Stormwater Management in Shoreland

Dan Petrik | Shoreland Program Manager

DEPARTMENT OF NATURAL RESOURCES

Purpose of 1989 Shoreland Standards

- Protect/maintain habitat/vegetation, especially riparian vegetation
- Protect Visual character
- Protect water quality

On the whole, the SL Rules emphasize

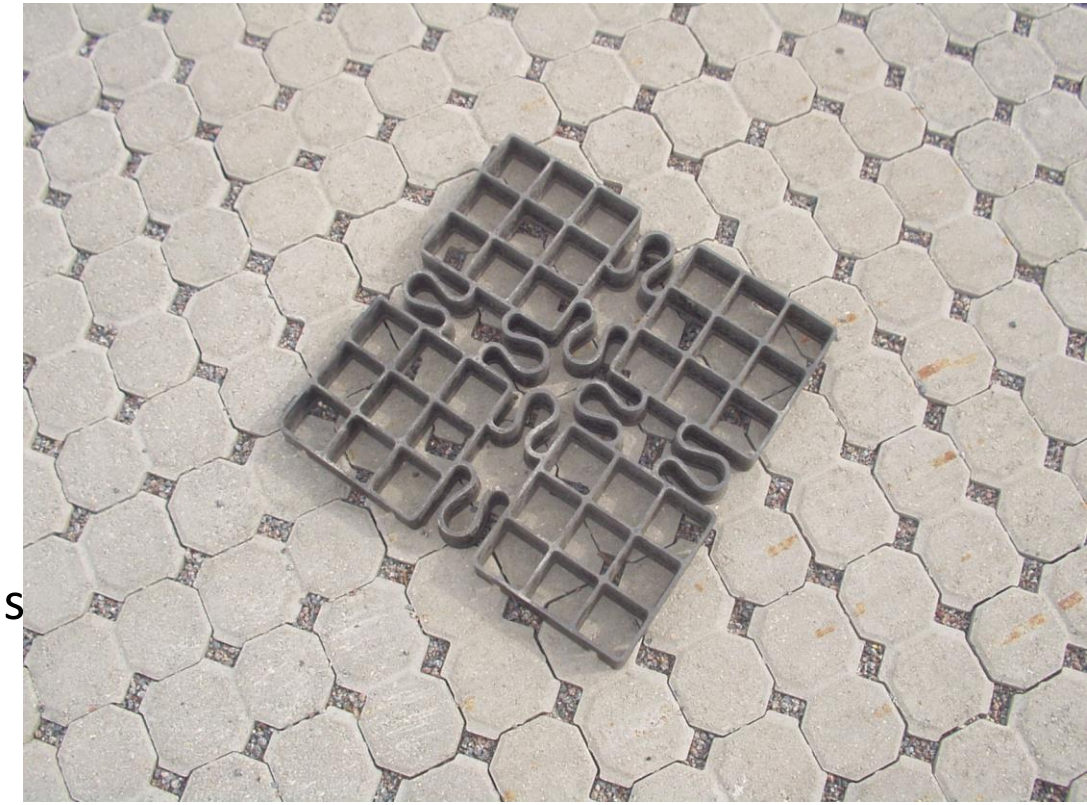
- Natural drainage systems to convey, store, filter, and retain stormwater
  - Existing natural drainage
  - Wetlands
  - Vegetated soil surfaces, especially in the shore impact zone (SIZ)
- Limit impervious surface
  - 25% of lot area
  - 35% for first tiers in a shoreland commercial PUD (resorts, campgrounds)
- Prohibit/discourage impervious surfaces & vegetation clearing in the SIZ/BIZ
  - With limited exceptions – water access, WOAS

In order to…….

- Minimize runoff and associated pollutants
- Allow vegetation as the primary stormwater BMP
- Maintain vegetation for habitat and shoreline character

The “impervious” challenge!!!

- The term is not defined in the rules
- The term invites engineered solutions
- Permeable pavement didn’t exist in 1989
- Permeable pavement requires maintenance for long term effectiveness
  - Risk they will be replaced/covered with impervious surface
  - Not a good fit for residential applications



The “impervious” challenge!!!

- Whether the surface is impervious or permeable, too much of it undermines the purposes of the shoreland rules:
  - Protect/maintain habitat/vegetation, especially riparian vegetation
  - Protect Visual character
  - Protect water quality

The rain garden challenge

- Often “default” condition of approval
- Effectiveness/functionality to offset shoreland impacts questionable in residential situations
- Easily mowed over and filled in over time

DNR guidance for residential projects

- All hard surfaces should meet the 25% limit
- Any hard surface over this should be processed as a variance
- Mitigating conditions of variance approval should prioritize natural vegetation to minimize nutrient flow into surface waters:
    1. Riparian buffers
    2. Infiltration swales
    3. Berms
- No credit for permeable pavement
- Limit hard surface in SIZ/BIZ

DNR flexibility for commercial situations

- Higher levels of impervious surface may be acceptable for existing non-SIZ/BIZ areas in return for higher standards which could include:
  - Permeable pavement credit system
  - Riparian vegetation restoration
  - Volume reduction

Nature-based bioretention/biofiltration systems and potential phosphorus leaching impacts

Andy Erickson, PhD, PE, Research Manager
St. Anthony Falls Lab, University of Minnesota
Minnesota DNR Division of Ecological & Water Resources
Local Governments Forum
January 17, 2024

Funding Acknowledgement

- This project was supported by the Minnesota Stormwater Research and Technology Transfer Program administered by the University of Minnesota Water Resources Center through an appropriation from the Clean Water Fund established by Minnesota Clean Water Land and Legacy Amendment and from the Minnesota Stormwater Research Council.

- For more information about the Center and the Council, visit https://wrc.umn.edu/msrc

- For more information about the Minnesota Clean Water, Land and Legacy Amendment, visit https://www.legacy.mn.gov/about-funds

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the Water Resources Center or the Minnesota Stormwater Research Council.

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MINNESOTA STORMWATER RESEARCH COUNCIL

CLEAN WATER LAND & LEGACY AMENDMENT

What is Biofiltration???

