Water Resource Engineering Technical Update

Presented By:
Scott Blossom, P.E., CFM, LEED A.P.

Date:
September 16, 2014

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A Safety
Moment

Williamsburg Environmental Group has joined the Stantec family!

Stantec at a glance:

- Founded in 1954
- Over 13,000 employees in more than 200 locations
- Diverse range of services and sectors
- GSA Schedule Contract Holder
- Practice Areas include:
  - Architecture
  - Buildings Engineering
  - Community Development
  - Environmental Services
  - Geotechnical Engineering
  - Mining Engineering
  - Oil & Gas Engineering
  - Power Engineering
  - Project Management
  - Transportation Infrastructure Engineering
  - Water and Wastewater Engineering

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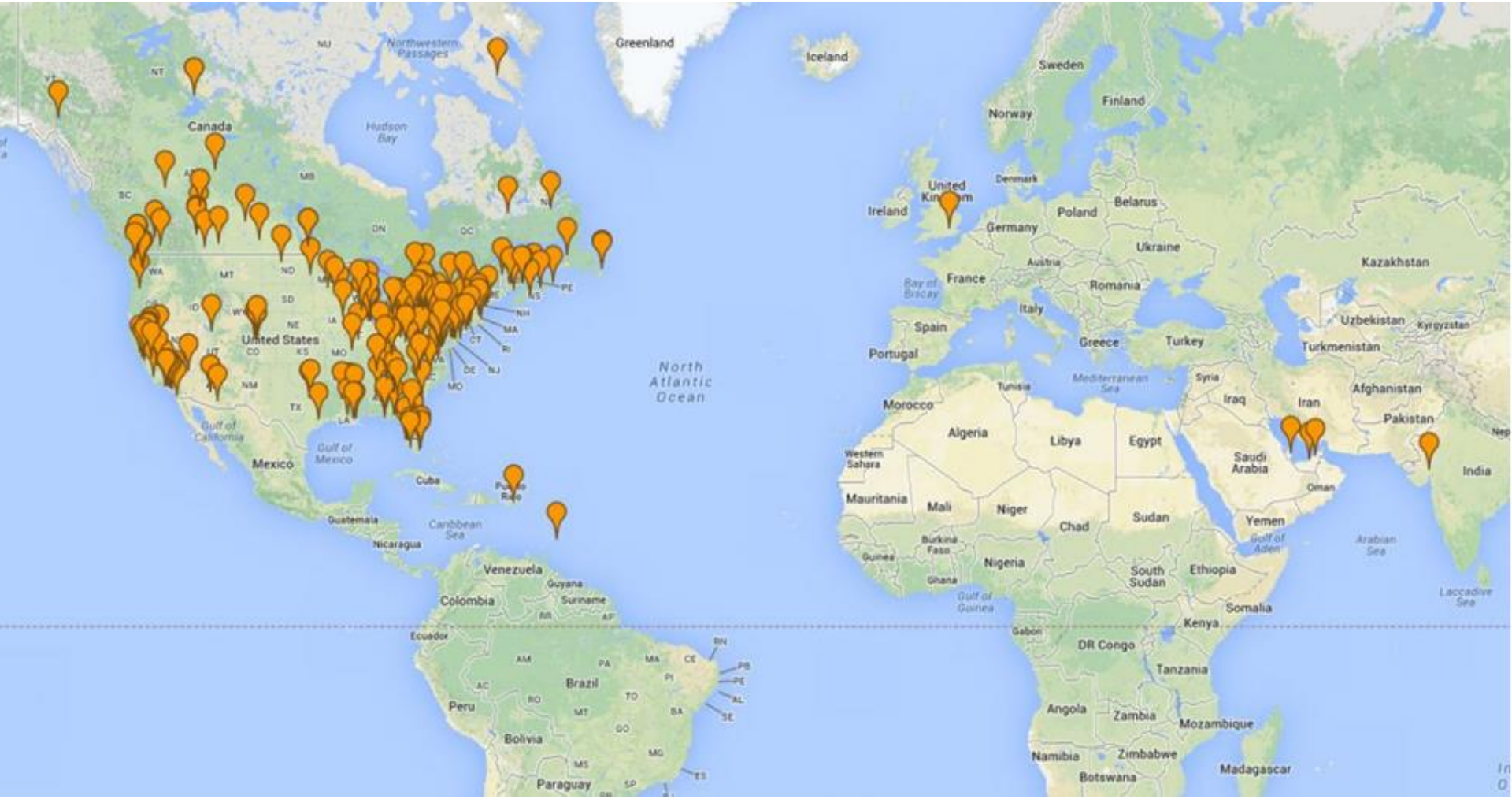
200+ Locations



