Stormwater and Transportation Webinars

Introductory Remarks:

Kate Kurgan
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Center for Environmental Excellence by AASHTO

Stormwater and Transportation Webinars

Sponsored by:

- Center for Environmental Excellence by AASHTO

in Cooperation with :

- Federal Highway Administration and
- Federal Transit Administration

Stormwater and Transportation Webinars

- This is the 3rd AASHTO Stormwater Webinar (2011/2012)
- 1st: Construction Effluent Guidelines – Numerical Limits are Coming (April 28th, 2011)
- 2nd: Efficient and Innovative Strategies for Achieving Better Environmental Performance (June 28th, 2011)

PDF of presentations and videos of live webinars available on the Center website:
http://environment.transportation.org/

Stormwater Community of Practice

- Construction Stormwater Management
- Effluent Limitations Guidelines
- TMDLs
- EPA Post-Construction Stormwater Control Rulemaking
- Source Control
- Maintenance and Operation BMPs
- Program Effectiveness Assessment including:
  - Metrics Used to Define Effectiveness
  - Audits: Results and Lessons Learned; Going through EPA or Other Regulator
  - DOT Organization; Interdisciplinary Teams; Best Generic Structure of a DOT

Stormwater Practitioner's Handbook

http://environment.transportation.org/pdf/programs/pg13-1%20lowres.pdf

Today's Seminar

Moderated by:

Eric Strecker, P.E.
Geosyntec Consultants
Portland, Oregon

Seminar Development Support:

Neil Weinstein
Low Impact Development Center
Maryland

Marie Venner
Venner Consulting
Denver, CO

Today's Seminar

Post Construction BMP Selection - Runoff Management to Meet Quantitative Pollution Limits

DOTs are being challenged as never before – audits, consent decrees, budget shortfalls and the unfolding of numerical effluent targets for specific pollutants and volume controls

We will explore:

- Challenges facing DOTs via increasingly more stringent and pollutant specific permit requirements
- The availability and use of several NCHRP and WERF research efforts intended to assist DOTs in the selection and design of BMPs to meet water quality goals for new projects as well as retrofits and
- Actual DOT experiences and methods for meeting permit requirements and managing BMP Assets

Polling Questions

- Please be ready to respond to our poll
- 3 questions:
  - Who do you work for
  - What is your primary work focus?
  - How many people are watching at this connection?

Today's Speakers/Topics

G. SCOTT MCGOWEN, P.E., Chief Environmental Engineer, California Department of Transportation ***Drivers for Post-Construction BMP Selection and Design***
ERIC STRECKER, P.E., Principal, Geosyntec Consultants, Portland Oregon ***BMP Selection and Design Steps and NCHRP Research Manuals***
LE NGUYEN, P.E., Hydraulics Engineer, Washington State Department of Transportation ***Washington State DOTs Approach to Meeting Specific Pollutant Requirements***
MICHAEL BARRETT, Ph.D., Research Associate Professor, University of Texas ***Porous Pavement Overlays and Their Potential for Addressing Highway Pollutants***
PETER MATTEJAT, P.E., NPDES Coordinator, Maryland Transportation Authority ***Asset Management – Keeping Track of BMPs to Ensure Their Effectiveness***

Today's Seminar

- Each Speaker will have approximately 10 to 20 minutes for their presentations
- Presentations will be followed by a question and answer period at the end
- Questions can be submitted via the GoTo Webinar side bar (anytime during Webinar)
- As of today, there are over 220 sites registered for this Webinar

Post Construction BMP Selection - Runoff Management to Meet Quantitative Pollution Limits

Drivers for Post-Construction BMP Selection and Design - Transportation Agencies

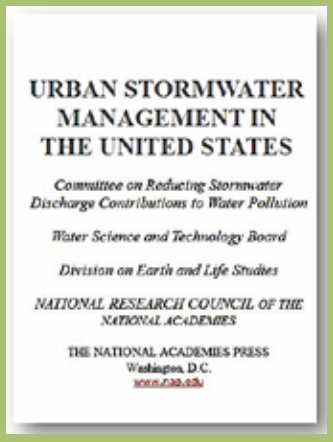
Scott McGowen, P.E.
Chief Environmental Engineer
California Department of Transportation

Regulatory Drivers

- Clean Water Act (CWA)
  - Stormwater National Pollutant Discharge Elimination System (NPDES) Permits- Municipal, Construction, Industrial
  - Total Maximum Daily Loads (TMDL)
  - Wetlands
- Endangered Species Act (ESA)

Emerging Stormwater Issues

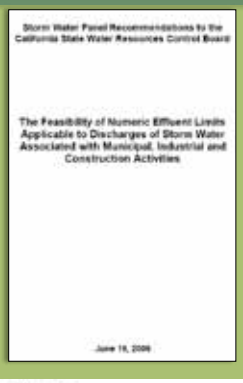
- National Academy of Sciences Report:
  - Recommends emphasis on volume control
  - Recommends watershed based permitting
  - Recommends EPA ban sources at National level – i.e. use of copper in brake pads
- EPA Stormwater rulemaking now underway, but delayed



14

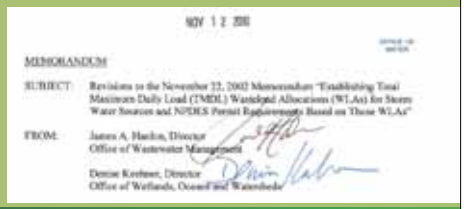
Emerging Stormwater Issues (cont.)

- Endangered Species Act (ESA)
- Numeric Effluent Limits/Benchmarks – Construction, General Industrial, and MS4 NPDES Permits
- "Retain on site" /volume control requirements in permits/TMDLs
- EPA Policy Memo on TMDLs:
  - Utilize Effluent Limits vs. BMP Approach
  - Volume and Impervious Area as surrogates


Storm Water Panel Recommendations to the California State Water Resources Control Board

The Feasibility of Numeric Effluent Limits Applicable to Discharges of Storm Water Associated with Municipal, Industrial and Construction Activities

June 19, 2006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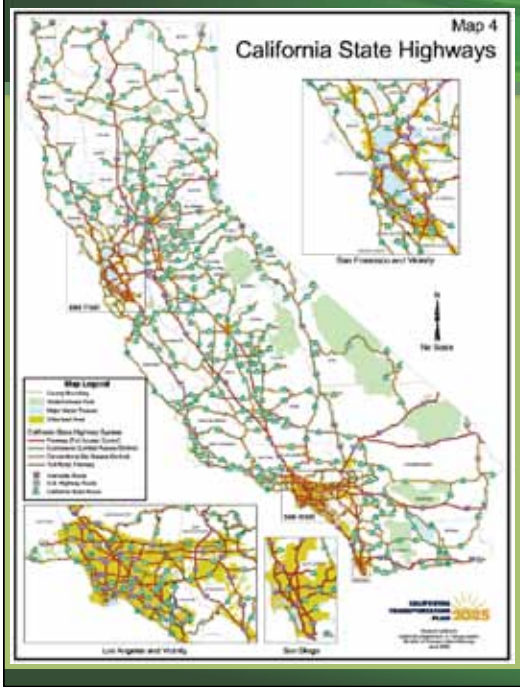
MEMORANDUM

SUBJECT: Revisions to the November 22, 2002 Memorandum "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs"

FROM: James A. Hanlon, Director
Office of Wastewater Management

Denise Keehner, Director
Office of Wetlands, Oceans and Watersheds



Integrated System

- Freeway – Full Access
- Expressway - Limited Access
- Conventional – No Access
- Toll Roads

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Consistency

- *"…consistent, effective and efficient implementation of storm water management practices statewide in all of the Department's Districts" – SWMP*
- Same principles
- Forms
- Training
- Guidance
- Implementation
- Enforcement

