations for how to deal with no response from voting members to avoid delays in decisions.”
 - i. *Response: This sentence was revised to address a comment (No. 57.a) that it was not clear. Upon review of moving the revised sentence to Appendix I, Section 3, it was decided that type of information does not align with the content of that Appendix. Therefore, the text remains in Section 6.3.*
58. Section 6.3, last paragraph: Comment that the following two sentences are redundant with a previous sentence (located two sentences above), and recommends replacing that one with these two, which communicate the though more distinctively. “[Appendix I – Section 3](#) contains the SaMS logo use guidelines that are intended to promote brand consistency and awareness. These guidelines may be amended as the SaMS initiative progresses and further insights are gained.”
- a. *Response: As recommended, the following sentence has been deleted: “The guidelines in [Appendix I – Section 3](#) are a starting point for the process, but these may be revised by the voting members of SaMS*

or the reviewing body depending on future decisions.” Due to the other revisions made in the paragraph, we decided that those two sentences identified in the above comment should remain in their current location.

Chapter 7: Water Quality Monitoring

59. Last paragraph: Comment that the text needs to be clear on who is monitoring what. Comment is in response to the following sentence: “The monitoring and research recommendations discussed in this section were developed for public, private, and volunteer audiences ([Section 3.1](#)).”
- a. *Response: The details of what is monitored are covered in the relevant recommendations, but there are not recommendations for specific groups to monitor “x” and other groups to monitor “y.” There are, however, recommended monitoring groups for the pilot program, so the following sentence has been added to provide clarity, “Although the discussion of the pilot monitoring approach (Section 7.3) identifies recommended monitoring groups and their roles in the effort, the rest of the recommendations are intended to be used by all of these audiences.”*
60. Section 7.3, last paragraph: Comments on the cost estimate of \$20,000-\$100,000 for a 5-year project. Questions the lower number, as it seems unrealistic that two small watershed sites could be monitored for \$4,000 per year, given the initial equipment costs would consume that amount. Question if the monitoring being funded is limited to specific conductance monitoring. Comment that it is important to provide accurate estimates of the likely costs in order to avoid undermining our credibility, which could then result in questions about our other recommendations.
- a. *Response: The material/analytical cost estimates were drawn from the costs summary shared at the last Water Quality Monitoring and Workgroup meeting, which were based on estimates for analytical costs and equipment only. The equipment costs included a hobo conductivity probe with associated software and hardware, a six pack of 1 L sample bottles, a 100 pack of filters, and a digital thermometer. The analytical costs for the full ion suite included 12 monthly samples and an assumed 5 winter events. The large range in the costs for a 5 year study comes from the low estimate representing only one site in each of the two watersheds, and the high estimate representing five sites in each of the two watersheds.*

Chapter 8: Inter-Governmental Coordination

61. Comment that some discussion of other potential State and local opportunities for integrating salt management would be appropriate. For example, could salt management practices be considered in DEQ’s VEEP environmental excellence programs? Or inclusion of salt management practices in site plan checklists that are submitted to local governments for review/zoning approvals, as often LEED checklists must be submitted.
- a. *Response: Salt management practices are already included in some applications for the Virginia Environmental Excellence Program (VEEP), and facilities applying to the VEEP should consider including salt management practices in their application. A sentence has been added to Section 11.2 Voluntary SaMS Implementation to address this. It reads, “Lastly, businesses interested in applying for the Virginia Environmental Excellence Program (VEEP) should consider including salt management practices (including planning and application practices found in Section 3 and tracking and reporting practices found in Section 4) in their VEEP facility-based applications. For more information on the VEEP program and the benefits of the program, visit <https://www.deq.virginia.gov/Programs/PollutionPrevention/VirginiaEnvironmentalExcellenceProgram>.*

aspx.” Local government members of the Steering Committee are encouraged to consider whether adding winter maintenance considerations to development proposal/zoning change reviews could help to incentivize voluntary use of winter maintenance BMPs. Depending on the results of DEQ and local government consideration of this recommendation, an additional “Future Recommendations” could be added to the Inter-Governmental Coordination section of Chapter 9 if the Steering Committee is supportive.