13,000 Professionals

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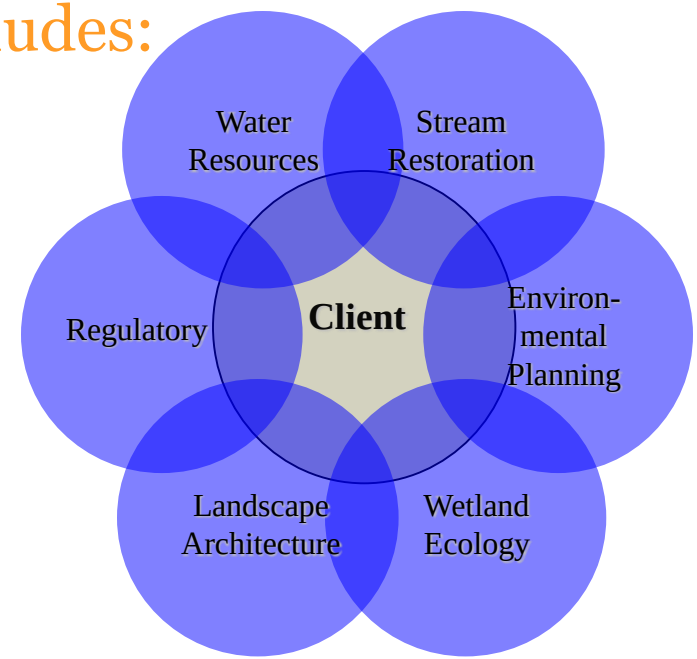
Multi Disciplinary Approach

Our Local Environmental Staff includes:

- Water Resources Engineers
- Environmental Planners
- Regulatory Specialists
- Wetland Ecologists
- LEED Accredited
- Landscape Architects
- Environmental Technicians
- CAD/GIS Specialists



...responsive services and high-quality deliverables on-time and within budget

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Stormwater Stakeholders

Stantec (formerly WEG) supports a variety of public- and private-sector clientele, including:

- Local, State, and Federal Government/Municipalities
- Commercial and Residential Developers
- Engineers/Surveyors/Planners
- Institutions
- Colleges and Universities
- K-12 Schools
- Home Owners Associations
- Utilities
- Non-profit Organizations
- Golf Courses, Parks, and Recreational Facilities

…timely, cost-effective solutions to today's complex environmental issues without "headaches" for our clients

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Federal Considerations

Regulatory Drivers

- National Environmental Policy Act (NEPA) Compliance/Documentation
  - Environmental Assessments (EAs)
  - Categorical Exclusions (CATEXs)
- Executive Order 13514 and 13423
- Section 438 of the Energy Independence and Security Act (EISA) Compliance
- Integrated Natural Resources Management Plan (INRMP) Review
- Environmental Management System (EMS) Support

…capacity and expertise to conduct simultaneous, collaborative, large-scale, complex projects which are focused on sustainability and LID techniques

1 Water Resources: General

2 Regulatory Drivers

3 Technical Review

4 Best Management Practices

5 Case Studies

…team of exceptional professionals with extensive experience supporting federal clients in their efforts to achieve objectives

1 Water Resources: General

Water Resources & Sustainability

- Lake/BMP Design
- Dam Safety Permits
- Master Drainage Plans
- Erosion and Sediment Control Plans
- Water Quality Impact Assessments
- Watershed Planning and Design
- Hydrologic and Hydraulic Analysis
- Floodplain Analysis
- Stream Restoration
- Low Impact Development Design
- Water Supply Studies/Evaluations

WEG

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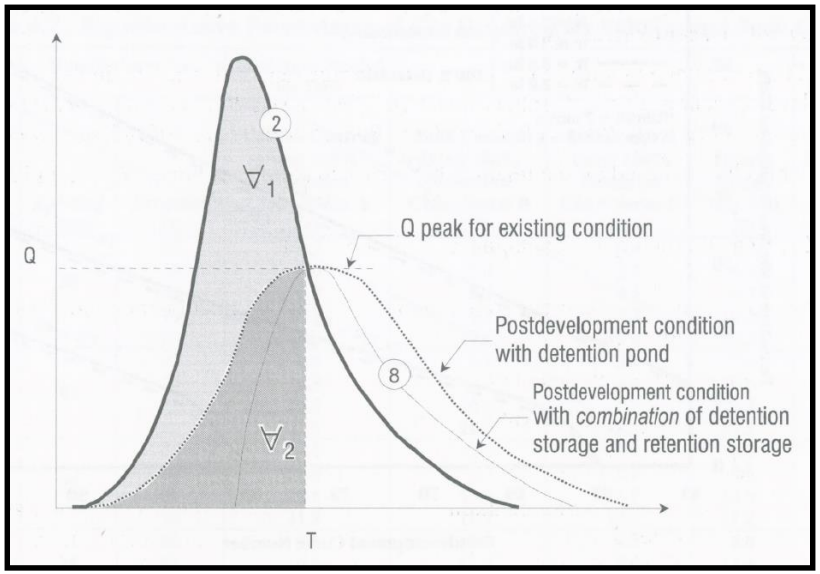
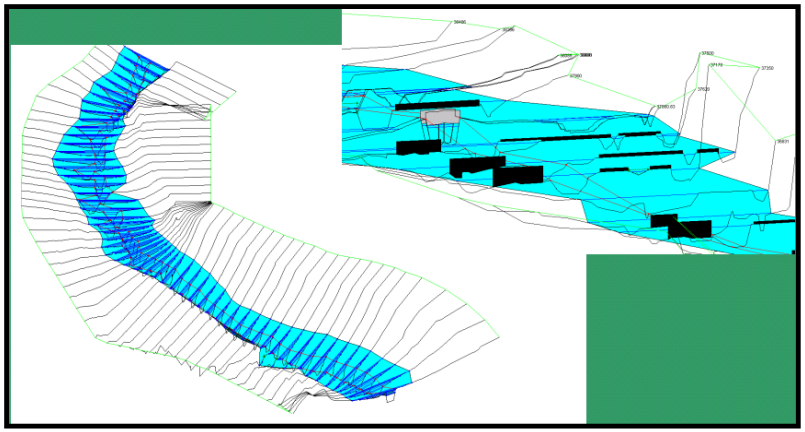
Hydrologic & Hydraulic Analysis

