Chloride Trends of the Delaware River and Pathways Forward

Regulated Flow Advisory Committee (RFAC)
March 20, 2025

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Delaware River Basin Commission
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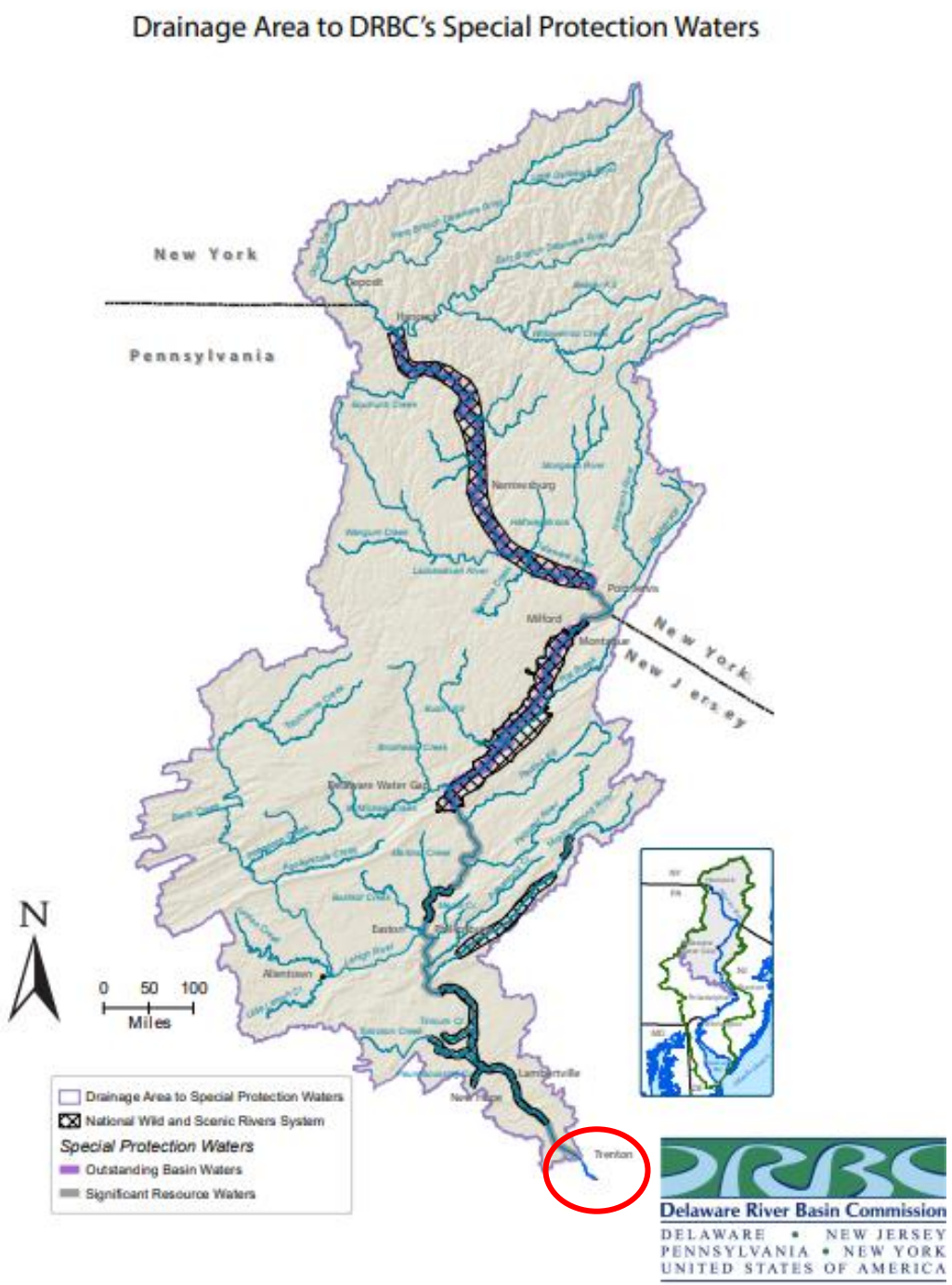
Image: by ©Luboslav Ivanko / Dreamstime

Non-tidal chloride trends

Impacts to public health, infrastructure, and ecosystems

Chlorides in Zones 2 and 3

Options for management



Special Protection Waters (SPW) Program

- Approved by Commissioners and adopted in 1992.
  - Lower Delaware added to the Final Rule in 2008.
- Covers the entire non-tidal Delaware River drainage area.
- Antidegradation program to maintain **exceptional** water quality.