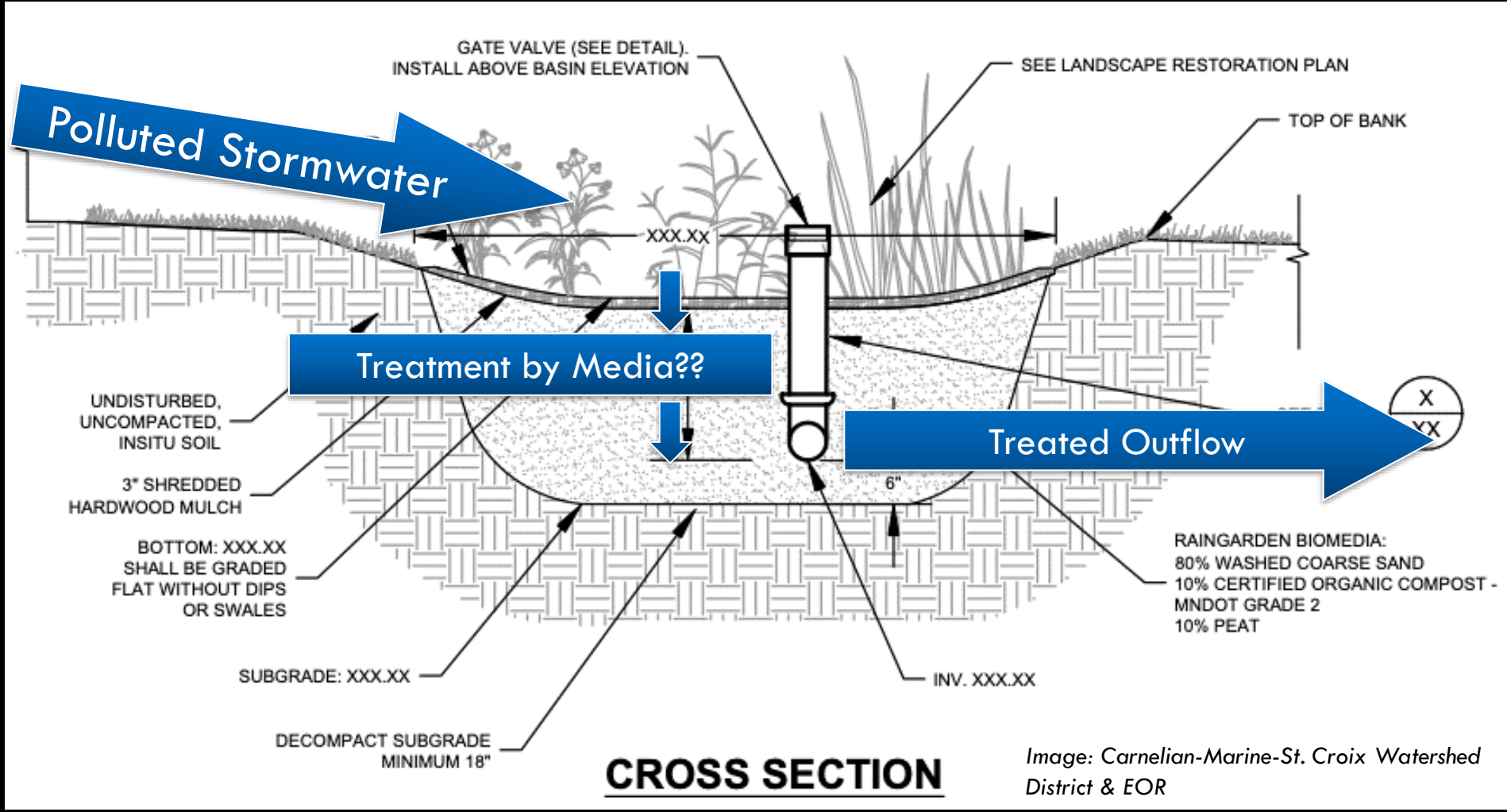


Image: Carnelian-Marine-St. Croix Watershed District & EOR

Base Media:

- ASTM C33 Sand
- Leaf-based Compost

Challenges?

- Phos. Release
- Slow Filtration
- Poor Vegetation

Modifications?

- Peat?
- Iron?
- Others?

Compost Benefits

- Organic Matter Supports:
  - Vegetation Growth
    - Aesthetics, Pollinators, Natives, moisture holding, evapotranspiration
  - Microbial Communities
    - Breakdown of Nitrogen, PAHs, & Carbon-based compounds
  - Metals Capture
  - Re-used Material / Sustainable Supply

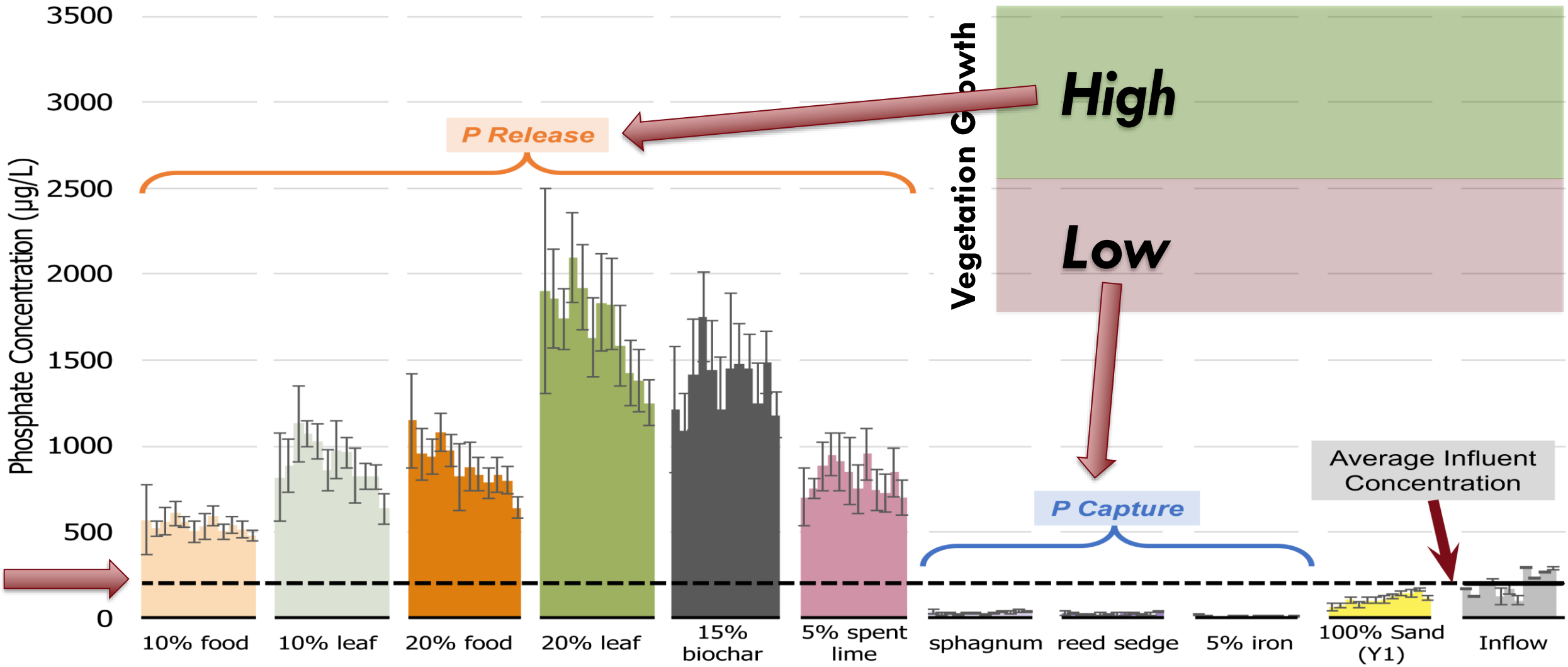
Photo: https://oaklandnursery.com/blog/?p=161