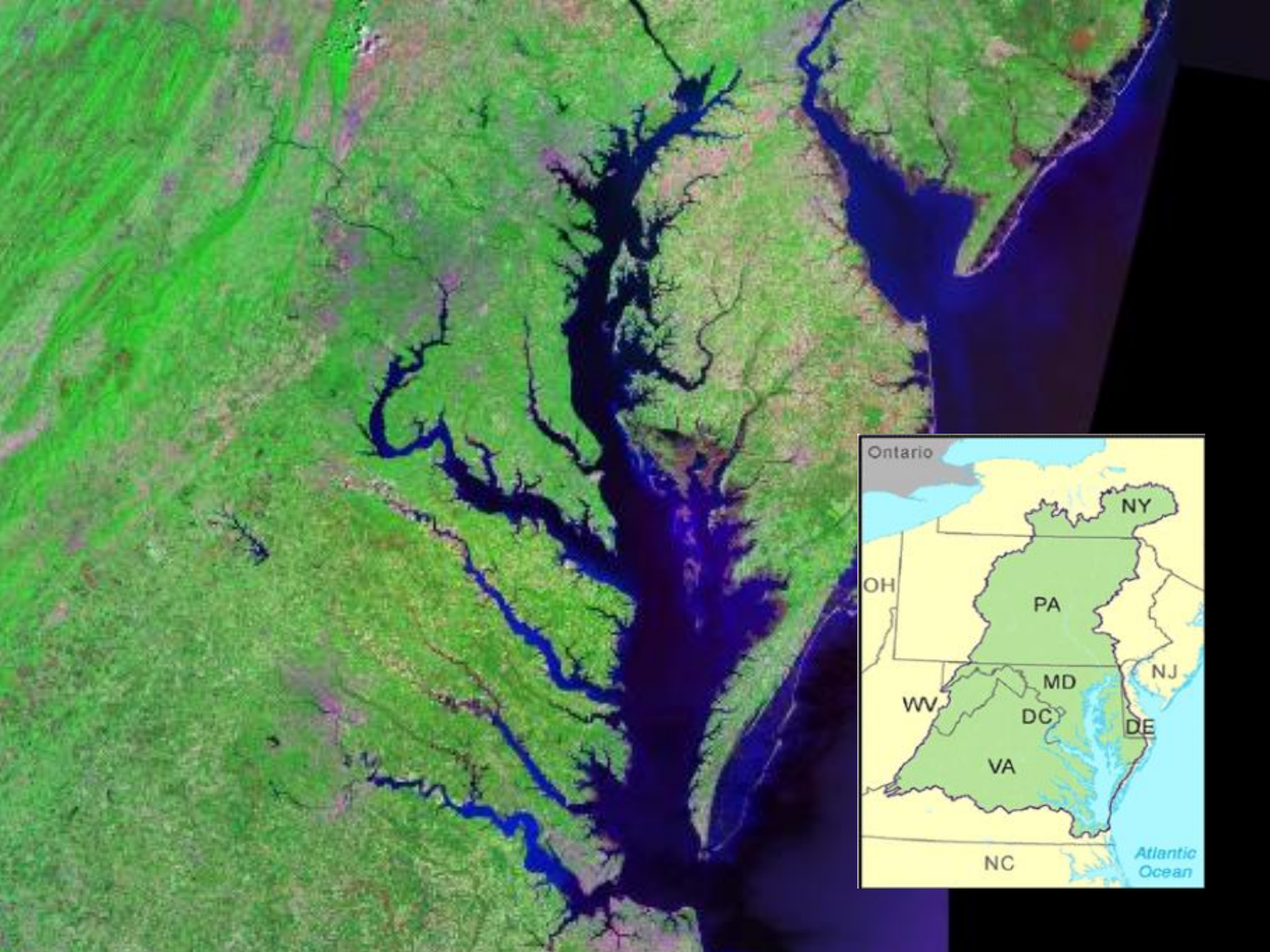
- Replicate Predevelopment Hydrograph
- Increase Initial Abstraction