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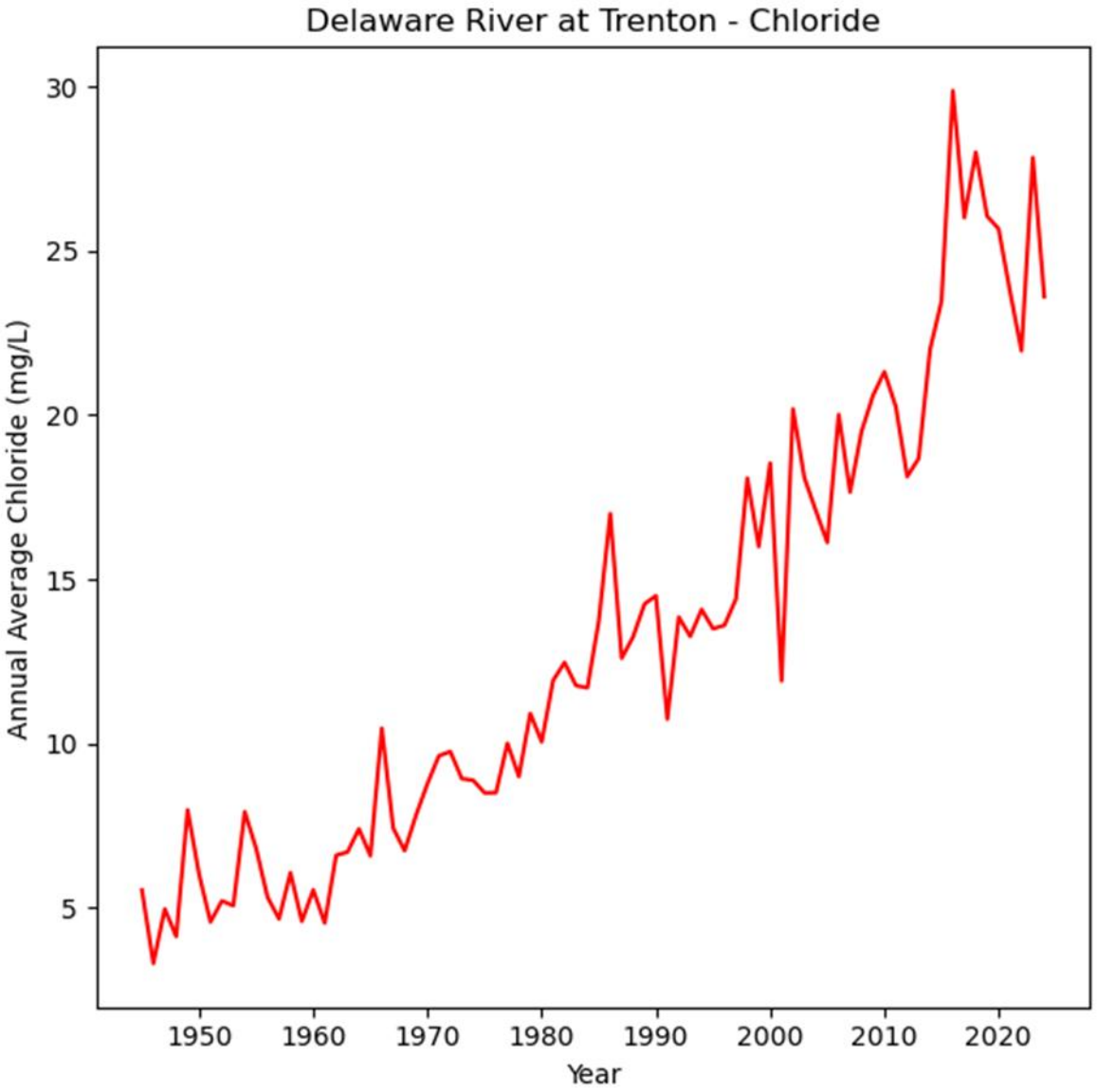
Chloride levels are steadily increasing over time



Data obtained from the Water Quality Portal

- Monitored by many agencies, the Delaware River at Trenton has a long historical record.
- Downstream catchment of the non-tidal (SPW).

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The Basin is located within the “Salt Belt”