Mesocosm Experiments

14 simulated events in Y1 (2019)
+8 simulated events in Y2 (2020)

- 100% Clean Washed Sand
- 10% food residue compost
- 20% food residue compost
- 10% leaf compost
- 20% leaf compost
- 20% sphagnum peat
- 20% reed sedge peat
- 15% biochar + 20% leaf
- 5% spent lime + 20% leaf
- 5% iron + 20% leaf

Phosphate Capture/Release in Y1 (2019)



Mesocosm Experiments

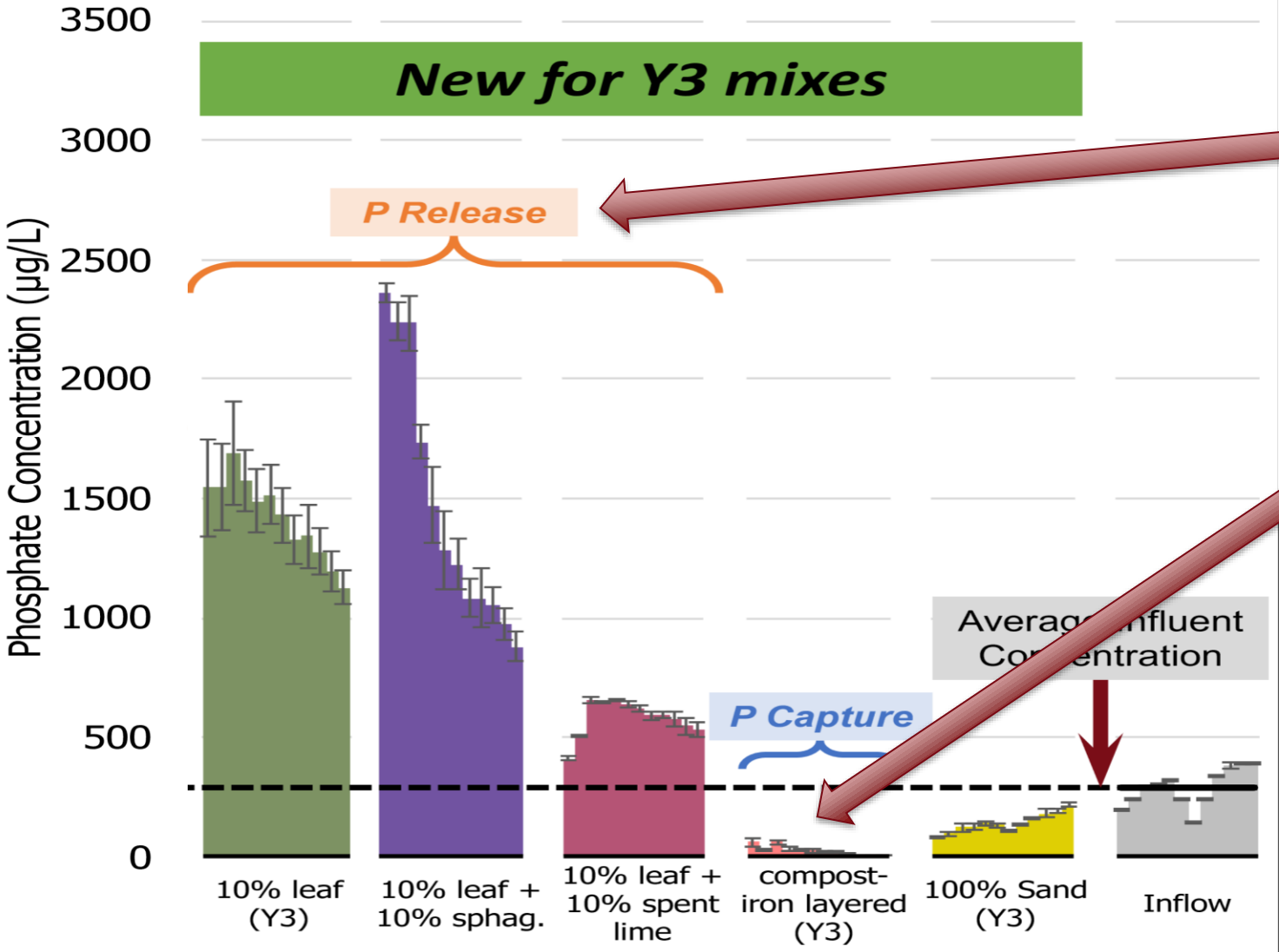
14 simulated events in Y1 (2019)
+8 simulated events in Y2 (2020)
+12 simulated events in Y3 (2021)

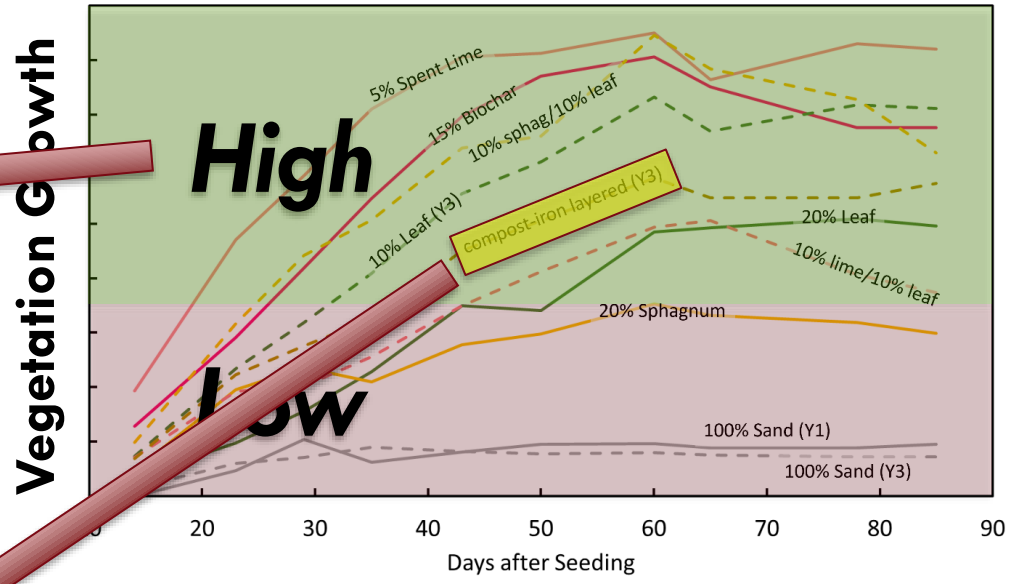
- 100% Clean Washed Sand
- ~~10% food residue compost~~
- ~~20% food residue compost~~
- ~~10% leaf compost~~
- 20% leaf compost
- 20% sphagnum peat
- ~~20% reed sedge peat~~
- 15% biochar + 20% leaf
- 5% spent lime + 20% leaf
- ~~5% iron + 20% leaf~~