- i. **One commenter questioned if groups have the capacity to ensure commitments are met if development proposals include commitments (outside of established certifications and programs) to implement certain winter maintenance BMPs, because that is necessary to ensure those commitments are met. Recommended this be outside of the regulatory process for development. Encouraging property owners in general to implement winter maintenance BMPs through outreach, or encouraging development to participate in established programs like VEEP, can achieve the same objective without placing additional burden on a locality. Another commenter voiced support if local governments are onboard, and also supported adding an additional Future Recommendations.**

A. *Response: Due to the nature of this possible future recommendation and since there were limited responses received, we will touch on this at the Steering Committee meeting to inform final response.*

62. Section 8.3, 1st paragraph: Comment that it would be instructive to the public to elaborate a bit on the connection between slip-and-fall liability of property owners and their motivation to have contractors apply more salt than needed to hopefully prevent such falls. With liability relief and certification programs, the winter management contracts can be set up for the contractors to apply reduced amounts of salt, as long as they are meeting best practice guidelines. This comment is in reference to the sentence “The topic most frequently mentioned was liability reform (slip and fall liability relief). Several SAC members perceived this as potentially the most impactful policy support for SaMS recommendations.”

- a. *Response: Inserted the following: “Under current liability provisions, property owners and winter maintenance professionals may apply more winter salts than necessary to reduce the potential that they will be found liable for damages in the event of an injury suffered by someone who slipped and fell on the property. If operators with a winter maintenance BMP certification, and the property owners who contract with them, had limits to their liability for slip and fall claims, the perceived incentive to over apply salts may be reduced.”*

- i. **Comment provided similar to that provided for No. 49.a about whether liability relief is even possible without new state legislative authority. Recommended revising slightly given the legislative limitations.**

A. *Response: We agree that this is not possible without legislative action. In this discussion of a future recommendation, we hope that the language quoted below should address the concerns expressed by this comment. The applicable text that is in the Toolkit is in the paragraph following the new text quoted in the response above and states, “They [SAC members] recognize that legislative policy often requires long-term efforts to frame proposals, build support, and prepare for formal legislative consideration.”*

Chapter 9: Future Recommendations and Research Needs

63. Question if the need for periodic regional forums to assess the status and progress of carrying out SaMS recommendations be added this to this section? Noted that this is mentioned elsewhere in the text.
- a. *Response: The SaMS Implementation Assessment forum is a current recommendation. It is briefly addressed in the second paragraph of this section, identifying that it is the intended forum for revisiting most of these future recommendations and that it is discussed in more detail in Section 11.*
64. Asked if the pilot water quality monitoring program in 2 small watersheds should be more specifically addressed in this section?
- a. *Response: The bullet discussing this program has been revised to include a “(Section 7.3)” so that readers have a familiar tie back besides the mention of Appendix M.*
65. Comment that use of RWIS (having chemical guides to tell staff of how much is on the roadway but VDOT has eliminated these products) and other resources may available down the road but not in place. Optical sensors that detect how much salt (in real time) would also help down the road. (See Madrid Spain Carlos III University). Prevent too much salt on roadway based on the truck spreading the material.
- a. *Response: We appreciate the interesting perspective on feasibility of this advanced technology. Note, RWIS is a BMP discussed in the BMP Pros and Cons.*

Chapter 10: Funding Sources and Financial Considerations

66. 3rd paragraph: Noted that the link to “program in Baltimore” under the “The Center for Watershed Protection” did not work. An error message was received that read: “Error establishing a database connection”.
- a. *Response: That seems to have been a temporary error as it is working again.*

Chapter 11: Implementation

67. Comment voicing support for use as guidance document only - for "voluntary" use as appropriate.
- a. *Response: Thank you for your comment*
68. 2nd paragraph:
- a. Commenter proposed revising the paragraph: “As has been noted, SaMS is voluntary and largely proactive. Although SaMS originated as an outgrowth of the Accotink Creek Chloride TMDL, it offers the potential that water quality impacts from salts can be avoided or reduced such that future regulatory actions are made unnecessary. Using a regional approach, SaMS seeks to protect healthy waters and restore those with elevated chloride levels to meet water quality standards by encouraging proactive and adaptive implementation of the toolkit. Through the tremendous level of stakeholder contributions and consensus, the opportunities for operational cost savings, the willingness to change behaviors and expectations in the public, and the real and troubling outcomes of no action, the forecast for collaborative, adaptive, and voluntary SaMS implementation is optimistic.”
 - i. *Response: The revision has been accepted.*
 - b. Comment that the following sentence needs to be broken into several shorter thoughts – it is way too long and the construction makes it hard to understand clearly: “Nonetheless, through the tremendous level of stakeholder contributions and consensus, the opportunities for operational cost savings, the

willingness to change behaviors and expectations in the public, and the real and troubling outcomes of no action, the forecast for collaborative, adaptive, and voluntary SaMS implementation is optimistic.”