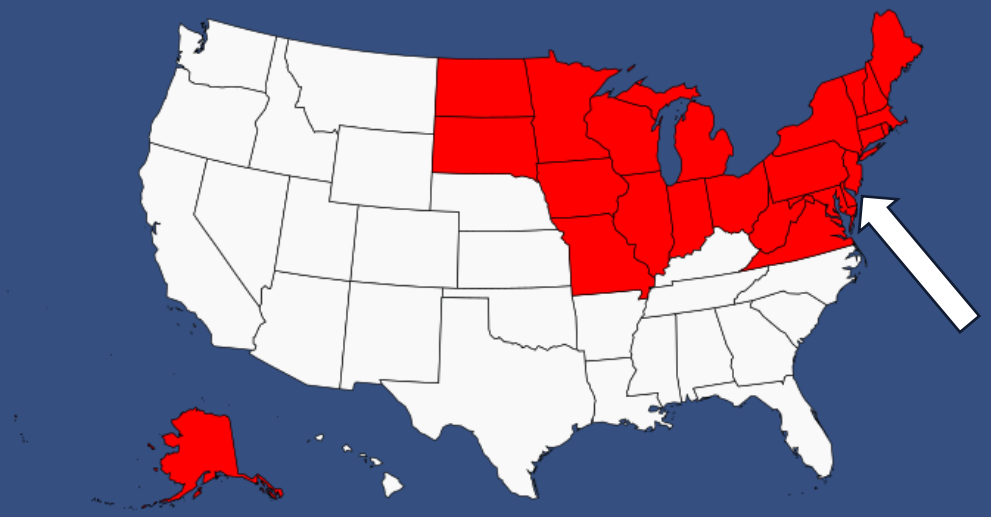

Image: by Randommapmaker, Wikimedia Commons, CC BY-SA 4.0

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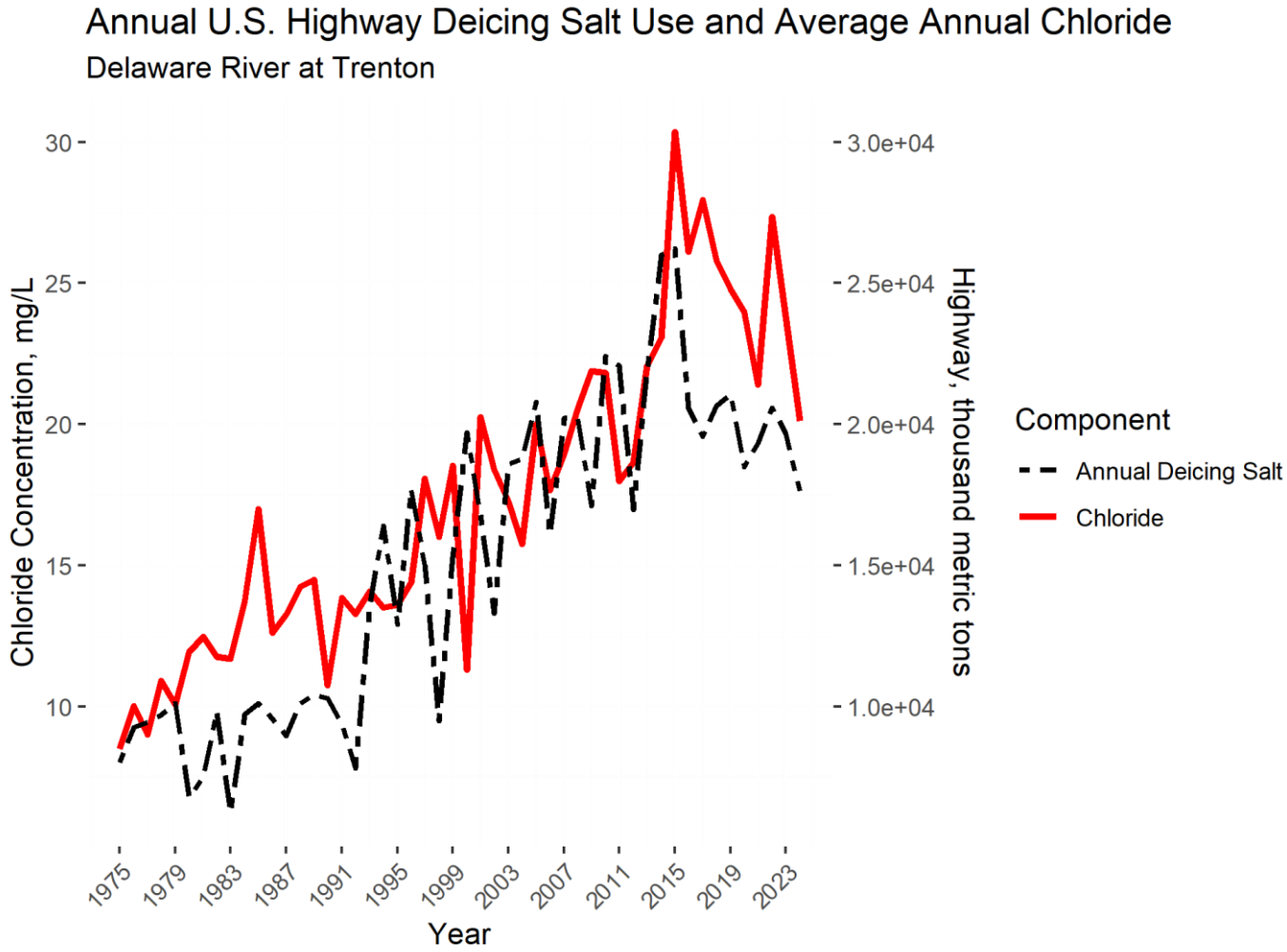

U.S. Highway Deicing Salt Data Source: USGS Mineral Commodity Summaries (1975 – 2024)