New mixes for Y3 (2021) (12 events):

- 100% Clean Washed Sand
- 10% leaf compost
- Layered 10% leaf compost (top half) OVER 5% iron (bottom half)
- 10% spent lime + 10% leaf compost
- 10% sphagnum peat + 10% leaf compost

Phosphate Capture/Release in Y3





Key Takeaway: Compost-iron layered mix appears to grow tall plants while also capturing P

Mesocosm Experiments

14 simulated events in Y1 (2019)
+8 simulated events in Y2 (2020)
+12 simulated events in Y3 (2021)

- 100% Clean Washed Sand
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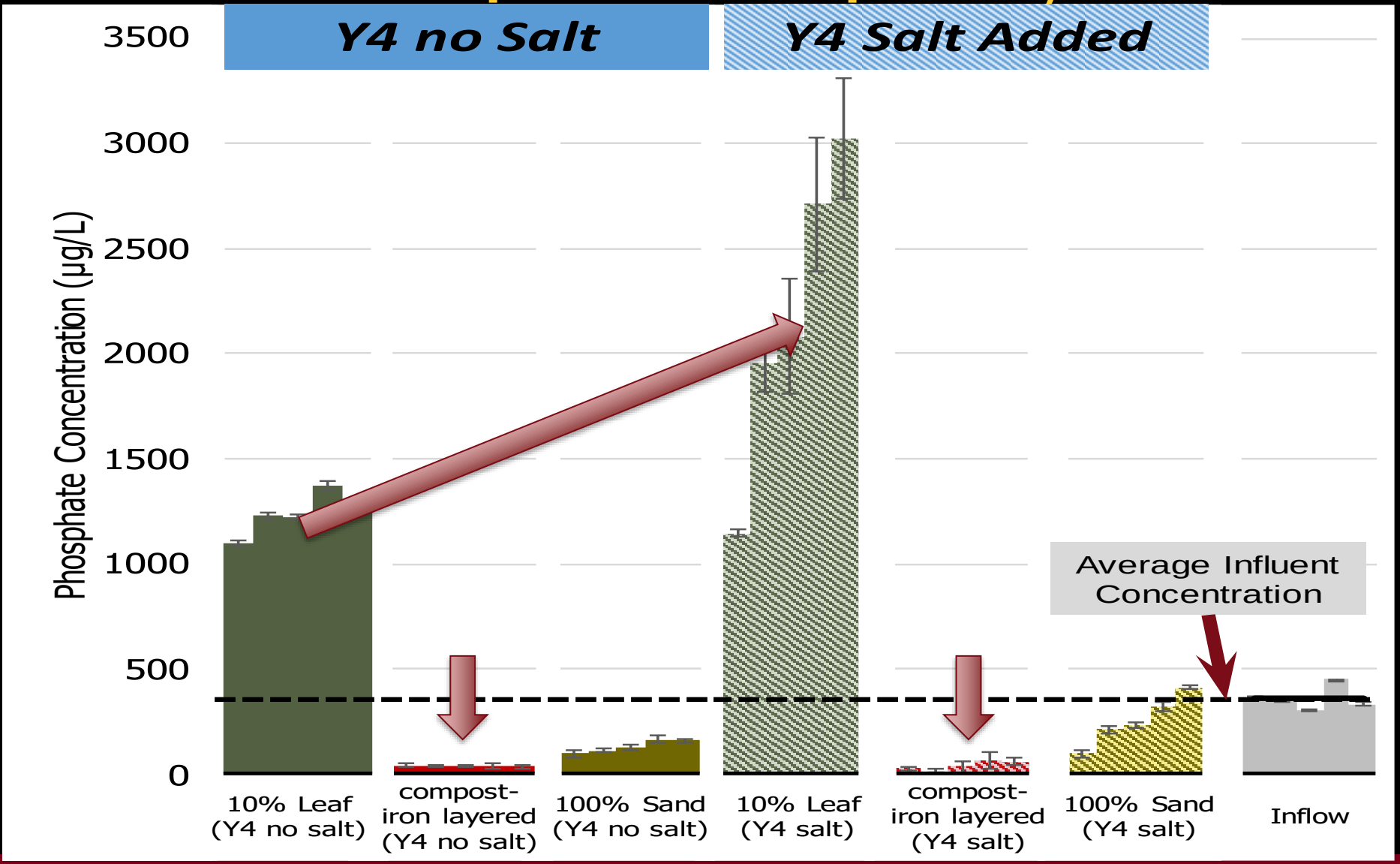
- 10% spent lime + 10% leaf compost
- 10% sphagnum peat + 10% leaf compost

Mixes for Y4 (2022) (5 events):

- No Salt
- Salt

Phosphate Capture/Release in Y4



Key Takeaways:

Road Salt makes it WORSE!

…and iron-bound P is not affected by salt

Where is the Villain?

