Synthesizing Restoration Research to Inform Chesapeake Bay Decision-Making

Pooled Monitoring Forum

Chesapeake Bay Trust Award #26574

Thursday, June 18, 2026

Thriving Coasts CONSULTING

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SALT·WATER

Chesapeake Bay Trust

Presentation Overview

1. Project Context and Goals
2. Project Approach and What We Heard
3. Science Synthesis and Review Process
4. Product Suite Overview
5. Demo of Products
6. Next Steps

Our Team

Dr. Seth Theuerkauf (Project Lead)

- Marine ecologist bridging science, policy & restoration (18+ yrs)
- Former NOAA and TNC scientist, Federal regulator
- *Leading science synthesis component of project*

Aaron Kornbluth

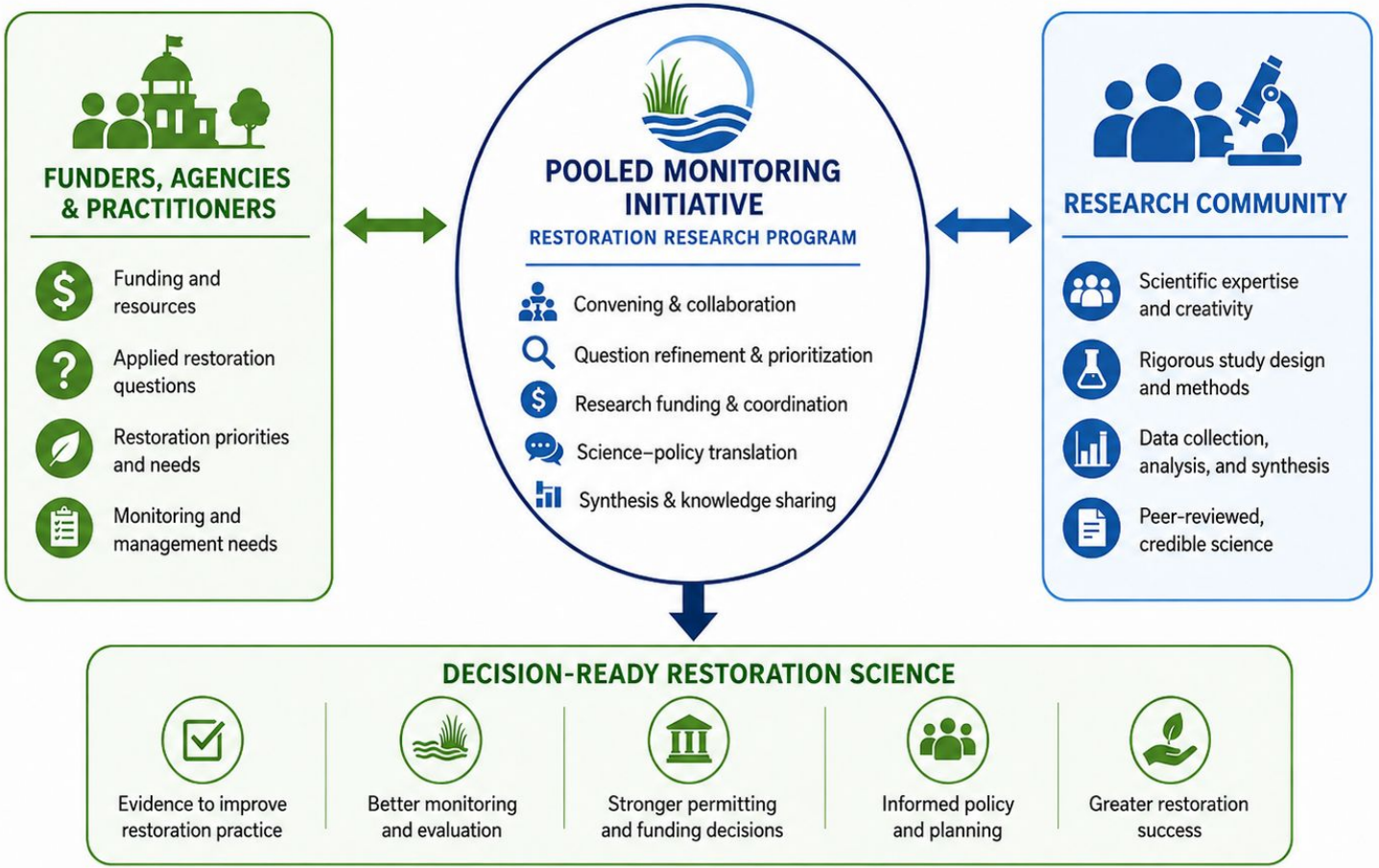
- 20+ yrs advancing marine policy & science communication
- Former Pew Oceans Senior Officer; co-created *SOAR* oyster restoration program
- *Leading communications product and policy connectivity*