Special Protection Waters (SPW) Monitoring

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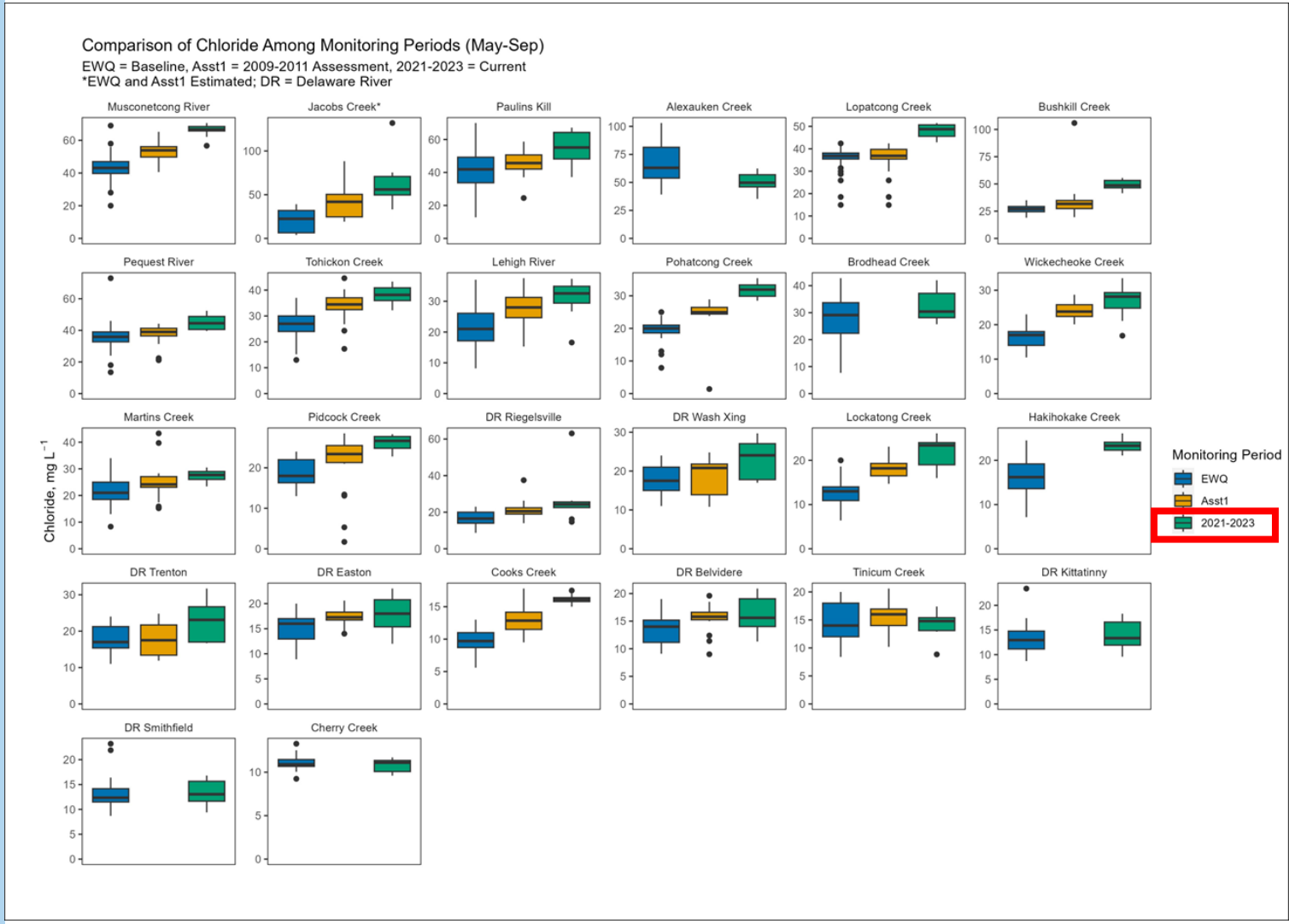
Summary Matrix of Water Quality Changes at Lower Delaware Control Points: 2000-2004 Baseline vs. 2009-2011 Assessment Round 1

Site Color Key: Dark Blue = Interstate Control Point (ICP); Dark Red = Pennsylvania Tributary Boundary Control Point (BCP); Dark Green = New Jersey Tributary Boundary Control Point (BCP)

	Parameter / Site-->	Del. River at Trenton	Del. River at Washngtn Crossing	Pidcock Creek, PA	Delaware River at Lambrtvlle	Wicke-cheoke Creek, NJ	Lockatong Creek, NJ	Delaware River at Bulls Island	Pauna-cussing Creek, PA	Tohickon Creek, PA	Tinicum Creek, PA	Nishi-sakawick Creek, NJ	Del. River at Milford	Cooks Creek, PA	Musco-netcong River, NJ	Del. River at Rieglsvll	Pohat-cong Creek, NJ	Lehigh River, PA	Del. River at Easton	Bushkill Creek, PA	Martins Creek, PA	Pequest River, NJ	Del. River at Belvidere	Paulins Kill River, NJ	Del. River at Portland
	Site Number-->	1343 ICP	1418 ICP	1463 BCP	1487 ICP	1525 BCP	1540 BCP	1554 ICP	1556 BCP	1570 BCP	1616 BCP	1641 BCP	1677 ICP	1737 BCP	1746 BCP	1748 ICP	1774 BCP	1837 BCP	1838 ICP	1841 BCP	1907 BCP	1978 BCP	1978 ICP	2070 BCP	2074 ICP
Field	Dissolved Oxygen (DO) mg/l											~													
	Dissolved Oxygen Saturation %											~													
	pH, units																								
	Water Temperature, degrees C																								
Nutrients	Ammonia Nitrogen as N, Total mg/l																								
	Nitrate + Nitrite as N, Total mg/l																**								
	Nitrogen as N, Total (TN) mg/l																**								
	Nitrogen, Kjeldahl, Total (TKN) mg/l																								
	Orthophosphate as P, Total mg/l																								
	Phosphorus as P, Total (TP) mg/l																								
Bacteria	Enterococcus colonies/100 ml	~			~																				
	Escherichia coli colonies/100 ml	**	**	**	**	**	**			**	**	**													
	Fecal coliform colonies/100 ml																								
Conventionals	Alkalinity as CaCO3, Total mg/l																								
	Hardness as CaCO3, Total mg/l											~													
	Chloride, Total mg/l			**		**	**	**	**	**		**	**	**	**	**	**	**	~	**	**	**	**		**
	Specific Conductance µmho/cm			**		**	**	~	**	**	**	**	**	**	**	~	**	**	~	~	~	**	~		
	Total Dissolved Solids (TDS) mg/l																								
	Total Suspended Solids (TSS) mg/l																								
	Turbidity NTU																								

KEY: (blank) = No indication of measurable change to EWQ; ** = Indication of measurable water quality change toward more degraded status; ~ = Weak indication of measurable water quality change toward more degraded status

Chloride Trends (2000 – 2023)



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Impacts to Ecosystems and Infrastructure

Studies indicate that sensitive freshwater species are affected even at chloride levels below the recommended USEPA criteria (Stroud, 2025).