- i. *Response: Sentence has been revised to read as follows: “Nonetheless, the forecast for a successful voluntary implementation of SaMS is optimistic based on the level of stakeholder contribution and consensus, opportunities for operational costs savings, public support to change winter storm behaviors and expectations and the increasing concern of the negative impacts from “no action.”*

69. Section 11.1:

- a. Role of the MS4 Section is difficult to comprehend. For example, the last sentence of the first paragraph states, "This process of implementation will continue until water quality standards for chloride are not exceeded and maintained". It is unclear what "this process" refers to. Recommend re-working this section, and highlight the connection, if any, of the SaMS toolkit to the MS4 Program.

- i. *Response: The SaMS Toolkit is a resource to help those who desire to improve their winter storm operations. There is no regulatory requirement associated with the toolkit and therefore, it is voluntary. This toolkit may or may not be used as a resource by MS4 Permit holders, it is their choice to do so or not, to help develop their local action plans to address the Accotink Creek chloride TMDLs or for improving winter salt management practices outside of the Accotink Creek watershed.*

MS4 Permit holders subject to the Accotink Creek TMDLs will need to develop local action plans for chloride in accordance with the requirements of their permit. What was meant by the phrase “process of implementation” is that permittees will need to continue to implement their local action plan in an iterative process to address the water quality goals of the chloride TMDL.

The text, “This process of implementation will continue until water quality standards for chloride are not exceeded and maintained” was revised to provide clarity on what is meant by “process of implementation.” The revised text is “Permittees will continue to implement their local action plans in an iterative fashion to address the water quality goals of the chloride TMDL.”

- b. Comments were received to revise the 2nd sentence of “Holders of a Municipal Separate Storm Sewer System (MS4) permit, such as counties, cities and other entities, with regulated areas within the Accotink Creek Chloride TMDL watershed will need to address the requirements of the TMDL in their permit.”

- i. *Response: This sentence was revised to: “Holders of a Municipal Separate Storm Sewer System (MS4) permit (e.g., counties, cities and other quasi-government entities), with regulated areas within the Accotink Creek Chloride TMDL watershed will need to address the requirements of the TMDL in accordance with the requirements of their respective permits.”*

Appendix A: Environmental Impacts and Potential Economic Costs and Benefits of Improved Management Practices

70. Ch. 1, 2nd paragraph: Comment that the value mentioned in the following sentence is for drinking water and need to add “drinking” before “water”: “The United States Environmental Protection Agency (USEPA) established a [secondary maximum contaminant level](#) in water for chloride of 250 mg/L (USEPA 2017b).”

a. *Response: The revision has been made.*

71. Ch. 1, Table 3: Comment on the cost for CMA. Noted that CMA is much lighter than salt and therefore, a ton of CMA is a greater volume of material than a ton of salt. Recommended this be important to note somehow due to the significant cost difference.

a. *Response: While that is an important point, since application rates are set by mass, these costs are informative to that calculation. CMA also requires higher application rates (e.g., lbs/ft²), and the other compounds don't use the same application rates. Therefore a footnote was added to state "Application rates can vary significantly between products and temperature regimes. These costs are provided as an incomplete first glimpse into relative costs."*

72. Ch. 2.1.1.1: Comment that in the Mid-Atlantic, chloride concentrations in relatively unperturbed watersheds are typically less than 5–10 mg/L. It seems worth a statement that in the absence of human activity, most streams northern Virginia would be at the average of 8 mg/L or below. The comment is in reference to the sentence: "Freshwater usually has chloride concentrations less than 300 mg/L (CCME 2011; Freshwater Society 2016; and Stranko et al. 2013). In most parts of North America, surface waters have concentrations of chloride ranging from less than 10 milligrams per liter (mg/L) to approximately 120 mg/L with an average of 8 mg/L (CASE 2015; Environment Canada 2001; Kelting and Laxson 2010; NASEM 2007; and Wenck Associates 2009)."