System Condition

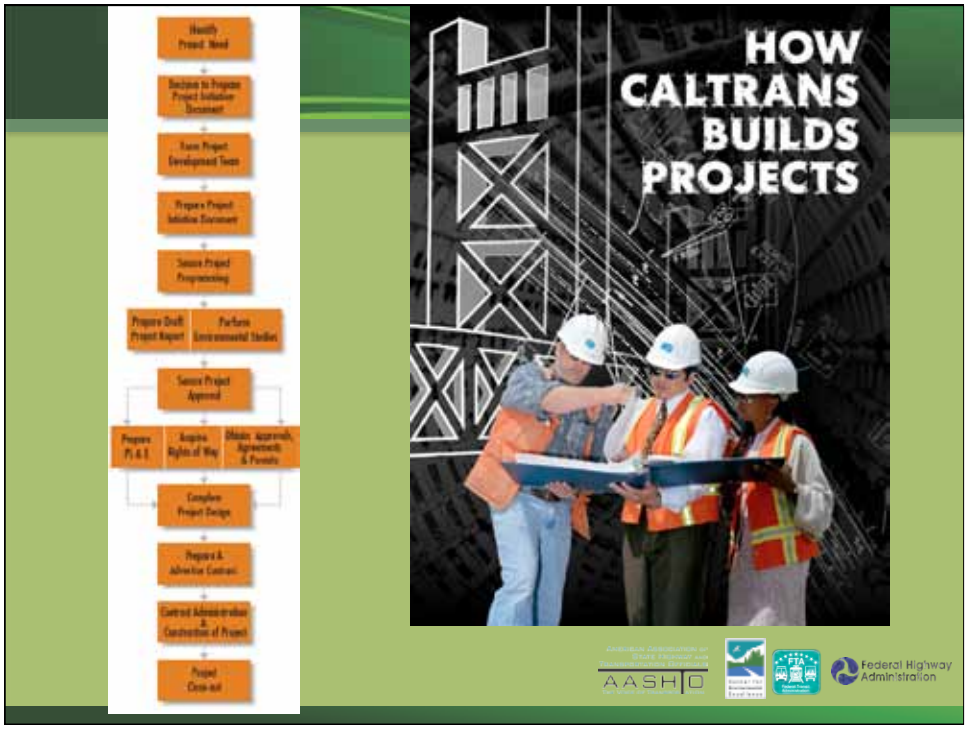
- The State Highway System and drainage system was built decades ago, before water quality treatment standards were established for stormwater
- Design, construction and maintenance

Unique Operational Conditions

- Linear
- Limited right of way, frequently constrained by adjacent land-uses
- High speeds
- Highly controlled environment
  - Clear Recovery Zone
  - Right of way access control on freeways
  - Fencing and other barriers
- 24/7/365 operation
- Facilitates emergency response (Police, Fire, Medical, Evacuation)
- Seasonal operational activities (traction control conditions)

Challenges for DOTs -Statewide TMDLs

- Minor fraction stakeholder
- Typical catchments of 3-5 acres
- Adjacent to many jurisdictions
- Named in multiple TMDLs (serial TMDLs)
- DOTs are assigned a WLA
- Schedules do not align with project delivery



Example Challenges for DOTs Maintenance and Operations

Safety and safe access required

- Drain inlet inserts not applicable
- Lane closures
- Effective sweeping
- Urban locations with limited right of way

National DOT Effort with EPA

- Collaboration on National Stormwater Rulemaking and New Regulations
- "TS4" (vs. MS4 – Municipal Permits) for DOTs
  - Funding Structure is unique
  - Limited Legal Authority on Enforcement
  - Safety for Motorists is biggest concern
  - Revisit applicability of 6 minimum measures
  - TMDL Compliance
  - Prioritization

Road-Related MS4 Website

www.epa.gov/npdes/stormwater/roads

- Materials & Practices
- Technical Studies
- Programs & Permits
- Case Studies
- News & Events
- Program Links

What could be an ideal TS4?

- Focus on transportation pollutants (single land use)
- Pollution Prevention- focus on source control
- Treatment BMPs appropriate for highways
- Allow pollutant trading – other highway segments or off-DOT property
- Construction for highway (allow segmenting risk levels)
- IC/ID limitation on enforcement – work with local MS4 (issues with run-on flows)
- Public Ed (one national message for highway DOTs)
- Statewide TMDL strategy (level of effort)

Large Particle

Scott McGowen, P.E.
Chief Environmental Engineer
California Department of Transportation

Post Construction BMP Selection - Runoff Management to Meet Quantitative Pollution Limits

BMP Selection and Design Steps and NCHRP/WERF Research Manuals

Eric Strecker
Geosyntec Consultants
Portland, OR

Geosyntec consultants

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The Need

- Numerical limits/targets due to:
  - TMDLs
  - ESA
  - CERCLA/RCRA Surface Water Compliance Orders
  - Other
- BMP Selection and Design Guidance to Meet More Stringent and Numerical Goals

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Summary of NCHRP and Related Studies and Relevance to Improving BMP Selection and Design

Stormwater Characteristics and Impacts

- Environmental Impact of Construction and Repair Materials on Surface and Ground Waters – Report 440
- Identification of Research Needs Related to Highway Runoff Management Report 521

Research Guidance on BMP Selection and Design

- Critical Assessment of Stormwater Treatment and Control Selection Issues- WERF
- Evaluation of Best Management Practices for Highway Runoff Control – NCHRP 565
- Decentralized Stormwater Controls for Urban Retrofit and Combined Sewer Overflow Reduction- WERF

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Environmental Impact of Construction and Repair Materials on Surface and Ground Waters

"Materials Contributions and Source Control"

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Environmental Impact of Construction and Repair Materials on Surface and Ground Waters

- Study Conducted by Oregon State University
- 7-year study to develop and demonstrate a methodology for evaluation of potential environmental impact of highway construction and repair (C&R) materials on surface and ground waters

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Recycling-what to do with scrap tires?

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34

Recycled Materials -Use in Highway Construction

Research Questions

- What possible impacts will occur to aquatic resources if this material is used for highway construction and repairs?
- Is there a risk of a problem occurring if this material is used?
- How should possible environmental impacts be assessed?

36

General Conclusions

- Problem assessment methodology was developed and validated
- Leachate from "pure" C&R materials often toxic to algae and daphnia. Algae most sensitive
- Toxicity is greatly reduced or removed when materials are incorporated into asphalt concrete (AC) or Portland cement concrete (PCC)
- Toxicity is also reduced in earthen/vegetated drainage systems

Development of BMP Evaluation Methodologies for Highway Applications

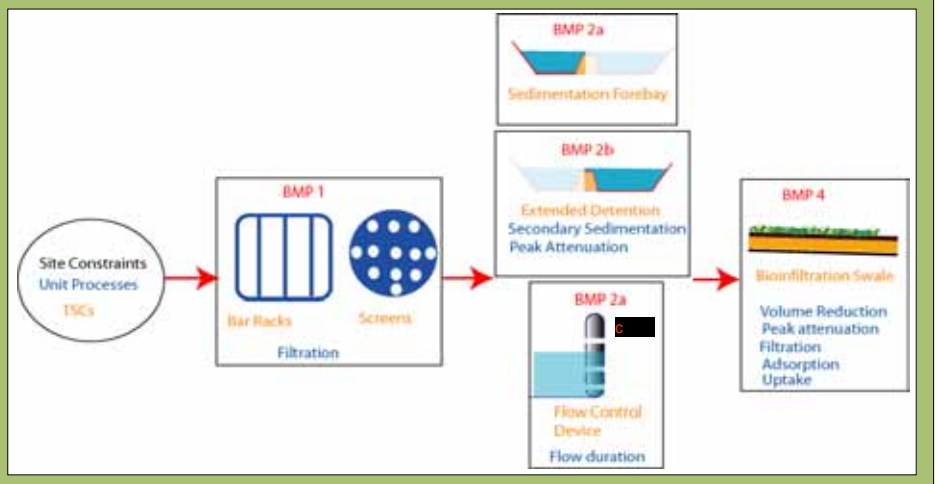
Overall Goal

- Use the "best information" available to provide guidance on the selection and use of stormwater water quality controls
- Develop stormwater controls selection and evaluation methodology for use by practitioners
  - NCHRP – Highway Specific
  - WERF – Urban Environment
- Emphasize :
  - Treatabilty
  - Evaluation and design by examination of fundamental unit processes
  - Include criteria of practicability, performance, and hydrologic assessment
  - Provide technical guidance documents and related reports/research findings