Image: https://clipartix.com/detective-clipart-image-25522/

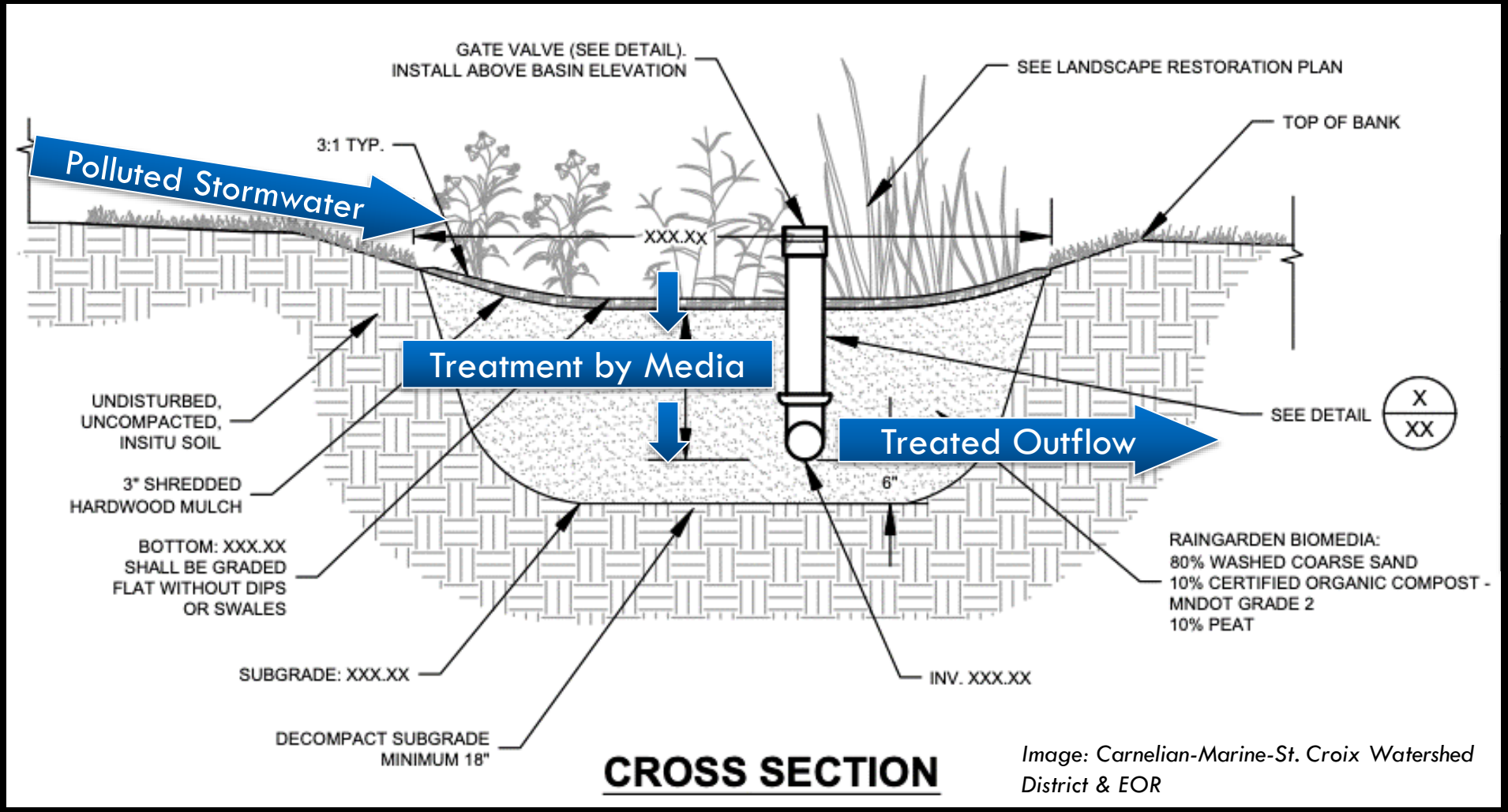
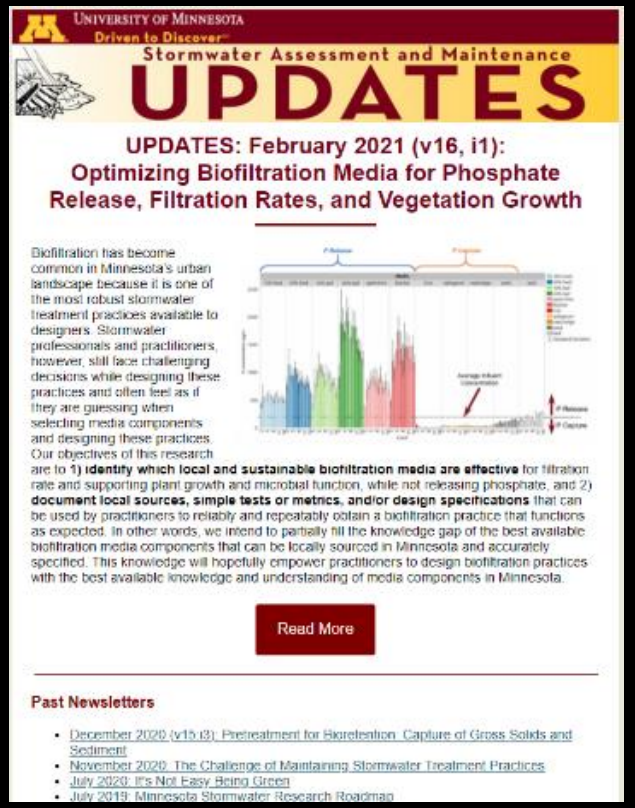


Image: Carnelian-Marine-St. Croix Watershed District & EOR

Cast:

- ~~Stormwater~~
- ~~Impervious Surfaces~~
- ~~Phosphate~~
- ~~Compost~~
- Underdrain

Stormwater UPDATES Newsletter



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Stormwater Assessment and Maintenance

UPDATES

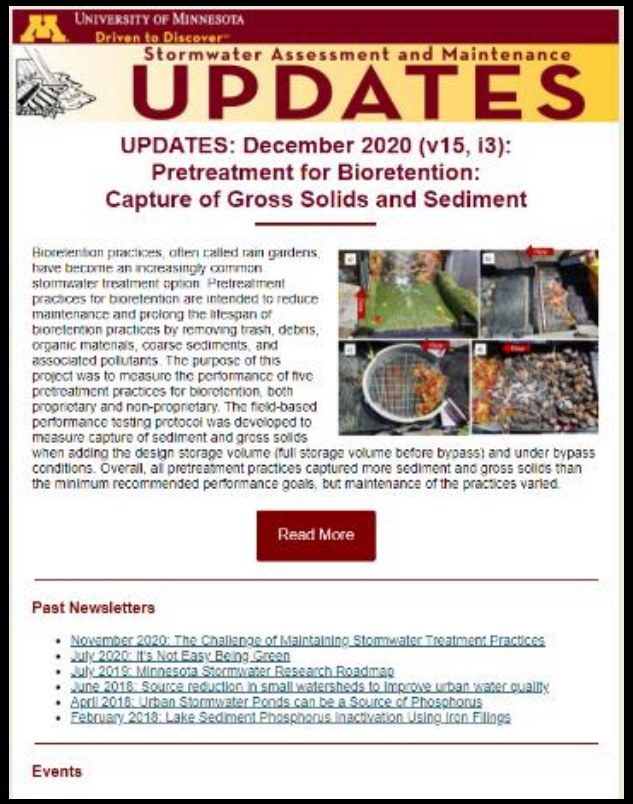
UPDATES: February 2021 (v16, i1):
Optimizing Biofiltration Media for Phosphate Release, Filtration Rates, and Vegetation Growth

Biofiltration has become common in Minnesota's urban landscape because it is one of the most robust stormwater treatment practices available to designers. Stormwater professionals and practitioners, however, still face challenging decisions while designing these practices and often feel as if they are guessing when selecting media components and designing these practices. Our objectives of this research are to **1) identify which local and sustainable biofiltration media are effective** for filtration rate and supporting plant growth and microbial function, while not releasing phosphate, and 2) **document local sources, simple tests or metrics, and/or design specifications** that can be used by practitioners to reliably and repeatably obtain a biofiltration practice that functions as expected. In other words, we intend to partially fill the knowledge gap of the best available biofiltration media components that can be locally sourced in Minnesota and accurately specified. This knowledge will hopefully empower practitioners to design biofiltration practices with the best available knowledge and understanding of media components in Minnesota.

