

Appendix E: Maryland's Chloride Strategy

Chloride Sources and Locations of Impaired Waters

Chloride Sources in Maryland

Chloride is naturally present in most surface waters, but elevated concentrations can harm freshwater organisms. Chloride can enter a watershed from a wide variety of natural and anthropogenic sources. These can include the use of salts as deicing or anti-icing agents on roads, parking lots, and sidewalks; losses from stored winter salt; human and animal wastes; water softeners; fertilizer application; atmospheric deposition; and the dissolution of geologic formations.

The primary source of chloride in Maryland watersheds is winter salt (see biological stressor identification [studies](#)). There are no near-surface naturally occurring salt deposits in Maryland. A water quality analysis of Cabin John Creek (MD; MDE, unpublished), a tributary to the Potomac River with a mostly urban watershed, estimated that more than 93% of chloride loading originates from de-icing and anti-icing operations. Salt can accumulate in groundwater and be released to streams throughout the year. The residence time of road salt in a watershed can be as long as 40-70 years.

Winter salt, primarily composed of sodium chloride, is applied to paved surfaces to prevent snow and ice from sticking to impervious surfaces. Winter salt is typically applied in either its crystalline form, as rock salt, or in its aqueous form, as a salt brine. Runoff from surfaces treated with salt tends to have very high chloride concentrations. This document does not include discussion of other winter materials, such as aircraft deicing chemicals (e.g., propylene glycol) and airport pavement deicing/anti-icing chemicals (e.g., sodium formate and potassium acetate).

Assessment Units

The table below lists all the Maryland waters in Category 5s for chloride in the State's 2024 Integrated Report. All the chloride listings are for freshwater rivers and streams. The source of the chloride is urban runoff/storm sewers transporting residual winter salt from impervious surfaces, and the impaired designated use is aquatic life and wildlife. [Biostressor analyses](#) indicated that chloride is a major stressor affecting biological integrity in these watersheds. An initial chloride threshold value of 50 mg/L was selected to indicate potential biological degradation for the stressor identification used to determine Category 5 listings for chloride. Further chloride data analysis indicated that the source of the chloride is the application of winter salt.

In the combined 2020-2022 IR, a subcategory of 5s (for salt) was created specifically for the chloride impairments because waters assessed in Category 5s are high priorities to be addressed through pollution control requirements and restoration approaches and are a lower priority for TMDL development.

Maryland's 2024 Category 5s listings for chloride, and links to associated BSID reports, can be found in the table below. BSID reports contain detailed characterizations for each watershed.

Table E- 1: Category 5s Chloride Listings

AU_ID	Basin_Name	HUC	Basin_Code	BSID Report
MD-02130805	Loch Raven Reservoir	02060003	02130805	link
MD-02130901	Back River	02060003	02130901	link
MD-02130903	Baltimore Harbor	02060003	02130903	link
MD-02130906	Patapsco River Lower North Branch	02060003	02130906	link
MD-02130701	Bush River	02060003	02130701	link
MD-02130802	Lower Gunpowder Falls	02060003	02130802	link
MD-02130904	Jones Falls	02060003	02130904	link
MD-02130905	Gwynns Falls	02060003	02130905	link
MD-02130907	Liberty Reservoir	02060003	02130907	link
MD-02131001	Magothy River	02060004	02131001	link
MD-02131003	South River	02060004	02131003	link
MD-02131104	Patuxent River upper	02060006	02131104	link
MD-02131105	Little Patuxent River	02060006	02131105	link
MD-02140109	Port Tobacco River	02070011	02140109	link
MD-02140111	Mattawoman Creek	02070011	02140111	link
MD-02140201	Potomac River Upper tidal	02070010	02140201	link
MD-02140202- Wadeable_Streams	Potomac River Montgomery County	02070008	02140202	link
MD-02140203	Piscataway Creek	02070010	02140203	link
MD-02140205	Anacostia River	02070010	02140205	link
MD-02140207	Cabin John Creek	02070008	02140207	link
MD-02140208	Seneca Creek	02070008	02140208	link
MD-02140501- Wadeable_Streams	Potomac River Washington County	02070004	02140501	link
MD-02140504	Conococheague Creek	02070004	02140504	link
MD-02140509	Little Tonoloway Creek	02070004	02140509	link
MD-02141002	Evitts Creek	02070002	02141002	link
MD-02141003	Wills Creek	02070002	02141003	link
MD-02141004	Georges Creek	02070002	02141004	link
MD-05020204	Casselman River	05020006	05020204	link