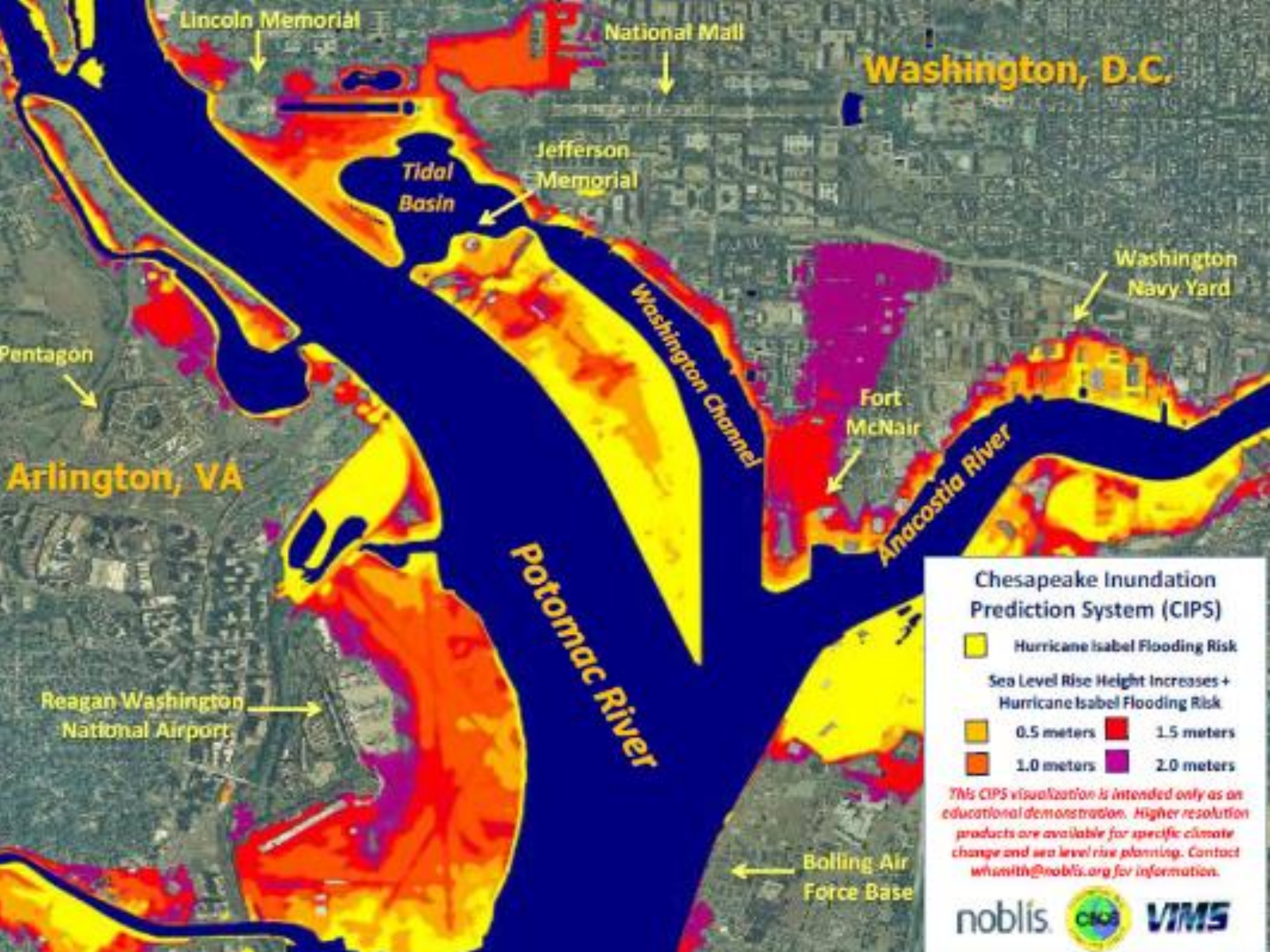


Source: LID Hydrologic Analysis
Prince George County 2000



- Watershed Connection to River & Stream Hydraulics
- Responsible Floodplain Management
- Stream Stability & Restoration


Ontario
NY
OH
PA
NJ
MD
WV
DC
DE
VA
NC
Atlantic Ocean


Lincoln Memorial
National Mall
Washington, D.C.
Jefferson Memorial
Tidal Basin
Washington Navy Yard
Washington Channel
Pentagon
Fort McNair
Anacostia River
Arlington, VA
Potomac River
Reagan Washington National Airport
Bolling Air Force Base
Chesapeake Inundation Prediction System (CIPS)
Hurricane Isabel Flooding Risk
Sea Level Rise Height Increases + Hurricane Isabel Flooding Risk
0.5 meters
1.0 meters
1.5 meters
2.0 meters
This CIPS visualization is intended only as an educational demonstration. Higher resolution products are available for specific climate change and sea level rise planning. Contact whsmith@noblis.org for information.
noblis
VIMS