a. *Response: The following language has been added to the paragraph, "In the Mid-Atlantic, a forested watershed and an agricultural watershed in the Maryland Piedmont with no impervious surface cover had average chloride concentrations of less than 5–8 mg/L (Kaushal et al., 2005; Moore et al., 2017; Bird et al., 2018), and three Coastal Plain watersheds in Virginia and Maryland with low impervious surface cover (<1.25% of watershed area) had average chloride less than 15 mg/L (Moore et al., 2020)." The following language was added to the end of the paragraph, "Based on approximately 30 million high-frequency observations of estimated chloride concentrations across the eastern US, including the Mid-Atlantic, estimated concentrations above the EPA chloride criteria were frequent and pervasive in watersheds with greater than 9–10% impervious surface cover and in the Mid-Atlantic occurred in some watersheds where estimated annual median chloride concentrations were greater than 30 mg/L and all watersheds where estimated annual median chloride was higher than 50 mg/L (Moore et al., 2020)."*

73. Ch.2.1.1.1.1:

a. Comment that because the narrative for Figures 8-10 is not on the same page as the figures, it makes it confusing.

i. *Response: In the revised document, we will try to align the text to be on or adjacent to the page on which the figure is shown.*

b. Comment that its perhaps worth explaining the components of boxplots for a non-scientific audience, e.g., bold line represents the median, the bottom and top of each box represents the 25th and 75th percentiles for the data (50% of the observations fall within the box, 25% of the points lie below the bottom of the box, and 75% of the observations fall above the box). Probably also worth mentioning that these data are from discrete samples and so the peaks often seen in the high-frequency data are likely to be missed.

i. *Response: The following language has been added to the end of the paragraph, "...using boxplots on data collected in discrete water samples. The boxplots summarize each year's data,*

where the bold line represents the median of samples collected that year and the top and bottom of the box represents the 75th and 25th percentile, respectively.”

74. Ch. 2.1.3.2: Comment from Joel Moore: Not sure it's necessary but I have a lot of newer references (2013 to present, including some reviews) if it'd be helpful. My summary of the newer literature would be that the problem is probably worse than we thought. And that the background geology/water chemistry conditions are quite important for understanding the magnitude of the negative effects. Macroinvertebrates at the lower end of the food chain seem to be the hardest hit.
- a. *Response: The commenter provided the following language that was added to the Appendix, “Recent studies give further evidence for the toxic effects of elevated chloride on aquatic species (Brand et al., 2010; Corsi et al., 2010; Findlay & Kelly, 2011; van Meter et al., 2011; Soucek et al., 2011; Searle et al., 2016; Hintz & Relyea, 2019). Complementary studies focused on elevated specific conductance, for which deicing salt use is the primary driver in urban watersheds in regions with frozen precipitation (Moore et al., 2020), report similar results. Natural, or background, stream conditions play a controlling role in the adaptability of organisms to elevated chloride with greater negative effects in macroinvertebrate communities adapted to low specific conductance conditions (Cormier et al., 2013; Clements & Kotalik, 2016; Utz et al., 2016; Cormier et al., 2018; Pond et al., 2017; Bray et al., 2019; Entekin et al., 2019; Fanelli et al., 2019). Benthic macroinvertebrates seem to be generally susceptible to elevated chloride (and specific conductance) with some groups being particularly sensitive, for example, the order Ephemeroptera which includes mayflies (e.g., Clements & Kotalik, 2016; Bray et al., 2019). An experiment examining several stressors on a multi-trophic level community found that deicing salt had the broadest negative effects and caused significant productivity decreases at all trophic levels (Dalinsky et al., 2014). Perhaps particularly concerning is that some recent studies found negative effects of elevated chloride were common at concentrations below the EPA aquatic life criteria. For example, changes in fish communities in the Maryland Piedmont were observed at chloride concentrations of 33–108 mg/L (Morgan et al., 2012). Community changes in benthic macroinvertebrates were observed at 50–90 mg/L chloride (Wallace & Biastoch, 2016). Reduced consumption of detritus by benthic macroinvertebrates in experiments occurred at sodium concentrations of 14 and 140 mg/L with associated chloride concentrations being approximately 28.2 and 282 mg/L (Tyree et al., 2016). Based on results from laboratory experiments where food conditions were adjusted to be representative of a number of freshwater bodies (rather than the abundant food conditions often used in experiments), the lethal concentration for 50% of *Daphnia* (LC50) was lower than the EPA chronic criterion in 7 of 8 experiments with the lowest LC50 being 52 mg/L (Brown & Yan, 2015). Overall water chemistry also plays an important role with negative effects, including lethality, observed at chloride concentrations below the EPA chronic criterion in waters with low hardness (Elphick et al., 2011). Additionally, studies focused on specific conductance found substantial community changes at conductivity levels that are representative of chloride concentrations well below the EPA chronic criterion (e.g., Pond et al., 2017; Cormier et al., 2018); see Moore et al., (2020) for relationships between chloride and conductivity in the Mid-Atlantic.”*
75. Ch. 2.1.3.3.1: Comment from Joel Moore: Here are a few more that are regionally relevant. Might be worth putting up in the main text too.