Chloride Reduction Approach and Strategies***Approach***

The Category 5s waters are a low priority for TMDL developments because there are no structural Best Management Practices (BMP) to remove chloride that do not cause additional negative environmental impacts; therefore, Maryland will implement adaptive management for

reducing salt application. Best practices for reducing salt application take into account delivery, storage, handling, placement on roads, and post-storm cleanup operations. Best practices emphasize the importance of using the least amount of salt as possible to provide safe, passable surfaces. They include applicator training, pre-storm planning, spill prevention and clean-up, post-storm reviews, and evaluating and adopting new technologies.

Implementation through required winter salt reductions in NPDES permits is already underway, and these pollution controls are applied statewide. Reducing salt application will also address human health, drinking water treatment, and other concerns. MDE has developed a [story map](#) that describes salt impacts.

Strategies

Maryland’s salt reduction strategies include:

1. Requirement for Salt Management Plan and implementation in State law for SHA.
2. Requirements for Salt Management Plans and implementation in the State’s MS4 permits.
3. Voluntary applicator training and certification.
4. Public awareness through MDE’s [salt web pages](#) and local government outreach efforts required in their Phase I MS4 permits.
5. Permit requirements for other potential point sources.

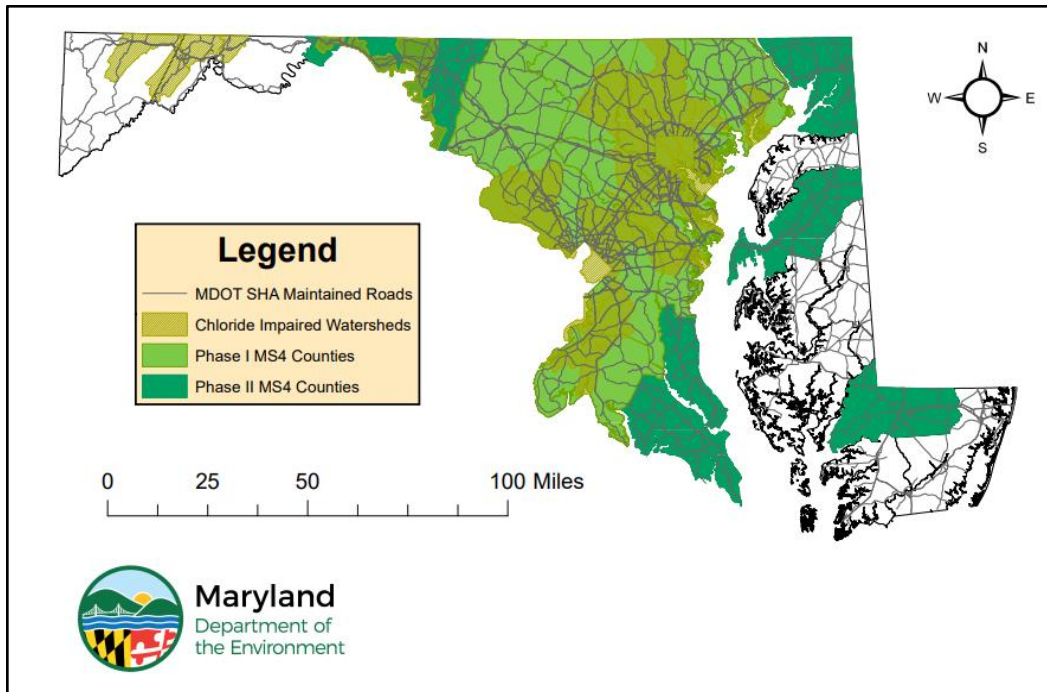


Figure E- 1: Map of Chloride-Impaired Watersheds, SHA-Maintained Roads, and MS4 Counties.