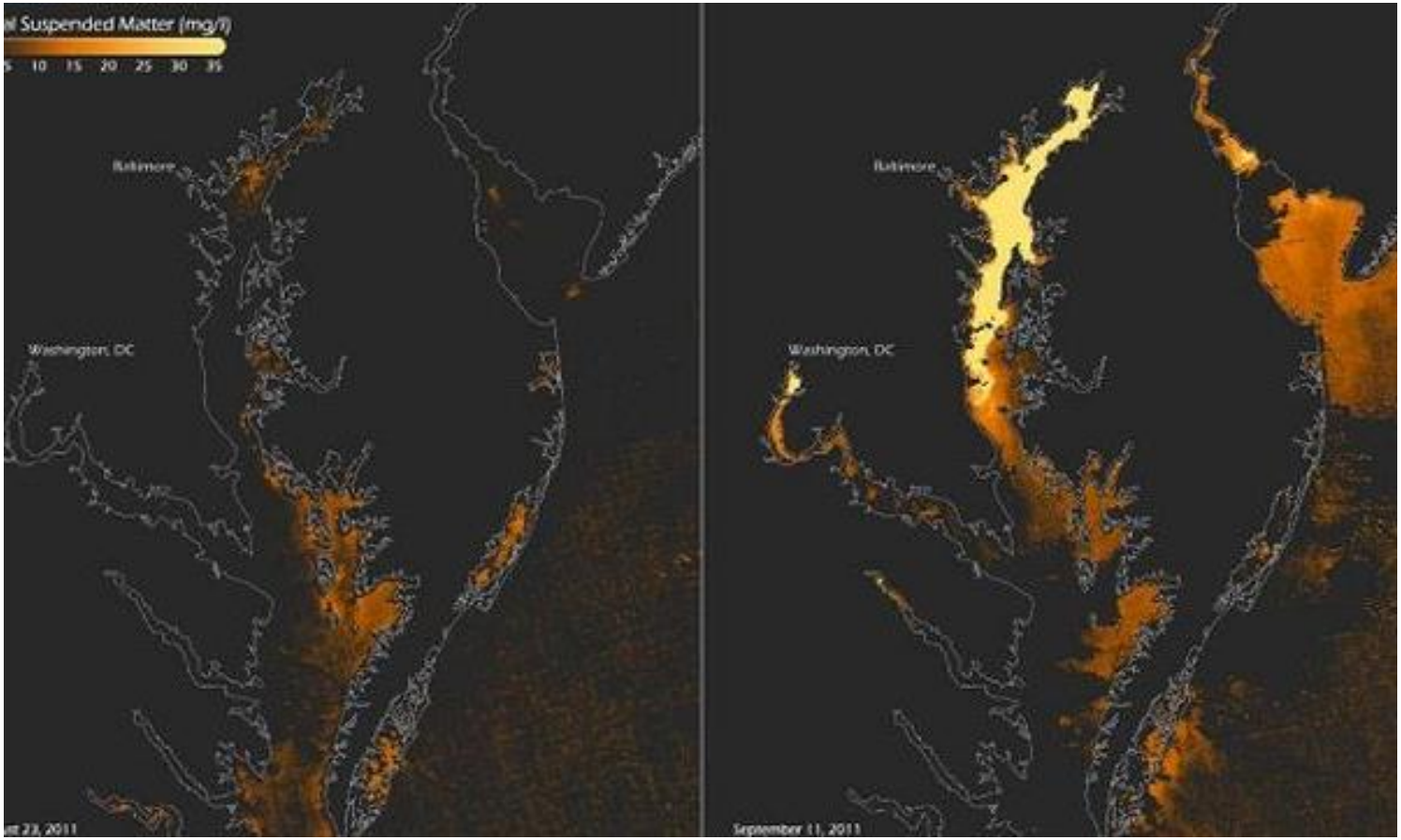
September 8-11 2011

Tropical Storm Lee

Susquehanna River at Harrisburg, Pennsylvania

Over 100,000 people evacuated from New York and Pennsylvania

Regional Priorities



2 Regulatory Drivers

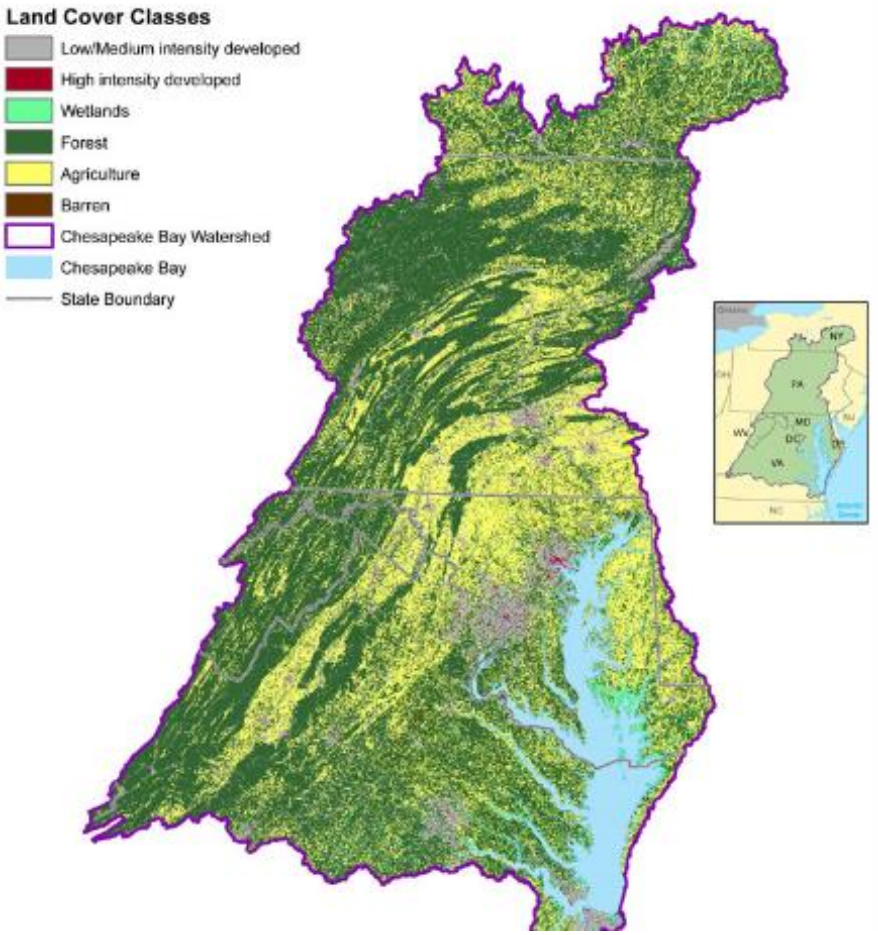
Chesapeake Bay TMDL – A Commitment to Clean Water