Corrosive chloride ions cause significant damage to vehicles, roads, and bridges, leading to costly annual repairs (USEPA, 2024).

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Risk to Human Health

Salt contamination in DRB

WARREN COUNTY

A town found the source of its contaminated wells: road salt. What's being done about it?

Updated: Feb. 27, 2019, 1:00 p.m. | Published: Feb. 27, 2019, 7:00 a.m.

ENVIRONMENT

Knowlton and Warren County to fund water filtration for Columbia residents

Bruce A Scruton
New Jersey Herald

Published 9:43 a.m. ET Jan. 27, 2023

Chloride is highly corrosive

MP MATERIALS PERFORMANCE
CORROSION PREVENTION AND CONTROL WORLDWIDE

The Science Behind It: Corrosion Caused Lead-Tainted Water in Flint, Michigan

By *Kathy Riggs Larsen* on 5/4/2020 1:40 PM

Increasing chloride in rivers of the conterminous U.S. and linkages to potential corrosivity and lead action level exceedances in drinking water

E.G. Stets [a,*], C.J. Lee [b], D.A. Lytle [c], M.R. Schock [c]

[a] U.S. Geological Survey, National Research Program, Boulder, CO 80303, USA
[b] U.S. Geological Survey, Kansas Water Science Center, Lawrence, KS 66049, USA
[c] U.S. Environmental Protection Agency, Water Supply and Water Resources Division, Cincinnati, OH 45268, USA

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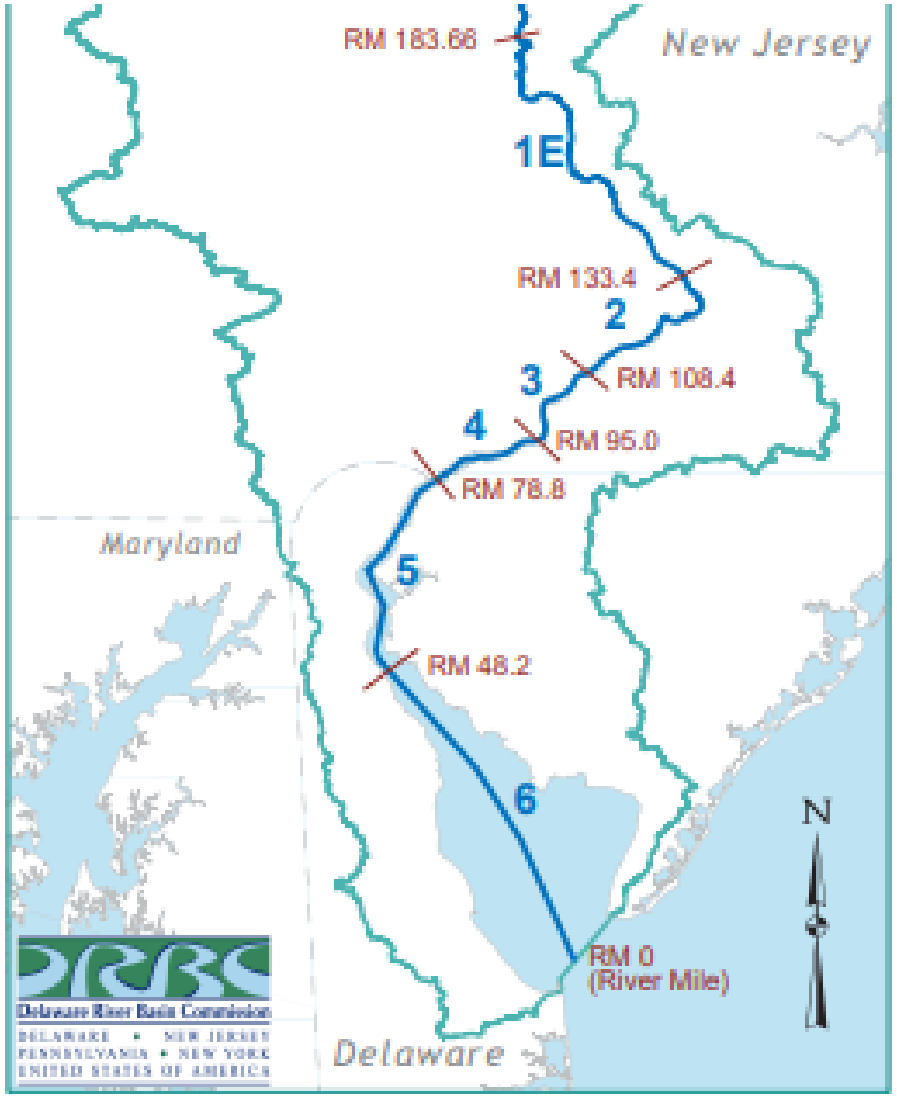
Water Quality Standards in the Estuary