- a. Green, F.B., East, A.G., Salice, C.J., 2019. Will temperature increases associated with climate change potentiate toxicity of environmentally relevant concentrations of chloride on larval green frogs (*Lithobates clamitans*)? *Science of the Total Environment*. 682: 282-290.
- b. Jones, B., Snodgrass, J.W., Ownby, D.R., 2015. Relative toxicity of NaCl and road deicing salt to developing amphibians. *Copeia*. 103: 72-77.
- c. Gallagher, M.T., Snodgrass, J.W., Brand, A.B., Casey, R.E., Lev, S.M., Van Meter, R.J., 2014. The role of pollutant accumulation in determining the use of stormwater ponds by amphibians. *Wetlands Ecology and Management*. 22: 551-564.
- d. *Response to all of No. 75: The commenter is providing the following language, which was added to the appendix: "Laboratory experiments that compared the toxicity of pure NaCl and deicing salt collected from an operator found that effects were similar between the two for green frogs and Northern Two-Lined salamander embryos, which pointed to loss of osmoregulatory control as the driver of negative effects on the organisms; the estimated LC50 was 2410 mg/L (Jones et al., 2015). The distribution of wood frogs in stormwater ponds in the Maryland Piedmont is strongly predicted by chloride concentration with wood frogs not found in any ponds where chloride concentrations exceeded 260 mg/L, and both field and laboratory results suggest that wood frogs are negatively affected by chloride concentrations less than 230 mg/L (Gallagher et al., 2014). Green frog tadpole larvae exposed to elevated chloride in the laboratory exhibited higher mortality at 22° and 25°C than at 18°C, indicating that warm days in particular winters and overall warming temperatures driven by climate change may contribute to the chloride toxicity problem for amphibians (Green et al., 2019)."*

76. Section 2.2.4, 4th paragraph: In references to the following sentence, provided another reference that is useful: "Pipe corrosion from salts is another major issue for drinking water utilities. As discussed in previous sections, chloride is commonly associated with increased corrosion. Corroded drinking water pipes require costly pipe repairs or replacements. In addition, the process of pipe corrosion can release metals such as lead into the drinking water system (Stets et al. 2017)." The reference is: Pieper, K.J., Tang, M., Jones, C.N., Weiss, S., Greene, A., Mohsin, H., Parks, J., Edwards, M.A., 2018. Impact of Road Salt on Drinking Water Quality and Infrastructure Corrosion in Private Wells. *Environmental Science and Technology*. 52: 14078-14087.

- a. *Response: The sentence will be modified to "...and into the drinking water of homes with contaminated well water," and the citation will be added.*