Consider Fundamental Process Categories (FPCs)

- Physical Processes:
  - Hydrologic/Hydraulic
  - Treatment
- Biological Treatment Processes
- Chemical Treatment Processes

Alternative 1 – Address Trash/debris, TSS, dCu, Volume/Flow



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NCHRP 25-31 (Completed in 2012)

Guidelines for Evaluating and Selecting Modifications to Existing Roadway Drainage Infrastructure to Improve Water Quality in Ultra-Urban Areas

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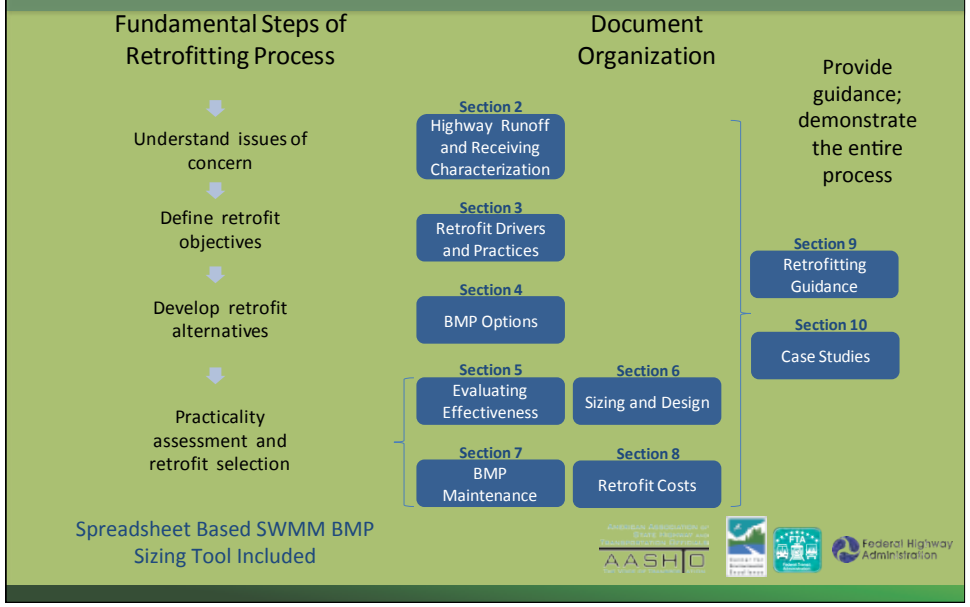
Ultra Urban Highway Retrofits - Very difficult

Design and construction constraints:

- Limited ROW
- High land lost
- High impervious cover
- Utility conflicts
- Unknown subsurface conditions
- Compacted soils
- Poor connectivity to existing drains
- High traffic volume

Guidance Document Organization



NCHRP Project 25-32 (complete 12/12)

Measuring and Removing Dissolved Metals from Stormwater in Highly Urbanized Areas

Michael Barrett, University of Texas at Austin

Initiating NCHRP Efforts

- NCHRP 25-37- A Watershed Approach to Mitigating Stormwater Impacts
- NCHRP 25-40 Long Term Performance and Life-Cycle Costs of BMPs
- NCHRP 25-41 Guidance for Achieving Volume Reduction
- NCHRP 25-42 Bridge Runoff Treatment Analysis and Treatment Options

The Future: Making Green "Work Harder"

Water Environment Research Foundation (WERF) Project

Internet-of-Things Based Highly Distributed Real-Time Control (DTRC)

47

Research Objectives

- Demonstrate that the highly distributed real-time control (DRTC) technologies for green infrastructure can play a critical role in transforming our nation's urban infrastructure
- Evaluate relative performance and cost
- Establish the foundations of a future of ubiquitous, digitally-connected, green infrastructure

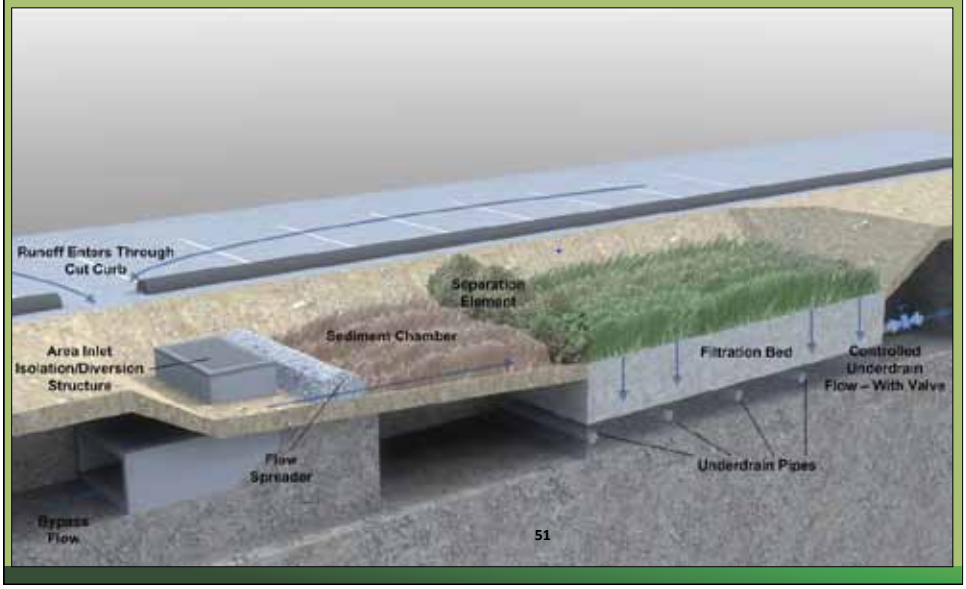
Distributed Real Time Controls -OptiRTC Platform

Current DTRC/High Performance Infrastructure Pilot and Project Types

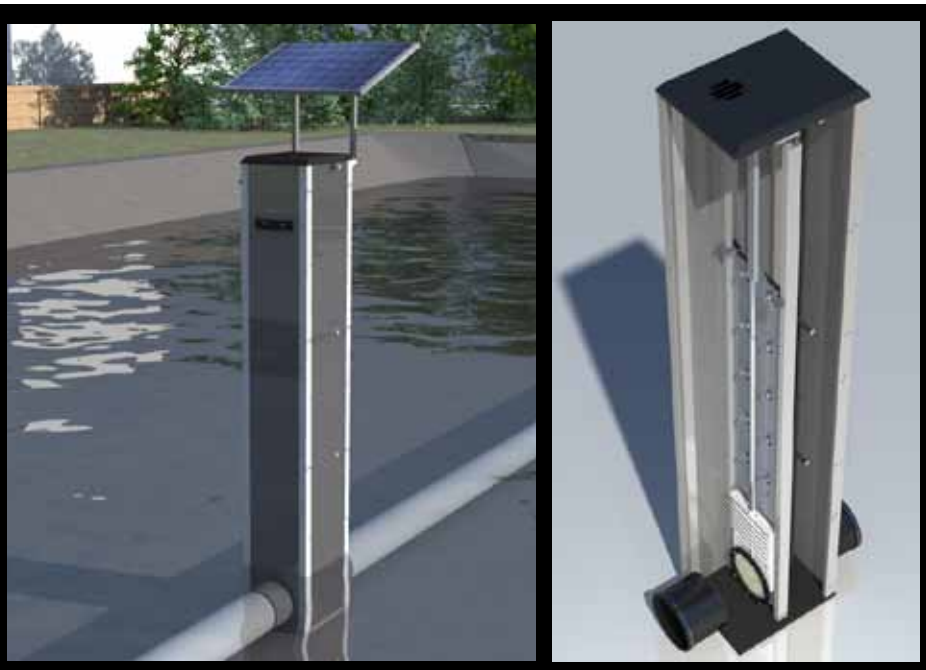
- Controlled underdrain bioretention
- Actively controlled extended detention wetland system outlets for impaired water quality performance optimization. (UT Austin, NC State)
- Flood control basin retrofit for water quality (controlled outlet retrofit only)