Andy Lacatell

- 35+ yrs leading Bay conservation & restoration initiatives
- Former TNC Chesapeake Bay Director; led world's largest oyster reef restoration
- *Supporting stakeholder engagement*

How the Pooled Monitoring Initiative Works

Turning restoration questions and resources into credible science for better decisions



Breadth of Science Supported

- **Stream Restoration -** 18 studies; 1,747 pages
- **Stormwater BMP Efficiency -** 13 studies; 850 pages
- **Pollutants of Emerging Concern (i.e., PCBs, salt, thermal, bacteria) -** 8 studies; 435 pages
- **Monitoring and Data Optimization -** 6 studies; 36 pages
- **Restoration Tradeoffs and Cross-Functional Benefits -** 15 studies; 320 pages

But breadth alone does not guarantee impact…

- Research findings are dispersed across many standalone studies
- Busy decision-makers need clear takeaways, not hundreds of pages of source material
- Results are not always organized around practical decision points
- *Without translation, valuable science can remain underused*

Project Objectives:

Turning Science into Usable Guidance

- **Synthesize** key findings, uncertainties, and practical implications across PMI–RRP studies
- **Translate** technical research into clear, decision-relevant guidance
- **Organize findings** around user needs and real-world restoration decisions
- **Develop accessible products** for practitioners, funders, regulators, and local governments
- **Increase the impact of PMI–RRP science** by supporting use in planning, funding, permitting, monitoring, and communication

PMI-RRP Research → Decision-Ready Science Synthesis Products → Better Use of Science in Restoration Decisions

Project Approach

1. **Needs Assessment – Stakeholder Interviews + Survey**
    a. 15 interviews and 28 survey responses to identify information needs, preferred formats, and decision contexts
2. **Policy Landscape Analysis**
    a. Reviewed the broader Bay restoration landscape to align products with real-world decisions and implementation needs
3. **Science Synthesis**
    a. Synthesized findings across five thematic areas using a reproducible AI-assisted workflow, expert review, and peer review
4. **Product Development**
    a. Developed five (5) synthesis briefing documents, three (3) interactive two-pagers, a social media toolkit, and a learning session package

What We Heard: Users Need Concise, Actionable Products

Key Findings:

a. **Information overload is a major barrier:** stakeholders need short, clear products, not long technical reports
b. **Brevity matters:** 64% of survey respondents preferred 1–2 page fact sheets
c. **Decision relevance is critical:** users want findings connected to restoration planning, funding, permitting, monitoring, and implementation
d. **Success stories and practical examples are needed:** stakeholders want evidence of what works and why
e. **Different audiences need different formats:** practitioners, regulators, funders, and policymakers require different levels of detail

Implication for this project: *Products needed to be concise, credible, audience-specific, and oriented around real-world decisions.*

Science Synthesis and Review Process

Step 1

Organized Studies by Theme

Themes include: stream restoration, stormwater BMP efficiency, pollutants, restoration tradeoffs, and monitoring

Step 2

Extract Key Findings

Used documented, reproducible AI-assisted workflows to extract key findings, uncertainties, and practical implications

Step 3

Technical Review and Verification

Conducted manual technical review to verify accuracy, interpretation, and relevance

Step 4

Draft Science Synthesis

Converted key findings and management implications into concise (4-8 page) science synthesis briefing documents

Step 5

Peer Review + Focus Groups

Each synthesis briefing document was reviewed by 2-3 original researchers, evaluated by ~18 practitioners and decision-makers via focus groups

Step 6

Final Products

Science synthesis briefing documents serve as stand-alone resources, and foundation of additional communication products