The Zone 3 Chloride Standard was a GFA Recommendation



Zone 2: RM 108 – RM 133 (not GFA)

Trenton to Tacony Palmyra Bridge

Protection of Drinking Water Intakes

Chloride: Maximum 15-dma average of 50 mg/l

Zone 3: RM 95 – RM 108

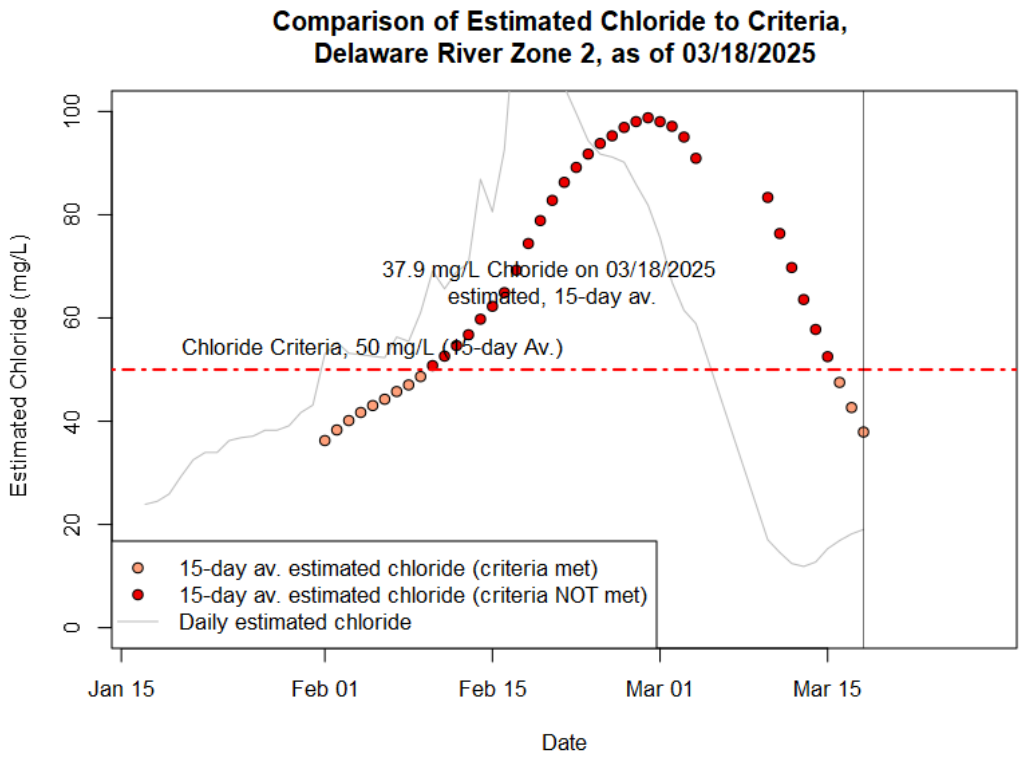
Glouster Point* to Tacony Palmyra Bridge*

Protection of PRM Aquifer (and DW Intakes)

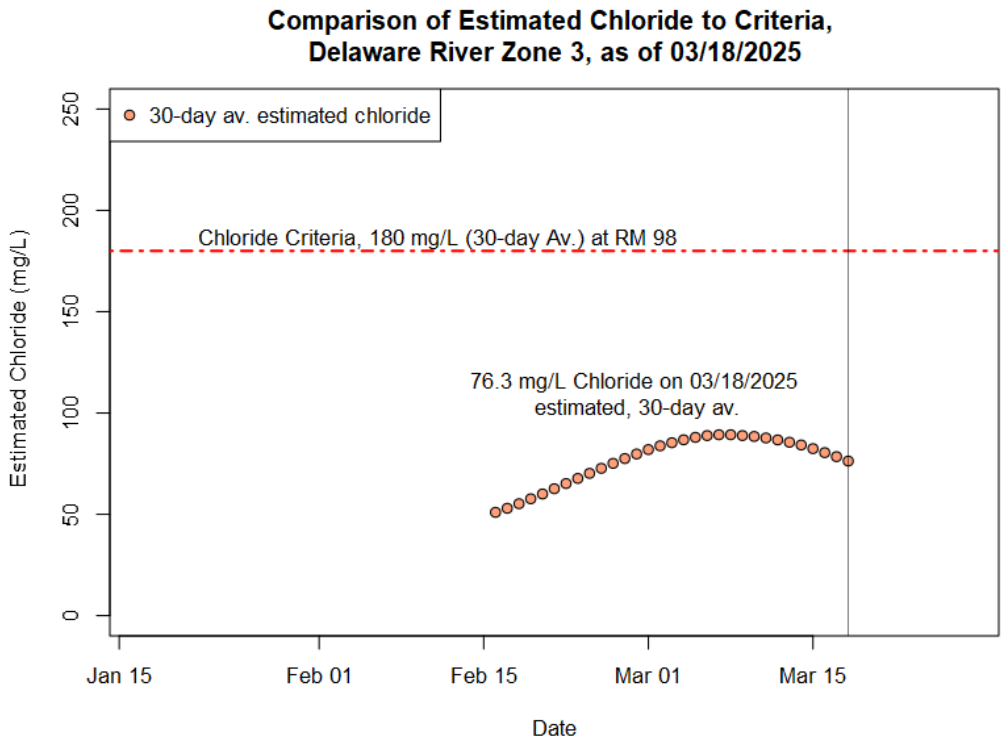
Chloride: maximum 30-dma average of 180 mg/l