Read More

Past Newsletters

- December 2020 (v15 i3): Pretreatment for Bioretention: Capture of Gross Solids and Sediment
- November 2020: The Challenge of Maintaining Stormwater Treatment Practices
- July 2020: It's Not Easy Being Green
- July 2019: Minnesota Stormwater Research Roadmap



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Stormwater Assessment and Maintenance

UPDATES

UPDATES: December 2020 (v15, i3):
Pretreatment for Bioretention: Capture of Gross Solids and Sediment

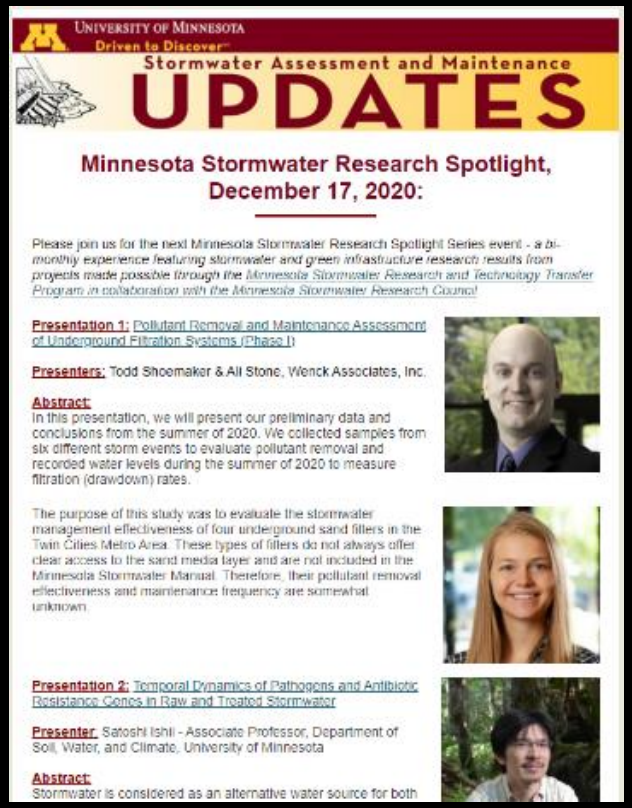
Bioretention practices, often called rain gardens, have become an increasingly common stormwater treatment option. Pretreatment practices for bioretention are intended to reduce maintenance and prolong the lifespan of bioretention practices by removing trash, debris, organic materials, coarse sediments, and associated pollutants. The purpose of this project was to measure the performance of five pretreatment practices for bioretention, both proprietary and non-proprietary. The field-based performance testing protocol was developed to measure capture of sediment and gross solids when adding the design storage volume (full storage volume before bypass) and under bypass conditions. Overall, all pretreatment practices captured more sediment and gross solids than the minimum recommended performance goals, but maintenance of the practices varied.

Read More

Past Newsletters

- November 2020: The Challenge of Maintaining Stormwater Treatment Practices
- July 2020: It's Not Easy Being Green
- July 2019: Minnesota Stormwater Research Roadmap
- June 2018: Source reduction in small watersheds to improve urban water quality
- April 2018: Urban Stormwater Ponds can be a Source of Phosphorus
- February 2018: Lake Sediment Phosphorus Inactivation Using Iron Filings

Events



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Stormwater Assessment and Maintenance

UPDATES

Minnesota Stormwater Research Spotlight, December 17, 2020:

Please join us for the next Minnesota Stormwater Research Spotlight Series event - *a bi-monthly experience featuring stormwater and green infrastructure research results from projects made possible through the Minnesota Stormwater Research and Technology Transfer Program in collaboration with the Minnesota Stormwater Research Council!*

Presentation 1: Pollutant Removal and Maintenance Assessment of Underground Filtration Systems (Phase I)

Presenters: Todd Shoemaker & Ali Stone, Wenck Associates, Inc.

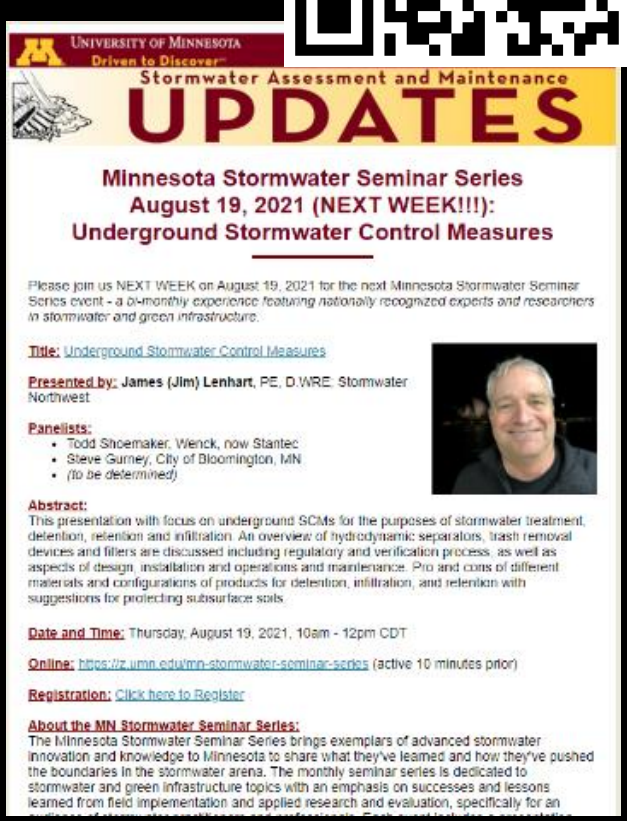
Abstract:
In this presentation, we will present our preliminary data and conclusions from the summer of 2020. We collected samples from six different storm events to evaluate pollutant removal and recorded water levels during the summer of 2020 to measure filtration (drawdown) rates.

The purpose of this study was to evaluate the stormwater management effectiveness of four underground sand filters in the Twin Cities Metro Area. These types of filters do not always offer clear access to the sand media layer and are not included in the Minnesota Stormwater Manual. Therefore, their pollutant removal effectiveness and maintenance frequency are somewhat unknown.

Presentation 2: Temporal Dynamics of Pathogens and Antibiotic Resistance Genes in Raw and Treated Stormwater

Presenter: Satoshi Ishii - Associate Professor, Department of Soil, Water, and Climate, University of Minnesota

Abstract:
Stormwater is considered as an alternative water source for both



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Stormwater Assessment and Maintenance

UPDATES

Minnesota Stormwater Seminar Series
August 19, 2021 (NEXT WEEK!!!):
Underground Stormwater Control Measures

Please join us NEXT WEEK on August 19, 2021 for the next Minnesota Stormwater Seminar Series event - *a bi-monthly experience featuring nationally recognized experts and researchers in stormwater and green infrastructure.*

Title: Underground Stormwater Control Measures

Presented by: James (Jim) Lenhart, PE, D.WRE, Stormwater Northwest

Panelists:
- Todd Shoemaker, Wenck, now Stantec
- Steve Gurney, City of Bloomington, MN
- *(to be determined)*

Abstract:
This presentation with focus on underground SCMs for the purposes of stormwater treatment, detention, retention and infiltration. An overview of hydrodynamic separators, trash removal devices and filters are discussed including regulatory and verification process, as well as aspects of design, installation and operations and maintenance. Pro and cons of different materials and configurations of products for detention, infiltration, and retention with suggestions for protecting subsurface soils.