- Advanced rainwater harvesting systems
- Automated green and blue roofs for timing control in combined sewer systems
- Security and environmental monitoring at drinking water well headsOthers

Pilot Technology: Controlled Under Drain Bioretention



St. Joseph RTC Wetland Forebay



RTC Outlet Control Structure

Distributed RTC Findings to Date

- Distributed Smart Real Time Controllers are being demonstrated to make green infrastructure "work harder"
  - significantly more wet weather volume control for CSOs
  - ability to maximize treatment and infiltration
- Very cost-effective flood control facility retrofit option – create water quality volume within flood control volume and maintain flood control

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54

Summary

- NCHRP project reports provide tools for project evaluation and BMP Design to improve compliance
- Emerging research findings and technologies are showing promise for improving pollution and volume control from highways and other DOT facilities

Post Construction BMP Selection - Runoff Management to Meet Quantitative Pollution Limits

Washington State DOTs Approach to Meeting Specific Pollutant Requirements

Le Nguyen
Washington State Department of Transportation

WSDOT Issues

- Endangered Species Act (low copper and zinc targets)
- TMDLs
- MS4 Permits
- Ecology Required Performance

Environmental Requirements in WA

Basic and ***Enhanced*** Treatment Requirement

- ***Dissolved Copper: 30% removal***
- ***Dissolved Zinc: 60% removal***
- TSS: 80% removal (basic treatment)
- Phosphorus

Retrofit Requirement

- Provide flow control and treatment to *both the new/ re-constructed and* the existing pavement in the Puget Sound Area

The Challenges

- Physical constraints: most of the projects in the Puget Sound area are in highly urbanized areas with limited available spaces to install treatment facilities
- Utilities and other infrastructure conflicts
- Very limited available and approved "enhanced" treatment BMPs (approved by Ecology):
  - stormwater wetlands,
  - media filter drain (ecology embankment),
  - compost amended vegetated filer strip (CAVFS) and
  - compost-amended biofiltration swale (CABS).

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Design Challenges

- Urban Setting
- Limited ROW precluded use of large stormwater treatment facilities
- Nearby Renton Airport limited types of facilities

- Superelevated Curves
- Existing Storm Drain Systems
- Existing Walls
- Steep Slopes

Washington State Department of Transportation

AASHTO Federal Highway Administration

Design Challenges

- No embankment or steep embankments
- Conflict with bridge foundations, retaining walls and utilities
- Elevation differences
- Existing wetlands
- High groundwater elevations

How WSDOT Overcomes the Challenges and Meets the Environmental Requirements

- Innovative designs, based on fundamentals of hydrology, hydraulics, and pollution removal unit processes ("Custom made/Designer" BMPs).
- Custom treatment BMPs are created to match site conditions and are not readily available/ described in stormwater manuals.
- WSDOT Solutions:
  - Work together as a multidisciplinary team
  - Invite stakeholders throughout the design process

SR 303 – Manette Bridge Replacement

- Information Sources:
  - http://www.wsdot.wa.gov/projects/sr303/manettebridgereplacement/
  - http://civil-engineering.asce.org/link/ce/2010/sep/66?s=0
  - http://www.flickr.com/photos/wsdot/sets/72157622243275231/with/6333433182/

- Length: 1,600 feet approximately
- Bridge runoff received no treatment under existing condition

SR 303 – Manette Bridge Replacement

Innovative Design

- A treatment BMP underneath a city park, a unique design that may happen only in City of Bremerton, WA.
- The City Mayor and Engineering Manager applauded WSDOT for this innovative design.

SR 303 – Manette Bridge Replacement

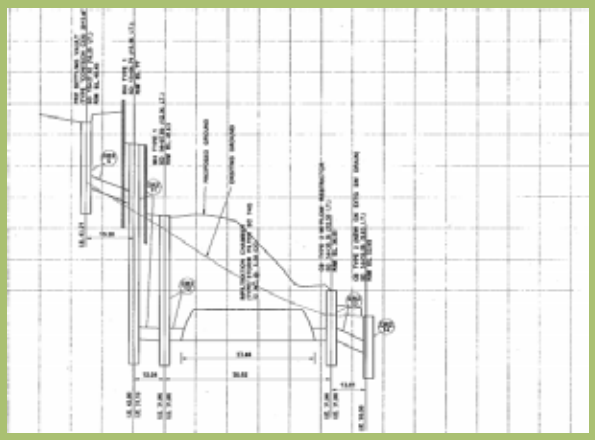
Challenges

- Infiltration BMPs typically require large surface area
- Tiny available footprint at one end of the bridge (50-ft x 50-ft)
- Meeting LID requirements
- On top of the treatment BMP, it must be designed as a mini park so people can sit down, have lunches and look out to the bay
- Schedule – 1 month to finish the design

SR 303 – Manette Bridge Replacement

Challenges

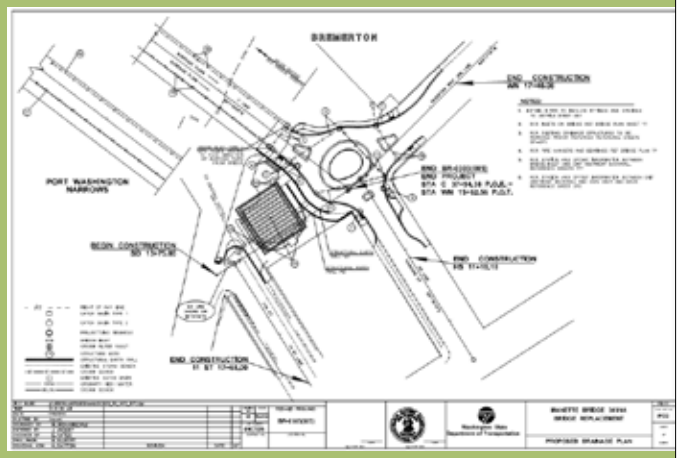
- Available space is small
- Located in the steep embankment (2H:1V) slope
- Infiltration area must be flat
- Infiltration rate must not be too high or too low, ideally it is about 2 in/hr in saturated condition