77. Section 3.1.1:

- a. 3rd bullet: Comment that "projects that have been damaged" in the sentence "Costs of damaged vegetation in buffers, BMPs, riparian restorations, stormwater ponds, etc. projects that have been damaged; costs of addressing influx of more salt-tolerant species; costs to winter service providers (and others) of replacing vegetation killed or damaged by salt spray" is vague and unclear. Recommends it be clarified, otherwise suggested deleting the statement.
 - i. *Response: The phrase has been deleted.*
- b. Last paragraph: Comment on the sentence that cost estimate is in 1992 dollars (or earlier). When correcting for inflation, \$73 dollars in January 1992 had the same buying power as ~\$135 in December 2019. <https://data.bls.gov/cgi-bin/cpicalc.pl?cost1=73&year1=199201&year2=201912>Fay et al. (2015) cite a few efforts to estimate the environmental costs of salts.
 - i. *Response: A sentence was added to this paragraph stating, "It is worth noting that the costs presented in this document have not been adjusted for inflation." No changes were made to values in the report so that they reflect those presented in the citations. There are many*

references to economic costs that vary substantially in their date of origin, and different studies used varied valuation methodologies. Adjusting all cost and benefit dollar estimates to their present value would be a substantial effort that would not significantly improve their usefulness as general references.

78. Section 3.1.2, 1st paragraph: Recommended to correct for inflation. In the following sentence, “Vitaliano (1992) estimated an increase in roadway maintenance of over \$600 per ton of salt applied and the damage to vehicles at \$113 per ton of salt applied.” That would be \$1116 and \$210, respectively.
- a. *Response: See response above.*
79. Appendix A.a., Table 11 and 12. Suggest using subscripts here and throughout for CaCl₂ and MgCl₂
- a. *Response: The suggested revisions have been made to table 11.*

Appendix B: Menu of Operational Best Management Practices: Pros and Cons

80. Section 1.4.1, #14: Recommendation to define “green brine” in this section.
- a. *Response: The sentence was revised to state “Captured salty wash water, sometimes called “Green Brine”, can be reused...”*
81. Section 2: Comment that there seems to be benefit in the suggested methods to pre-treat salt; however, storage building would need to be adequately maintained to ensure covered impervious storage
- a. *Response: We appreciate the perspective this commenter has provided.*
82. Section 2.3.1, #37 Abrasives: Comment that modifying abrasive use and allowing accumulation to melt naturally would require a change in culture and response expectations.
- a. *Response: The recommendation is not to allow accumulation to melt naturally, but instead to avoid, except when deemed necessary, using salt/abrasives blends.*
83. Section 2.4: Comment that at the current application rate being utilized at VDOT, their experience has been there is not a substantial reduction in deicer application. Surrounding localities with a higher application rate has seen more successful results with anti-icing. In order to achieve application rates that yield these above average results would require additional storage capacity and equipment, considering the mileage of roadways the department treats.
- a. *Response: We appreciate the perspective this commenter has provided.*

Appendix H: Awareness Survey Results Summary

84. Winter Behaviors, next paragraph after “Perceived Salt Impact” chart: Comment that noted the bulleted section on the next page after the “Perceived Salt Impact” chart appeared truncated.
- a. *Response: Upon reviewing that part of the document, it appears the layout has been altered such that the bullet falls alongside the chart. This will be addressed in a future revised toolkit.*

Appendix I: Education and Outreach Resources

85. Comment that the public education and participation appendix appears to lack any approved messaging that would be useful for localities when developing winter salt messaging.
- a. *Response: The Education and Outreach Workgroup effort began with the idea of developing a set of materials (handouts, pamphlets, posters) to begin populating an outreach toolkit. However, through subsequent meetings, it was identified that takes a substantial effort to come to common ground on those materials where there are a variety of stakeholders and each have different audiences to*

communicate with. The workgroup, particularly during the pilot outreach campaign, identified the need to be able to speak directly to their audience in the manner their audience is accustomed to. This viewpoint was particularly supported by the communication staff from stakeholder organizations. Therefore, the workgroup decided that it was instead preferential to support “speaking with one voice” by identifying a set of principles messages being developed should follow. Additionally, a logo was developed to further identify messages as stemming from the same effort. As more messages and materials are created, it is encouraged that they help build the outreach toolkit.

86. Section 4: Comment on awareness infographic to revise “\$300-\$700 million” to “\$300 to \$700 million”.
- a. *Response: Thank you for your comment. However, as the revision is more stylistic in nature, we have chosen not to make the suggested revision.*

Appendix Q: SaMS Project Area and Impervious Analysis

87. Section 2, methods diagram: Comment that the diagram would benefit from a description of what is being shown.
- a. *Response: A sentence was added below the diagram to state, “Rooftops were removed from the impervious layer to identify impervious surfaces on the ground, capable of receiving deicing treatments.”*