Product Suite Overview

Product Type	Primary Use
Science synthesis briefing documents *(PDF, 4-9 pages)* *Stream restoration; stormwater BMP efficiency; pollutants of emerging concern; restoration tradeoffs; monitoring and data optimization*	Technical grounding and decision support
Interactive two-pagers *(web-based)* *Stream restoration; stormwater BMP efficiency; salt management*	Accessible, web-based communication
Social media toolkit *(web-based)*	Outreach and awareness
Learning session package *(web-based)*	State-of-the-science knowledge transfer and facilitated discussion

***Goal:** Make existing science easier to find, easier to understand, and easier to apply.*

Science Synthesis Briefing Documents

Stream Restoration Science: Actionable Lessons from a Decade of Pooled Monitoring Initiative Research in the Chesapeake Bay Watershed

Prepared by: Thriving Coasts Consulting
Lead Author: Dr. Seth Theuerkauf

Background

Stream restoration has become a core tool in watershed management across the Chesapeake Bay region and beyond to combat erosion, nutrient loading, and habitat degradation.

In practice, stream restoration encompasses a range of interventions, including channel reconfiguration, floodplain reconnection, legacy sediment removal, installation of in-stream structures, riparian vegetation management, and construction of regenerative stormwater

How to Use This Synthesis

This synthesis summarizes key findings from research supported through PMI-RRP. It is intended to help practitioners, regulators, funders, local governments, and restoration partners more easily apply regionally relevant science to planning, design, permitting, monitoring, and adaptive management decisions.

The findings presented here are not intended to serve as a comprehensive review of all published literature on this topic. Rather, this document distills the major findings, uncertainties, and management implications from this focused body of Chesapeake Bay watershed research developed to address practical restoration and stormwater management questions. Where relevant, individual studies referenced in this synthesis may draw upon or synthesize broader scientific literature, but the primary purpose of this document is to translate PMI-RRP-supported research into accessible, decision-relevant guidance.

1. Stream Restoration Effectiveness: What Works, Where, and Why

What PMI-RRP Science Shows

Stream restoration performance—across a range of restoration approaches—is highly context-dependent, producing variable nutrient and sediment reductions across watershed settings and restoration approaches. Multiple independent evaluations show that:

- **Nitrogen reductions are more consistently observed in headwater systems**, with the greatest reductions in annual total nitrogen (TN) loads and per-acre load reductions observed in smaller drainage areas with lower impervious cover, while larger lowland systems exhibit more variable and often weaker or less detectable load responses (Filoso 2020). However, restoring larger channels and longer reaches can increase **absolute** nitrate removal (Hester & Scott 2024), but monitoring studies indicate that smaller headwater streams are often more responsive and can achieve higher **relative** removal efficiency. These findings highlight tradeoffs among project scale, cost, feasibility, and biological disturbance, particularly as larger watersheds require greater restoration extent to achieve comparable treatment effectiveness.

Management Implications

For managers seeking nutrient reductions, available evidence indicates that restoration effectiveness is strongly influenced by watershed context, including stream order, impervious cover, and catchment size. Empirical and modeling studies show differing patterns of effectiveness across the channel network, with some studies indicating greater relative responsiveness in headwater systems, while others suggest larger downstream channels may yield greater cumulative benefits. These findings highlight that restoration outcomes are highly site-specific and dependent on watershed context (Filoso 2020; Hester & Scott 2024).

Interactive Communication Products

Chesapeake Bay Trust

Science-Based Guidance for Salt Management

Lessons from the Pooled Monitoring Initiative's Restoration Research Program on Pollutants of Emerging Concern

November 2025

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Pooled Monitoring Initiative
Science-Based Restoration

About This Resource

How to Use This Page

- **Key Takeaways:** Quick actionable findings for resource managers working on salt management and pollutants of emerging concern
- **Implementation Guidance:** Detailed recommendations organized by topic area
- **Copy Button:** Click to copy any takeaway with full references
- **Share:** Use the share button above to distribute via email or social media
- **Export PDF:** Print or save as PDF for offline reference
- **Terms:** Hover over underlined terms for definitions

About the Pooled Monitoring Initiative

The **Chesapeake Bay Trust's Pooled Monitoring Initiative – Restoration Research Program (PMI-RRP)** was established to address scientific uncertainties around restoration effectiveness by funding targeted, policy-relevant research.