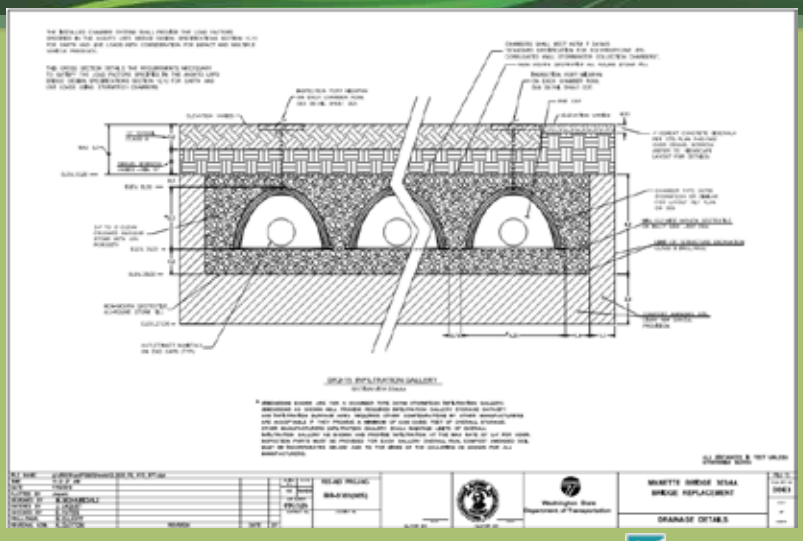
SR 303 – Manette Bridge Replacement

Solution

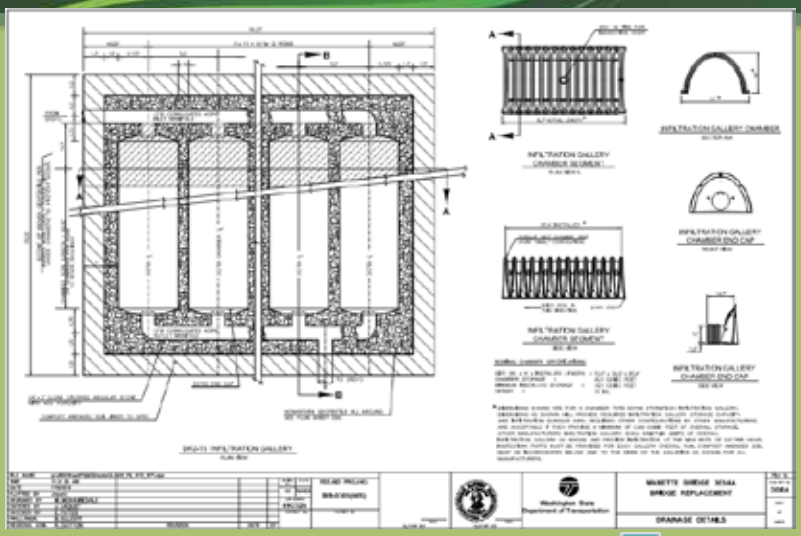
Infiltration gallery is located right next to the roundabout.



Infiltration Gallery Cross Section



Infiltration Gallery Plan View



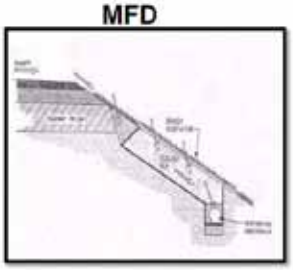
I-405 HOV Lane Widening

- Approximately 30 miles long
- Located in highly urbanized areas
- Five different cities
- Upgrade existing culverts to fish passage culverts
- Many existing wetlands throughout the project site

Standard vs. Modified Media Filter Design (MFD)

BMP Opportunities

MFD



- Replaces Grass Shoulders
- Acceptable Design up to 4:1 Slopes
- Ideal for Widening and Retrofits

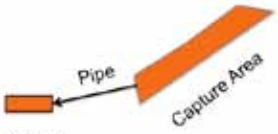
MMFD

- Small Footprint
- Ideal for piped collection systems
- Minimal hydraulic drop required
- Variable dimensions to fit site

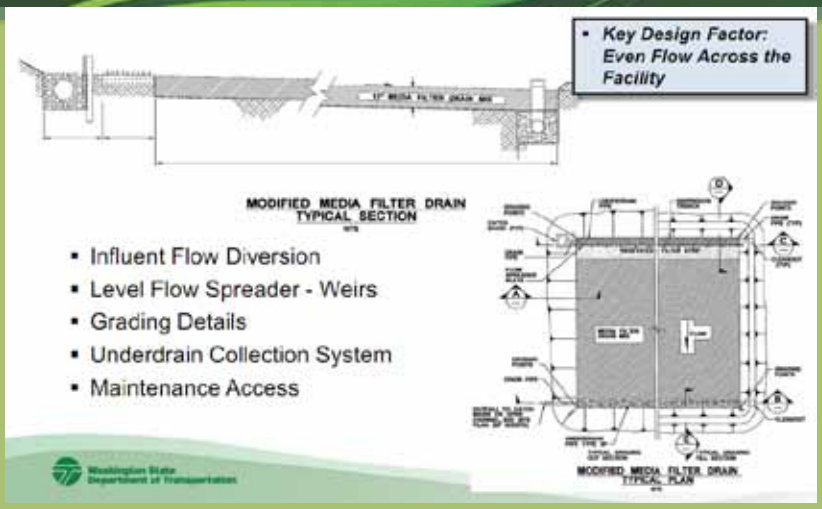
MMFD is End-of-Pipe Treatment BMP

Stormwater Treatment BMP Network

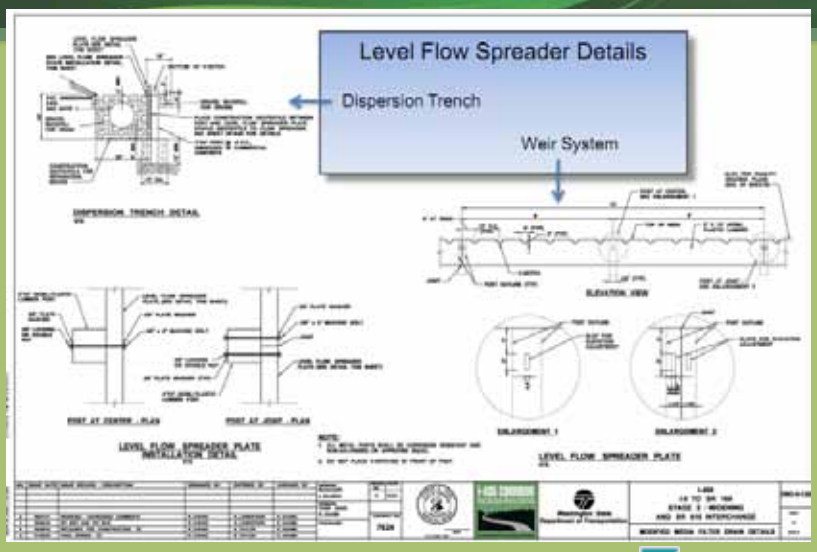
- Each color represents a treatment facility and associated capture area
- 8 MFDs
- 7 MMFDs



MMFD How Does It Work?



Flow Spreader Must Be Flat



MMFD Installation with Monitoring Equipment

Removal Percentages Observed:

- Dissolved Copper: 36.6%
- Dissolved Zinc: 64.6%
- TSS: 94.5%

Photograph of the MMFD Installation, by Angela Deardorff, WSDOT

Construction Photos / MMFD Location

Construction Photos / Flow Spreader Installation

Flow Spreader Must be Flat. -Easier Said Than Done

Construction Photos

Testing Using Water Truck to Simulate the Flow Rates

Flow must be evenly distributed all along the length of the flow spreader

Looking Beautiful

Cost and Maintenance Considerations?

Modified Media Filter Drain vs. Media Filter Drain

- MMFD footprint is much smaller than typical MFD, thus construction cost and maintenance cost would be less in this regard.
- MMFD is typically located away from the roadway, and MFD is located along roadway embankment and has some soft shoulder issue.