- The Bay TMDL is a key part of an accountability Framework to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025, with practices in place by 2017 to meet 60 percent of the necessary pollution reductions.

Land Cover

Chesapeake Bay Watershed

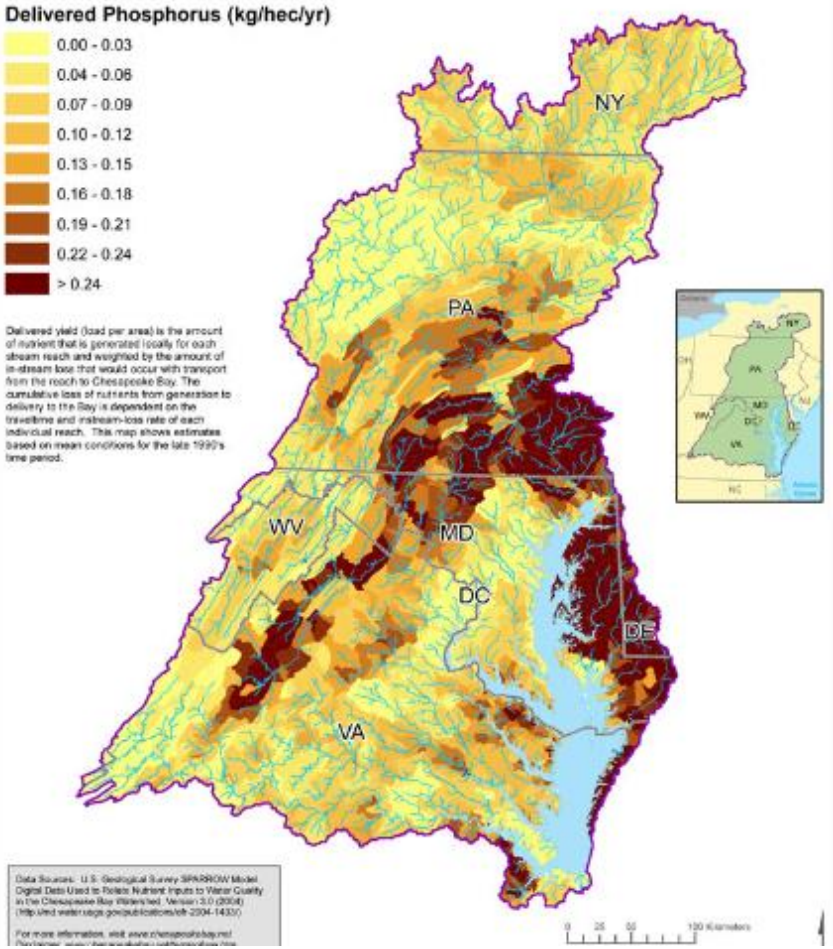
Chesapeake Bay Program
A Watershed Partnership



Agricultural Sources of Total Phosphorus

Delivered Yield to the Chesapeake Bay

Chesapeake Bay Program
A Watershed Partnership



MS4 Permits

Discharges from municipal separate storm sewer system regulations were developed and implemented in two phases.

- Implementation of the first phase began in the early 1990s and required that operators of MS4s serving populations of greater than 100,000 people (per the 1990 decennial census) apply for and obtain a permit to discharge stormwater from their outfalls.
- The second phase of MS4 regulations became effective March 23, 2003, and required that operators of small MS4s in "urbanized areas" (as defined by the latest decennial census) obtain a permit to discharge stormwater from their outfalls.