Date and Time: Thursday, August 19, 2021, 10am - 12pm CDT

Online: https://z.umn.edu/mn-stormwater-seminar-series (active 10 minutes prior)

Registration: Click here to Register

About the MN Stormwater Seminar Series:
The Minnesota Stormwater Seminar Series brings exemplars of advanced stormwater innovation and knowledge to Minnesota to share what they've learned and how they've pushed the boundaries in the stormwater arena. The monthly seminar series is dedicated to stormwater and green infrastructure topics with an emphasis on successes and lessons learned from field implementation and applied research and evaluation, specifically for an

Signup at http://stormwater.safl.umn.edu/

Minnesota Stormwater Seminar Series

YouTube Channel: http://z.umn.edu/swsrecord or
https://www.youtube.com/@MNStormwaterSeminar/videos

Past National Speakers:

Bill Hunt, Bridget Wadzuk, Bill Selbig, Jamie Houle, Marcus Quigley, Elizabeth Fassman-Beck, Scott Struck, Jenn Drake, Jon Hathaway, Allen Davis, Seth Brown, Stephanie Hurley, Jane Clary, Rob Traver, Tom Scheuler & David Wood

Michelle Simon, Nina Bassuk, Ryan Winston, Jim Lenhart, Bob Pitt, Mike Dietz, Harry Zhang, Chingwen Cheng, David McCarthy, Steve Corsi, Ken Schiff, Joel Moore, Bill Hunt, Jamie Houle, Virginia Smith

...and more to come!

Thanks for your attention!

Questions?

Andy Erickson
eric0706@umn.edu

RWMWD Programs to Improve Water Quality and Foster Coordination

DNR Monthly LGU Forum

January 17, 2024

rwmwd.org

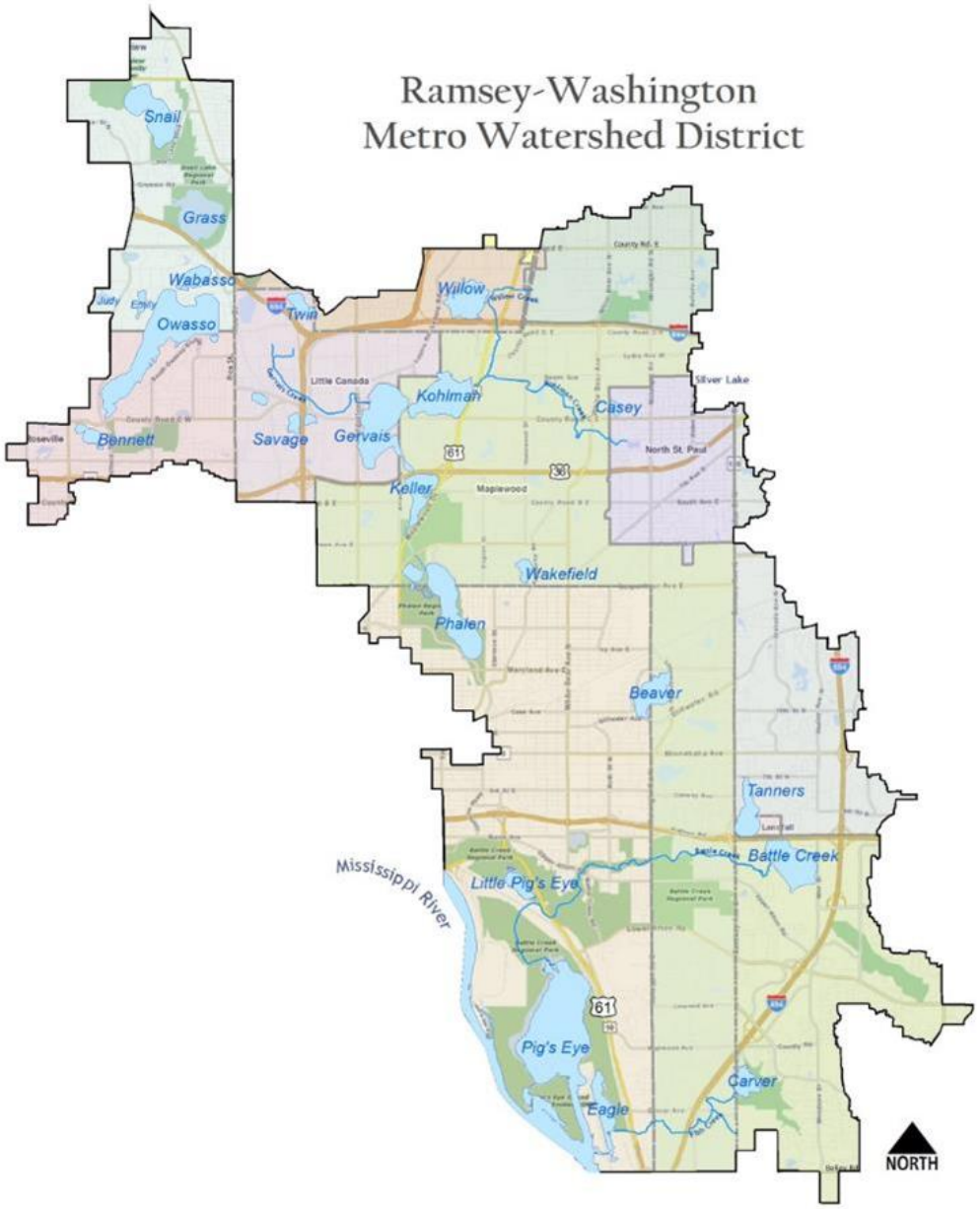
RAMSEY-WASHINGTON
METRO WATERSHED DISTRICT

Overview

About RWMWD

Permitting rules, enhanced requirements
- Closed permit BMP maintenance inspections

RWMWD Stormwater Facility Inspection/Maintenance
- Annual process, collaboration with public partners
- Inspection tool



Includes parts of:

- Ramsey County
- Washington County

Includes all or parts of:

- St. Paul
- Woodbury
- Oakdale
- Landfall
- North St. Paul
- Maplewood
- Little Canada
- White Bear Lake
- Vadnais Heights
- Gem Lake
- Shoreview
- Roseville

- 20 lakes, 5 streams, hundreds of wetlands

Our Work

- Water Quality Monitoring
- Permitting/Enforcement
- Natural Resources
- Watershed Education and Communication/Outreach
- Stewardship Grants
- Capital Improvement Projects (CIP)
- Flood Risk Reduction

Permitting at a Glance

- Watershed statute 103D.341
- Stormwater Management: quantity and quality
  - Discharge rates, pre- and post-project
  - 1.1” volume reduction
  - Maintenance of BMPs post-construction
- Flood Control
  - Reduce flood risk to new and existing structures
  - Regulate floodplain fill: ‘no net fill’
- Wetland Management
  - ‘No net loss’ of wetlands in District
  - Preserve wetland buffers
  - Wetland Conservation Act (WCA) LGU
- Erosion & Sediment Control
  - Prevent offsite impacts during construction
- Illicit Discharge/Connection to MS4

When is a Permit Required?