Salinity and chlorides in the Estuary

The Zone 2 Chloride Standard violated February through mid-March



Zone 2: Trenton to Tacony Palmyra Bridge*

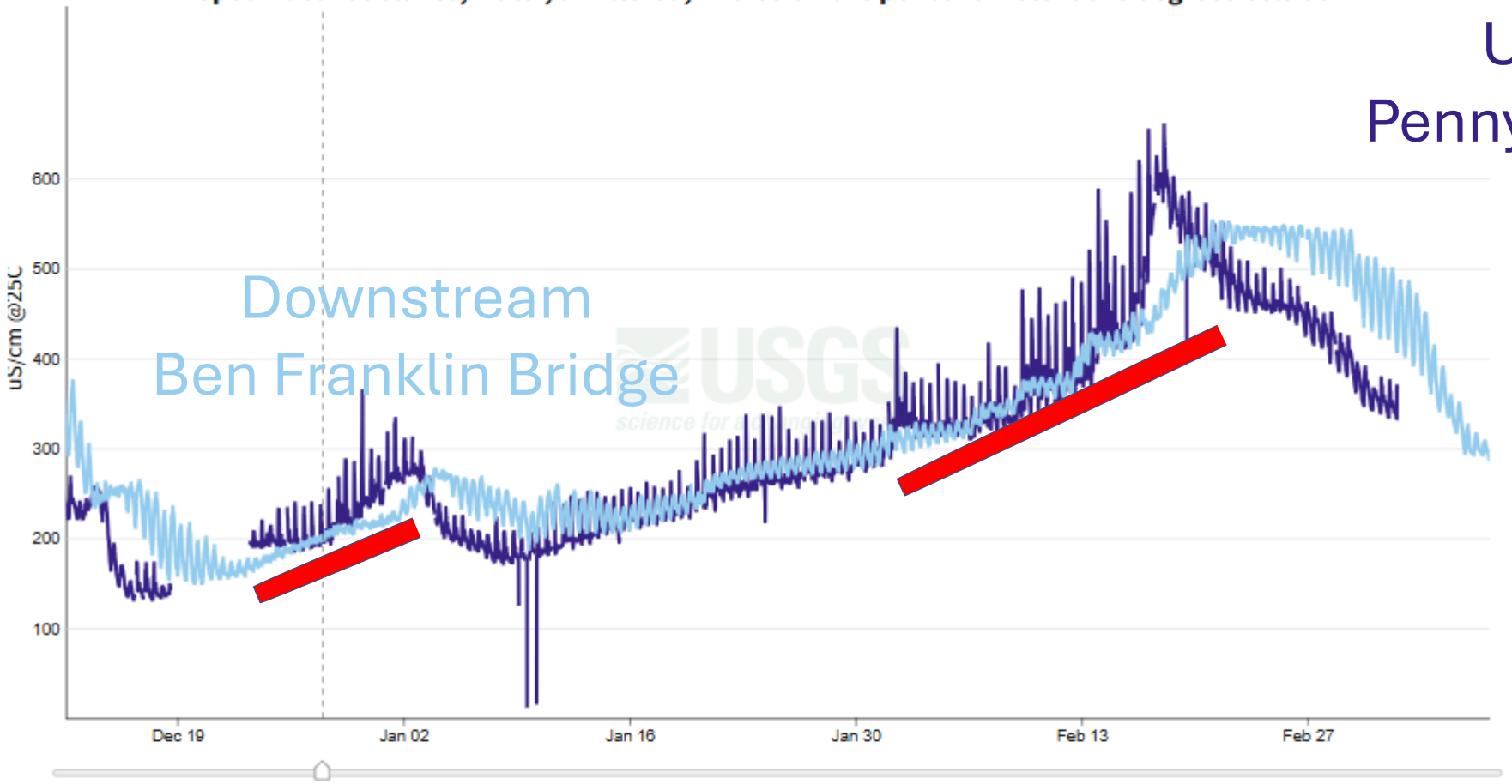


Zone 3: Glouster Point* to Tacony Palmyra Bridge*

*Reference locations are approximate.