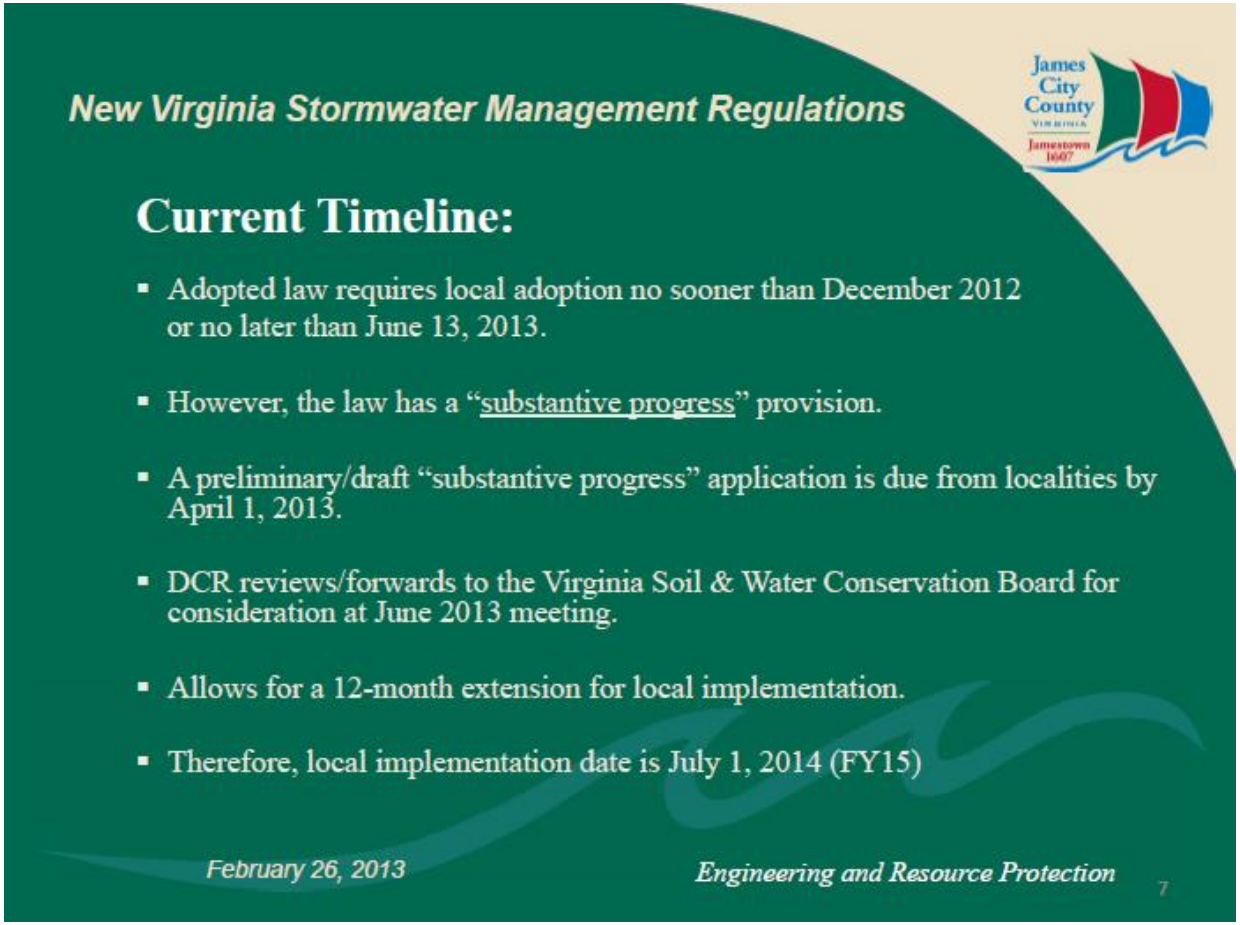
Many Federal facilities are MS4 permit holders.

MS4 Permits

- Small MS4s include storm sewer systems operated by cities, counties, towns, federal facilities such as military bases, Veteran's Affairs hospitals and research facilities, Department of Defense facilities and parkways, and state facilities such as VDOT, community colleges and public universities.

Many Federal facilities are MS4 permit holders.

Stormwater Regulations



Summer 2014.

VPDES Permit

1) Effective July 1, 2014 and expires on June 30, 2019.
2) Grandfathering: Shall remain subject to the Part II C technical criteria for stormwater for one additional state permit cycle (until June 30, 2019). After that time, portions of the project not under construction shall become subject to any new technical criteria adopted by the board.
3) Permit Reissuance
4) New SWPPP Template, Inspection Frequency
5) Discharge to TMDL/Impaired Waters/Exceptional Waters