Lessons Learned

- When faced with strict requirements and difficult conditions, "standard" BMPs may not work
- Need to innovate and adapt designs to fit site conditions and requirements
- Factors for success:
  - Multi-disciplinary teams
  - Stakeholder involvement
  - Close working relationship between design engineers and contractors

Contact Information

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Post Construction BMP Selection - Runoff Management to Meet Quantitative Pollution Limits

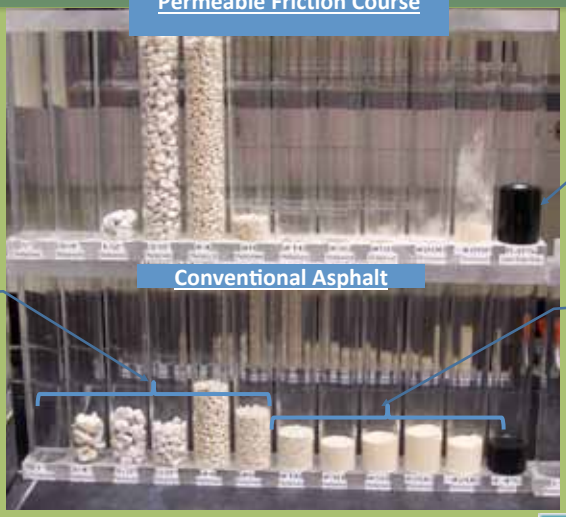
Porous Pavement Overlays and Their Potential for Addressing Highway Pollutants

Michael Barrett, Ph.D., P.E., D. WRE
University of Texas at Austin
June 7, 2012

Permeable Friction Course

- Overlay of porous asphalt placed on top of regular pavement
- Water drains through the pavement rather than across it

PFC Composition



Acknowledged Safety and Noise Benefits

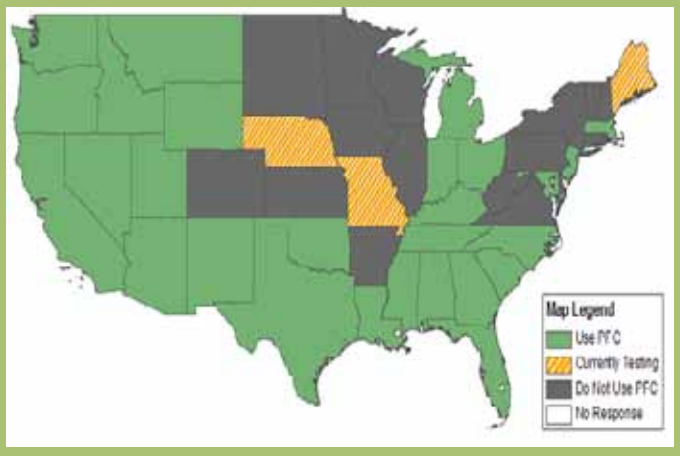
- Reduce splash and spray
- Reduced tendency to hydroplane
- Improved visibility
- Better traction characteristics
- Quieter

Splash and Spray

Conventional Asphalt

PFC

Where is PFC?



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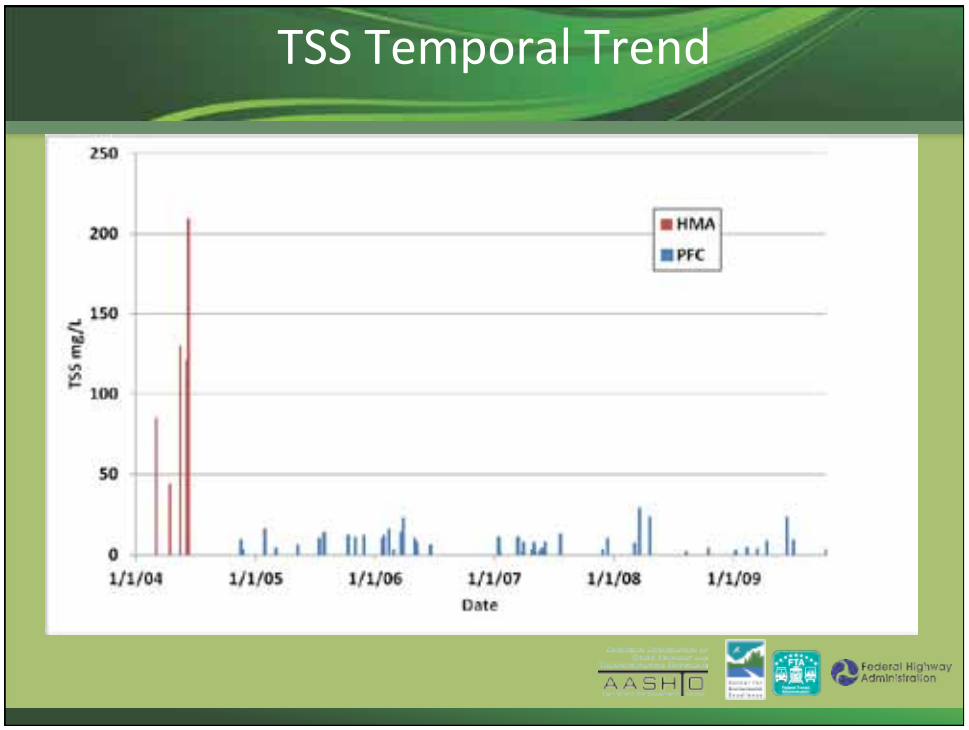
TSS Temporal Trend
250
200
150
100
50
0
TSS mg/L
HMA
PFC
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Date
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Water Quality at TX1

Constituent	Conventional Asphalt	PFC	Reduction %	p-value
TSS	118	8.8	92	0.016
Total P	0.13	0.07	48	0.047
Total Copper	27	13	50	0.010
D. Copper	6	10	-77	0.045
Total Lead	13	1	91	0.025
Total Zinc	167	29	83	0.002
Dissolved Zinc	47	22	53	0.139

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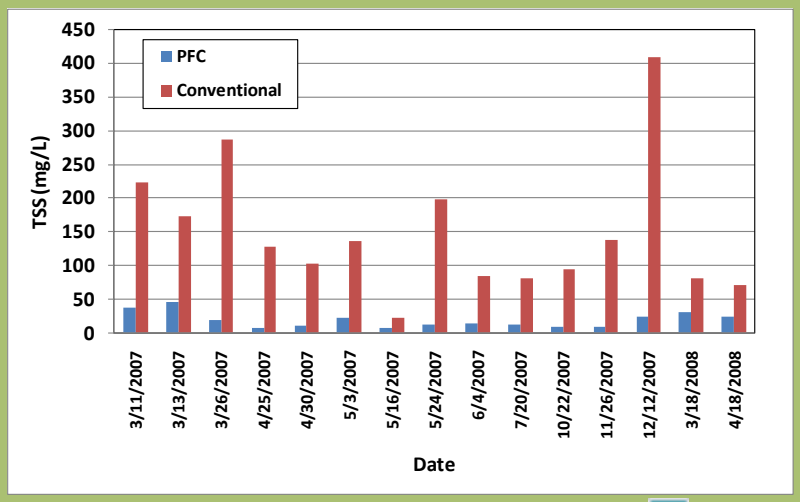
93

Paired Samples – TX2

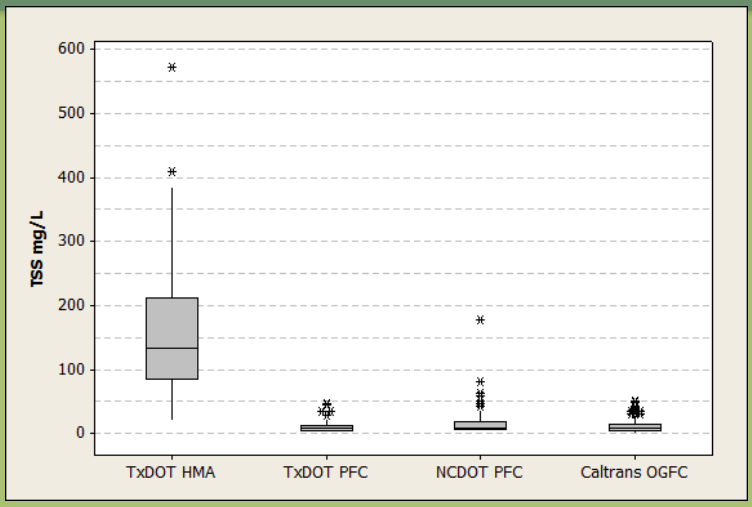


Water Quality at TX2

Constituent	Conventional Asphalt	PFC	Reduction %	p-value
TSS	148	18	88	<0.000
Total P	0.15	0.05	63	0.006
Total Copper	30	13	57	<0.000
D. Copper	6.3	9.0	-44	0.015
Total Lead	11	1.3	88	<0.000
Total Zinc	130	21	84	<0.000
Dissolved Zinc	18	11	40	0.043