AI Assistant

Feedback

ust.org

KEY TAKEAWAYS FOR RESOURCE MANAGERS

Reduce chloride loads at the source first

References: 2 Copy

All common deicers mobilize contaminant "cocktails," but NaCl is the strongest driver of copper release and strongly mobilizes nutrient release—mobilizing an order of magnitude more Cu and significantly more dissolved nitrogen (TDN) than $CaCl_2$ (though comparable to $MgCl_2$) at equivalent doses. Sodium ions displace ammonium and chloride displaces phosphate on soil exchange sites, promoting organic colloid dispersion and releasing nutrients and metals together. Prioritize cutting NaCl and substituting $CaCl_2$/$MgCl_2$ where safety allows.

Expect late-winter/spring water-quality risk windows

References: 1 Copy

Following winter salt (NaCl) applications, thaw events produce transient increases in effluent loads (e.g., +61% phosphorus and copper, +88% zinc, +66% total suspended solids), indicating short-term reductions in treatment efficiency rather than net export, with annual removals still exceeding ~85%.

Design and maintain for nutrient and salt resilience

References: 5 6 Copy

Internal water-storage (IWS) zones and healthy, diverse vegetation sustain denitrification and nutrient uptake despite elevated salinity. Sites without IWS or with salt-damaged vegetation exhibit higher nutrient export. Routine maintenance—spring sediment cleanouts and replacement of salt-injured plants—helps maintain nutrient removal efficiency.

POLICY & IMPLEMENTATION GUIDANCE FOR WINTER SALTING

1. Set clear chloride-reduction strategies

Adopt "safety first, salt last"

References: 3 Copy

Prioritize mechanical removal of snow, pre-wetting, and brine application over dry granular salt. Brines deliver less chloride per unit area, reducing nutrient mobilization from over-salting.

Preferentially trim NaCl

References: 2 Copy

Na^+ exchanges with NH_4^+, Ca^{2+}, and Mg^{2+}, releasing N and P along with metals. Where temperature allows, consider $CaCl_2$/$MgCl_2$ or blended products, while tracking their dosages and secondary chemistry.

4. Monitor during events — then adapt

Deploy high-frequency SC and NO_3^- sensors, monitor nutrients

References: 4 1 3 Copy

Monitoring NO_3^- alongside SC provides early warnings of road-salt influence and nutrient surges. TDN and PO_4^{3-} can be monitored via laboratory measurements of stream grab samples.

Use SC plateaus as operational checkpoints

References: 3 Copy

Use SC plateaus (~1,000–2,000 µS cm^{-1}) as operational checkpoints for salt load reduction mid-season.

Checkpoint Range: 1,000-2,000 µS/cm

AI Assistant

Next Steps

- **Syntheses and communication products available now on the PMI-RRP website!**
- Entering Phase II of this project, which centers on roll-out and supporting community uptake of the products.
- Future directions: (a) cross-walking syntheses with regulatory guidance, (b) expand scope of syntheses to include broader literature base, (c) develop additional communication products (e.g., shortform videos), and more!
- **Visit our table at the Forum - let's connect!**

seth@thrivingcoasts.com

Funding & Acknowledgements

Thank you for your attention!

Visit our table at the Forum - let's connect!

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The Pooled Monitoring Initiative funds applied science to advance restoration research for cumulative impacts, comparative effectiveness of stormwater practices, pollutants of emerging concern, and trade-offs with new research questions added annually.

https://cbtrust.org/grants/restoration-research/

Bridging Science and Policy Translation Slides

What are the take home points?
What does this mean for me?

Translation Slides by Erik Michelsen, Anne Arundel County Department of Public Works

What does this mean for me?

- The Trust has engaged experts in the field of science communication to provide digests of over a decade of information collected through the Pooled Monitoring Program to make it more accessible.

- Work products are focused on delivering brief, actionable findings, that can be incorporated into practice.

What does this mean for me?

What do I take from this as a practitioner?

- The syntheses on stream restoration, stormwater BMP efficiencies, and pollutants of emerging concern all offer insights into how to design and construct more effective restoration practices, and/or how to tailor them to achieve specific outcomes.

What do I take from this as a regulator?

- All work in regulated natural resources involves trade offs of one sort or another. These syntheses help bring to light both the potential benefits and drawbacks of restoration, depending on implementation characteristics such as location, approach, and practice.

What does this mean for me?

What do I take from this as a researcher?

- These syntheses provide a rich foundation of exploratory research ideas that could form the basis of future scientific work which more directly responds to some of the apparent trends or correlations identified in the initial work captured in these reports.