One of the following conditions are met:

1. Land disturbing activity > 1 acre OR greater than 1,000 sq ft if adjacent to water body
2. Land disturbing activity within the 100-year floodplain
3. Temporary or permanent impacts to wetlands
4. Direct connections or changes to hydrology entering Beltline Interceptor storm sewer

Inspecting After a Permit is Closed

- Maintenance agreements for private sites
- MOUs for public sites
- Inspection database with letter grade system
    - Notify BMP owners of required maintenance
- 2014: started to focus on underground BMP inspection w/ engineering consultant
    - 2023: Over 200 underground permit BMPs (oldest 1995)
- BMP Inspector Intern (2023 field season)
    - 275 above-ground BMP inspections

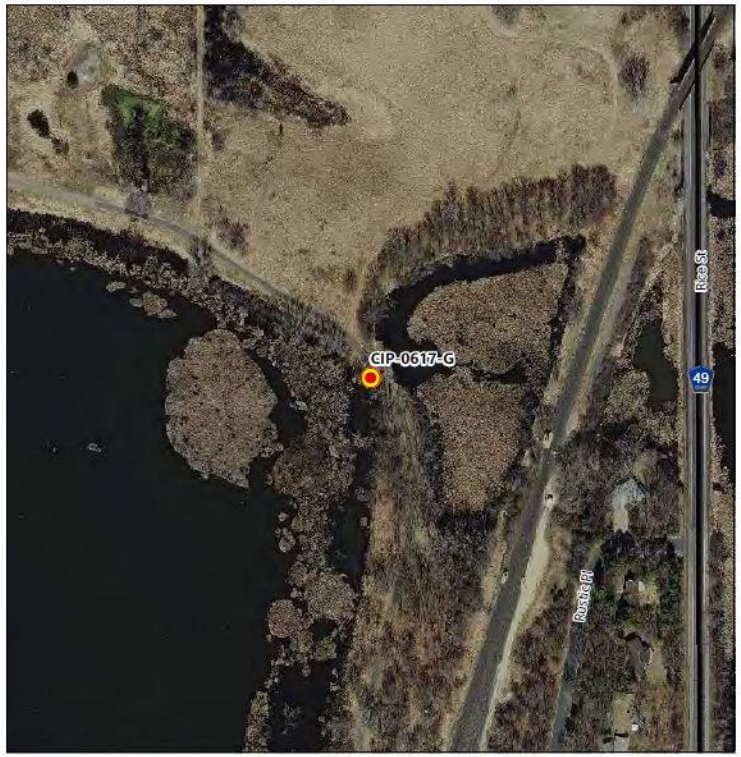
CIP Inspection & Maintenance

- CIP program since 1975
- 2000: combined projects under 1 bid contract (14 sites)
- 2017: engaged member cities (cost-share pond maintenance)
  - District covers all mobilization, design time, bidding process, change orders, pay apps, construction oversight/project admin, majority of permitting
  - Cities/counties reimburse for survey, coring, actual construction costs, erosion control
  - Annual timeline
    - July: notice to PW departments
    - Oct: start to compile and finalize project list
    - Dec: pending board approval, out to bid
    - Jan: bid awarded
    - Jan-Jun: work takes place, substantial completion
    - Final inspections w/ property owners
    - District pays contractor in full, then sends cities/counties invoices for their portion to be reimbursed back to RWMWD

CIP Inspection & Maintenance

2021: developed new Inspection Tool for internal use

- Desktop analysis
- Field inspection
  - Combines Survey123 and ESRI Field Maps
- Select BMP category (ex: grate/drain, pipe/culvert, bioretention basin)
- Assign values for each potential issue or finding
  - Higher score, worse shape
  - Final report w/ findings, photos, and prioritization level
- ~50 District sites (some w/ multiple structures or BMPs)
  - All are inspected annually
  - Takes 3 days w/ experienced crew



Unique ID: CIP-0617-G
Site ID: 617
Section: Grass Lake
Name: Dual arch pipes under Grass Lake trail east of overflow

---

Inspection Date: 8/12/2022 10:36:00 AM
Inspector Name: Vlasin
Category: Pipe/Culvert
Erosion/Sink Holes Over Pipe or at Pipe Ends Ranking Description: 1. No sink hole over pipe
Erosion/Sink Holes Over Pipe or at Pipe Ends Ranking Value: 1
Erosion/Sink Holes Over Pipe or at Pipe Ends Time Frame Value: 1
Erosion/Sink Holes Over Pipe or at Pipe Ends Notes:
Structural Damage Ranking Description: 1. 0-3 cracks, bends, or dings on structure
Structural Damage Ranking Value: 1
Structural Damage Time Frame Value: 1
Structural Damage Notes:
Blockages (debris, objects, plant growth, sediment, etc) Ranking Description: 4. Over 25% of diameter
Blockages (debris, objects, plant growth, sediment, etc) Ranking Value: 4
Blockages (debris, objects, plant growth, sediment, etc) Time Frame Value: 3
Blockages (debris, objects, plant growth, sediment, etc) Notes: NR treated cattails a couple weeks ago ... 3ftx3ft.

Down steam side has delta 15ft x30ft ... estimated 50yards
Riprap and Filter/Geotextile Condition Ranking Description: 1. Good, all riprap and filter in place or if none, score 0
Riprap and Filter/Geotextile Condition Ranking Value: 1
Riprap and Filter/Geotextile Condition Time Frame Value:
Riprap and Filter/Geotextile Condition Notes: No rip rap installed
Internal Joint Condition Ranking Description: 1. No defects
Internal Joint Condition Ranking Value: 1
Internal Joint Condition Time Frame Value: 1
Internal Joint Condition Notes:
Flow Line Condition Ranking Description: 1. No defects
Flow Line Condition Ranking Value: 1
Flow Line Condition Time Frame Value: 1
Flow Line Condition Notes: Looks good

District Owned: Yes
Flag for Further Review: Yes
Inspection Notes:
Total Score: 17
Normalized Score: 2.833333333

Ranking Value (1 - 4): 1 = good condition, 4 = needs attention/repair
Time Frame Value (1 - 4): 1 = no immediate repair needed or repair is not time sensitive, 4 = immediate repair needed

Inspection Indicator
Inspection Location
RWMWD Boundary

0 200 400
Feet
Image Source: Met Council (2020)

PIPES AND CULVERTS INSPECTION SUMMARY - 2022
Ramsey-Washington Metro Watershed District
UNIQUE ID: CIP-0617-G

RAMSEY-WASHINGTON
METRO WATERSHED DISTRICT


CAT

k You

Nicole Maras, Permit Coordinator
651-792-7976
nicole.maras@rwmwd.org
www.rwmwd.org