96

Comparison of TX, NC, CA Data



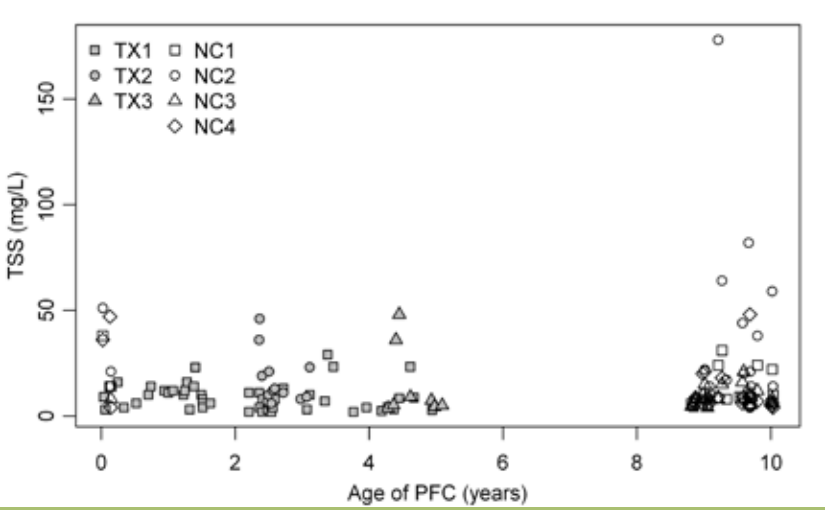
97

Performance Comparison

Constituent	Grouped OGFC vs. Austin Sand Filters				
	p-value	OGFC Mean	OGFC Median	Filter Mean	Filter Median
TSS (mg/L)	0.202	***6.666***	-	***5.557***	-
Total P (mg/L)	< 0.001	***0.057***	-	***0.159***	-
Nitrogen (mg/L)	< 0.001	***0.827***	-	***2.010***	-
Total Cu (μg/L)	0.020	***6.469***	-	***8.551***	-
Dissolved Cu (μg/L)	< 0.001	***4.108***	-	***6.801***	-
Total Pb (μg/L)	-	-	0.650	-	1.400
Dissolved Pb (μg/L)	-	-	0.080	-	1.000
Total Zn (μg/L)	0.075	***19.492***	-	***26.843***	-
Dissolved Zn (μg/L)	0.001	***10.176***	-	***19.298***	-

98

Water Quality Benefits



99

Source of Water Quality Benefits

- Reduced splash and spray minimizes washing of pollutants from vehicle undercarriage and engine compartment (source control)
- Reduced transport of pollutants on the road surface
- Filtration, settling, and sorption within PFC (treatment control)

Ongoing Research

Permeable Friction Summary

- Runoff from PFC is much cleaner than that from conventional pavement for particulate associated pollutants
- Widely used solely for safety and noise benefits
- Does not provide volume reduction
- Ideal method to retrofit existing highways for water quality
- It's FREE!!

Common Questions

- Previous bad experiences – Early mix designs (OGFC) prone to failure because of draindown
- Maintenance – Typically none in the US, varies in Europe
- Cost – Slightly more due to higher quality aggregate
- Freeze/Thaw – 5 year study in Indiana indicated pavement condition comparable to conventional pavement
- Snow/Ice – Requires more frequent application of deicers

More Info At:

Eck, Bradley, Winston, R., and Hunt, W., Barrett, M., Water quality of drainage from permeable friction course, American Society of Civil Engineers Journal of Environmental Engineering, Vol. 138, No. 2, pp. 174 – 181, February 2012

Klenzendorf, J.B., Eck, B.J., Charbeneau, R. J., and Barrett, M., Quantifying the behavior of porous asphalt overlays with respect to drainage hydraulics and runoff water quality, Environmental and Engineering Geoscience, Vol. XVIII, No. 1, pp. 99-111, February 2012.

Eck, Bradley, Barrett, M., and Charbeneau, Randall, Coupled surface-subsurface model for simulating drainage from permeable friction course highways, American Society of Civil Engineers Journal of Hydraulic Engineering, Vol. 138, No. 1, pp. 13-22, January 2012

104

Post Construction BMP Selection - Runoff Management to Meet Quantitative Pollution Limits

Asset Management – Keeping track of BMPs to Ensure their Effectiveness

Peter Mattejat, P.E. – Stormwater NPDES Coordinator
Office of Engineering & Construction -
Environmental Engineering Division

Overview of Asset Management

- Strategic approach to manage BMPs that provides long-term benefit and minimize life cycle cost
- Process to manage, operate, and maintain infrastructure
- Integrates planning, engineering, operations, and costs to realize cost-effective and reliable performance
- Consider regulatory compliance
- Principles:
  - Inventory
  - Condition Evaluation
  - Remediation
  - Tracking

Inventory

Overview

- Collect spatial and attribute information
- Understand how BMPs provide stormwater management (SWM) - *Quantity* and/or *Quality*
  - Treatment – reduce contaminants before entering surface water
  - Control – Reduce peak flow and velocity to prevent erosion & sedimentation
  - Reduction– reduce runoff volume
- Recognize SWM designs have evolved over time
- Implement to address Stormwater NPDES permit requirements

Inventory

Roadway Stormwater Management

- Traditional Implementation
  - Highly distributed (spread out) along roadways
  - Conventional approach: collect – convey - treat
  - Typically linear
- Evolving Approach
  - Integrate with roadway drainage
  - Use of "BMP trains"
  - Expanding BMP types (e.g. hybrid designs, proprietary devices, under-ground facilities)
  - Focus on watershed needs

Inventory

Common BMP Types

- Stormwater Ponds/Wetlands:
  - Retention Pond
  - Detention Pond
  - Extended Detention Pond
  - Stormwater Wetlands
- Infiltration Devices:
  - Trench
  - Basin
- Filtering Devices:
  - Sand Filters
  - Bioretention Facilities
  - Bioswales

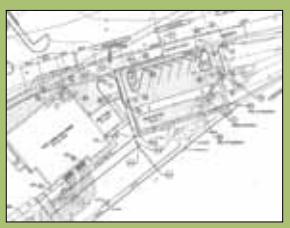
AASHTO Federal Highway Administration

Inventory

Common BMP Data

BMP Information
- BMP location
- BMP attributes
- Structures (e.g. Riser, Inlets, Manholes, Outfalls)
- Spillway, Channels
- Drainage areas

Documents
- Design Plans & Reports
- Aerial Maps & Photos
- Assessment Reports
- Work Orders



AASHTO Federal Highway Administration

Inventory

Other BMP Data

- Watersheds / Sub-Watersheds
- Impervious Area Treated
- Land Uses (Pollutant Loads)
- Environmental Features
- Proposed (e.g. Planning Projects)

Condition Evaluation

Overview

- Continuously assess condition
- Inspection
  - Assess stability & SWM performance
  - Evaluate based on design type
  - Identify remedial needs
  - Provides long-term data
- Detailed Assessment (as-needed)
  - Further assess BMP functions
  - Use to identify enhancement options
  - Wet-Weather monitoring to evaluate treatment performance