- using graph zoom -
November 12, 2024 - March 12, 2025

Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius



IMPORTANT Data may be provisional

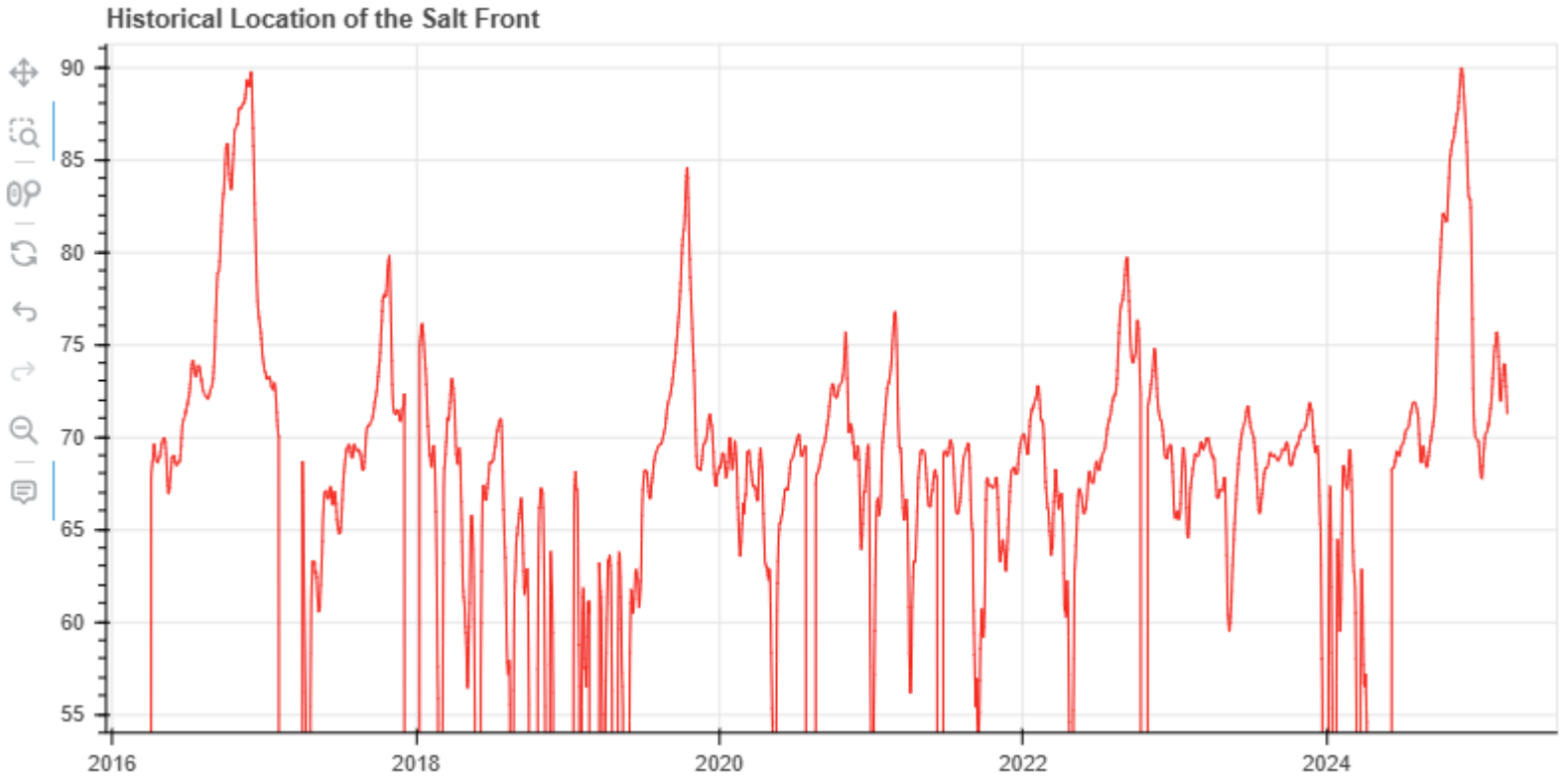
Show legend

Selected values

Location	Value	Status	Time
Delaware River at Pennypack Woods PA - 014670261	199 uS/cm @25C	Provisional	Dec 28 12:00 AM EST
Delaware River at Penn's Landing, Philadelphia, PA - 01467200	202 uS/cm @25C	Provisional	Dec 27 11:55 PM EST

Higher background salinity impacts the SF

The maximum salt front location has occurred in the road de-icing season



Increasing salinity X 2

Salt front may appear to be 1-2 miles upstream

The maximum salt front location occurs during the snow season

In 1965: 11/28; 2016: 11/28; 2024: 11/20

Salinity Impacts Freshwater Toxicity (SIFT) Workgroup

DRBC established a working group to address increasing non-tidal salinity

Lessons learned through collaboration

- DRBC formed a salinity workgroup to discuss management approaches
- All entities are struggling to identify an effective solution
- Outreach and voluntary approaches only go so far
- Finding a solution to address this issue is necessary

Potential Solutions to Manage Chloride

Implement regulatory action (TMDLs)

Pilot study to implement salt reduction measures

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In Summary

- Concerning chloride trends in the non-tidal and tidal freshwater Delaware River
  - Implications for salt front management in the Estuary
- The SPW program states that no measurable change (NMC) shall occur
  - NMC of chloride and conductivity first triggered 2009 – 2011 and remain elevated
- The repeating message from co-regulators and others is that this is **not** a straightforward issue to address
- DRBC staff plan to allocate more resources toward investigating and implementing salt management options

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Questions?

References:

Slide 4. US Geological Survey (USGS). *Mineral Commodity Summaries* [1975 – 2024]. U.S. Dept of the Interior, U.S. Geological Survey. https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries

Slide 6. Stroud Water Research Center. (2025) *Road Salt is Polluting Fresh Water*. Stroud Water Research Center. Accessed March 2, 2025. https://stroudcenter.org/salt/

Slide 6. U.S. Environmental Protection Agency (USEPA), Southeast New England Program (SNEP). (2024). *Winter is Coming! And with it tons of salt on our roads*. USEPA (SNEP). Accessed March 2, 2025. https://www.epa.gov/snep/winter-coming-and-it-tons-salt-our-roads

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