Additional information on Maryland’s salt reduction strategies is provided below. Winter storms vary in number, timing, intensity, duration, and type of precipitation. Through adaptive

management, trend analysis, and responsible plan implementation, long-term goals can be established to lessen the usage of salt and reduce its impact while maintaining safety and mobility.

1. State Highway Administration

In 2010, the Maryland State Legislature passed a law requiring the establishment of a Statewide Salt Management Plan by the Maryland Department of Transportation SHA. SHA's [Salt Management Plan](#) provides a thorough description of technical practices to minimize road salt and salt brine use and a broad system for implementing them. The Plan describes how SHA reduces the cost of materials, along with reducing the environmental impacts of salt overutilization. The Plan also emphasizes the importance of identifying trends in salt application, an element that could potentially link management actions with environmental outcomes. Furthermore, because the Plan is updated on a regular basis, with a mechanism for assimilating new information as it becomes available, it is compatible with an adaptive management approach.

SHA's Salt Management Plan has helped reduce salt application through increased training, tracking and recording usage, and implementing new techniques such as the use of brine-only routes. Implementation of SHA's Plan has already resulted in an approximately 50% reduction in their road salt application.

2. MS4 Jurisdictions

Maryland's MS4 permits cover over 90% of Maryland's impervious surface area. Revised five-year permits (2021) for large Phase I MS4s included Salt Management Plan requirements. Jurisdictions are required to reduce the use of winter weather deicing and anti-icing materials, without compromising public safety, by developing County Salt Management Plans (SMP) to be submitted to MDE in the permit's third year (2024) and implemented thereafter. Plans will include tracking and reporting, training and outreach, and evaluation of new methods and strategies. Each jurisdiction must also annually provide their winter road maintenance operator personnel and contractors with the latest training in deicer and anti-icer management.

Final determinations for Maryland's medium Phase I permits were made in December 2022. These permits contain the same requirements for salt reductions as the large Phase I permits.

Currently, Phase II MS4 permit holders are required to quantify and report pollution prevention efforts related to good housekeeping methods for snow and ice control, such as use of pretreatment, truck calibration and storage, and salt dome storage and containment.

3. Private Applicator Training and Certification

Maryland is developing a statewide voluntary private applicator training and certification program. Private applicators will learn best practices to help improve effectiveness and efficiency and reduce salt application while maintaining safety. A pilot program began in winter 2023. The course curriculum also includes material for people who hire winter salt applicators. By educating salt applicators and those who contract or employ them on ways to apply the

minimum amount of salt required for public safety, the negative impacts to State freshwater systems will be reduced.

4. Public Awareness

MDE maintains a [winter salt website](#) for the public, and MDE's Office of Communications periodically posts excerpts on social media. MDE is also working with the University of Maryland Extension to develop outreach products to be used for homeowners and seasonal winter maintenance workers. In addition, MS4 permits contain a requirement for jurisdictions to develop and distribute information on best salt management practices to their residents.

5. Permit Requirements for Other Potential Point Sources of Chloride

In permitting municipal and industrial facilities, the potential to discharge chloride, as well as instream impairment, are considered in determining requirements for monitoring and/or limits. These source loads are small compared to contributions from winter salt.

Achieving consistent instream chloride reductions will likely take many years. Fortunately, with the increasing recognition worldwide of the negative environmental impact of salt driving a demand for more efficient application techniques, the introduction of new and promising technologies should enable steady, incremental reductions into the foreseeable future.