Condition Evaluation

Inspection Protocol

- Inspection Manual: Reliable, Repeatable Procedures
- Parameters:
  - Focus on specific BMP elements
  - Scoring (e.g. 1 to 5)
  - Categories: Site, SWM, Structural
- Rating:
  - Good to Worse (e.g. A, B, C, D, E)
  - Relate condition with remedial response
- Data Collection:
  - Inspection data: scores, measurements, comments
  - Field Photos: site & defects

Condition Evaluation

Rating Schema Example

A = Functional with no performance or stability concerns
(No action required)

B = Functional with minor issues
(Maintenance may be needed)

C = Functional with moderate issues
(Remediation may be necessary)

D = Function may be compromised due to major problems
(Remediation likely necessary)

E = Function is deteriorating due to critical problems
(Remediation required)

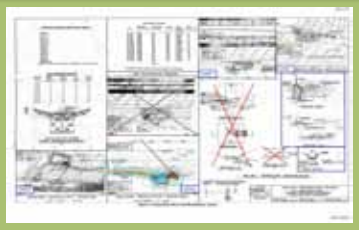
Remediation

Overview

- Maintain/Restore stability and/or performance
- Based on Inspections or Scheduled Activities
- Types:
  - Corrective – address issues related to lack of maintenance
  - Routine – annually perform prescribed activities
  - Cyclical – multi-year intervals perform prescribed activities
  - Rehabilitation – restore/improve BMP elements
  - Enhancement – reconfigure BMP for better performance
- Work Orders
  - "Punch List" of activities & annotated plans/maps/photos
  - Traffic, Utilities, Environmental Resources, Right-of-Way, E&S

Remediation

Elements of a Work Order



Remediation

Do not forget the details …

Remediation

Examples:

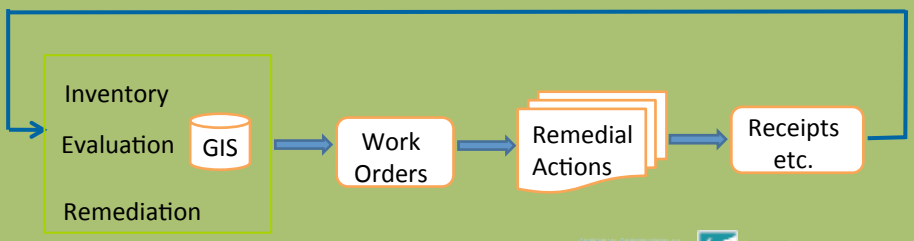
<u>Corrective Maintenance</u>

<u>Rehabilitation</u>

Tracking

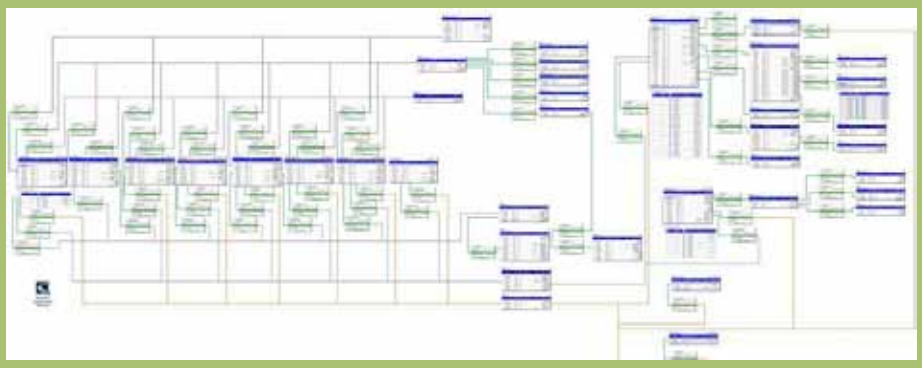
Overview

- Continuously track key data to aid in decision-making
- Maintain asset data: Inventory – Condition – Remediation
- Log cost data: Labor, Materials, Equipment, Contractors, etc.
- Manage existing, pending, and future BMPs
- Define work flows:



Tracking

GIS is a primary tool, but requires investment



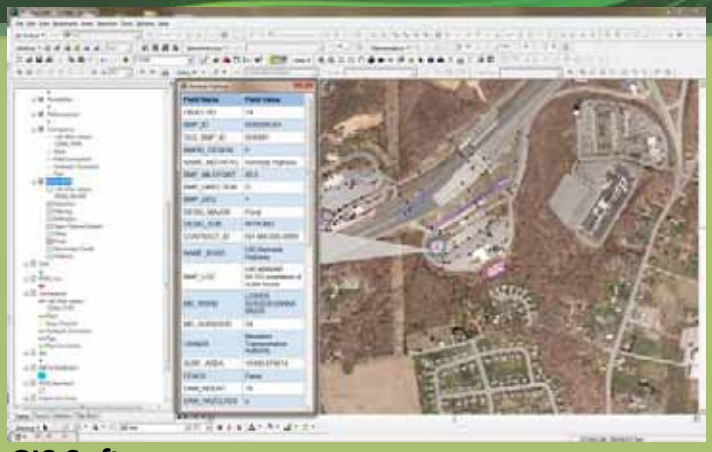
Geodatabase Schema Example

Tracking

GIS Model

- Inventory spatial & attribute data
- Inspection records (cyclical)
- Remediation records (cyclical)
- Domains:
  - Standard pull-down lists
  - Consistent data capture
- Document management

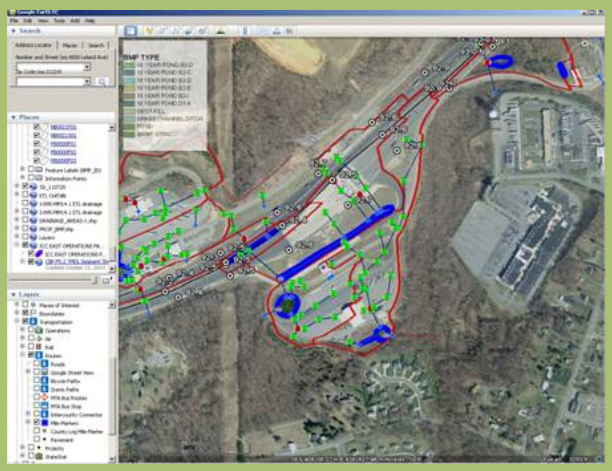
Tracking



GIS Software

Create / Edit / Query / View BMP Spatial /Attribute Data & Document Management

Tracking

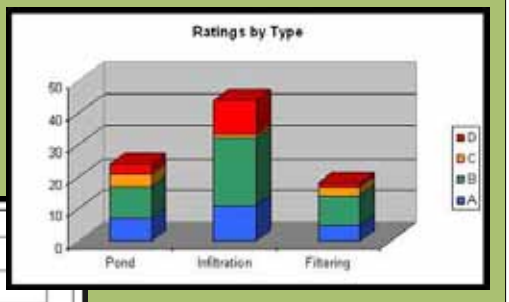


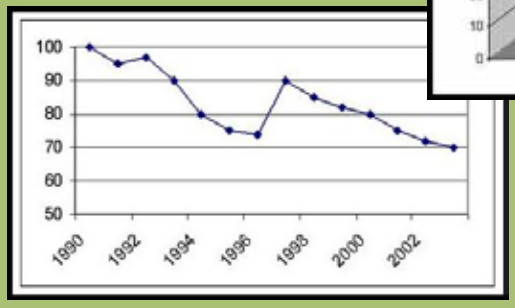
GIS Enterprise:

Query / View BMP Spatial and Attribute Data & Document Management

Tracking

Analyses / Reporting





Questions and Answers

- Please submit questions via the GoTo Webinar Bar

Concluding Remarks

- Please fill in and submit the simple on-line questionnaire (e-mail will provide directions)
- The webinar will be available for on-demand viewing and a pdf of the presentation for download at the Center website:
  - http://environment.transportation.org/
- Thank you for your attention and participation