Section 438

Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act

December 2009

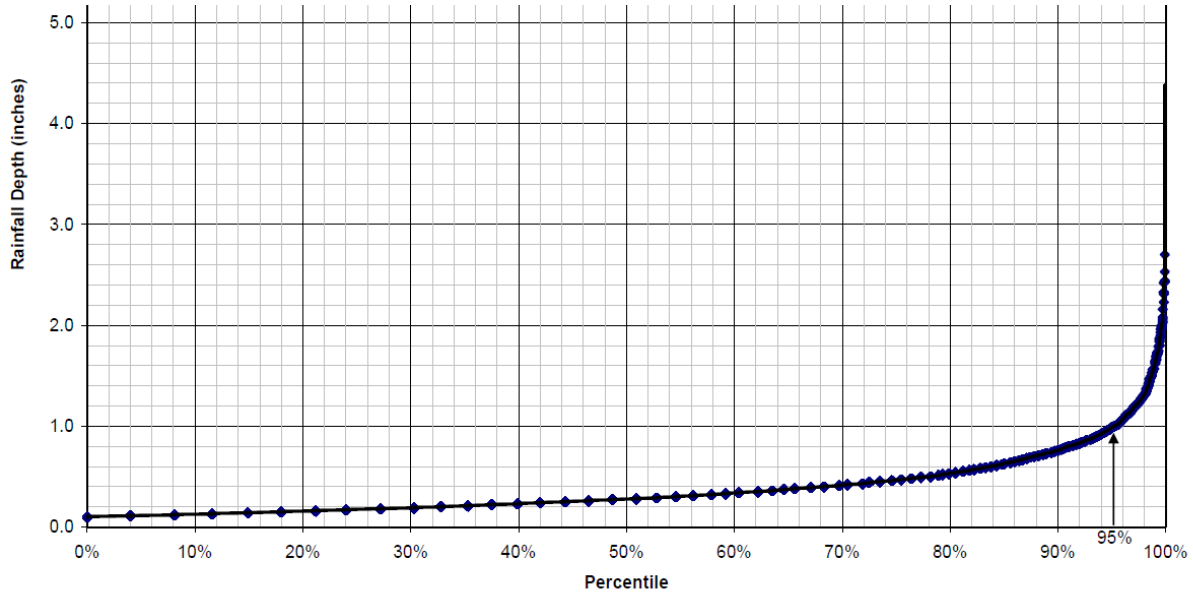


Figure 7. Rainfall Frequency Spectrum showing the 95th percentile rainfall event for Portland, OR (~1.0 inches)

Site and region specific.....

LEED Credits (SSc6.1) LEED 2009

OPTION 1. DESIGN STORMS

Select one of the following:

- (●) **Case 1.** Sites with existing imperviousness 50% or less.
- ( ) **Case 2.** Sites with existing imperviousness more than 50%.

CASE 1. EXISTING IMPERVIOUSNESS 50% OR LESS

Table SSc6.1-1. Site Runoff: One-Year, 24-Hour Design Storm

	Rate (cfs)	Quantity (cf/storm)
Predevelopment	9.12	7,219
Postdevelopment	1.71	6,125

Table SSc6.1-2. Site Runoff: Two-Year, 24-Hour Design Storm

	Rate (cfs)	Quantity (cf/storm)
Predevelopment	13.95	11,438
Postdevelopment	2.43	9,501

LEED 2009 for New Construction and Major Renovations
SS Credit 6.1: Stormwater Design - Quantity Control

- (●) **No Increase in Runoff.** The postdevelopment site runoff rate and quantity reported above does not exceed the predevelopment site runoff rate and quantity for the one- and two-year 24-hour design storms.
- ( ) **Stream Channel Protection.** The postdevelopment site runoff rate or quantity reported above exceeds the predevelopment site runoff rate or quantity. A stormwater management plan will be implemented to protect receiving stream channels from excessive erosion.

Upload SSc6.1-1. Provide a summary of the stormwater management plan to be implemented at the site, including:

1. Description of the stormwater management strategies.
2. Calculations supporting the runoff values reported above.

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LEED Credits (SSc6.2) LEED 2009

Complete the table below. List the TSS removal efficiencies for the Best Management Practices (BMPs) implemented on the project. The table will calculate the weighted TSS removal efficiency for each BMP based on the percentage of the site that the BMP treats where BMPs operate in a simple series. For more complex situations (such as two BMPs into one), either simplify the interactions to fit the table, or provide additional calculations in the Special Circumstances section of the form.

Table SSc6.2-1. TSS Removal Efficiency

BMP Type/Label	BMP Description and/or Location	In Series with BMP Above?	Percent Site Treated by BMP	TSS Removal Efficiency (%)	Source of TSS Removal Efficiency data	Weighted Average TSS Removal Efficiency (%)		
Structural	Extended Detention	N/A	90.8	90	National or regional source	81.72	+	-
Structural	Permeable Pavers	Yes	10.8	95	Manufacturer	1.03	+	-
Total weighted average TSS removal efficiency (must be at least 80%)						82.75		

☒ The BMPs listed in the table are designed to treat stormwater runoff from 90% of the average annual rainfall.

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Rainwater Management LEED V4

Path 2. 98th Percentile

Upload: Rainfall Events Calculator
Provide the completed Rainfall Events Calculator (found under the credit's "Resources" tab in the Credit Library) or equivalent documentation that demonstrates the total rainfall from the chosen percentile storm event and runoff managed on-site.

Upload: Runoff calculations
Provide calculations that demonstrate how the project team determined the total runoff volume and the volume of runoff managed by LID or green infrastructure measures.

Upload: LID documentation
Provide documents, such as specifications, plans, crossections, and details, that thoroughly depict the LID or green infrastructure techniques used.

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3 Technical Review

VA Stormwater Regulations

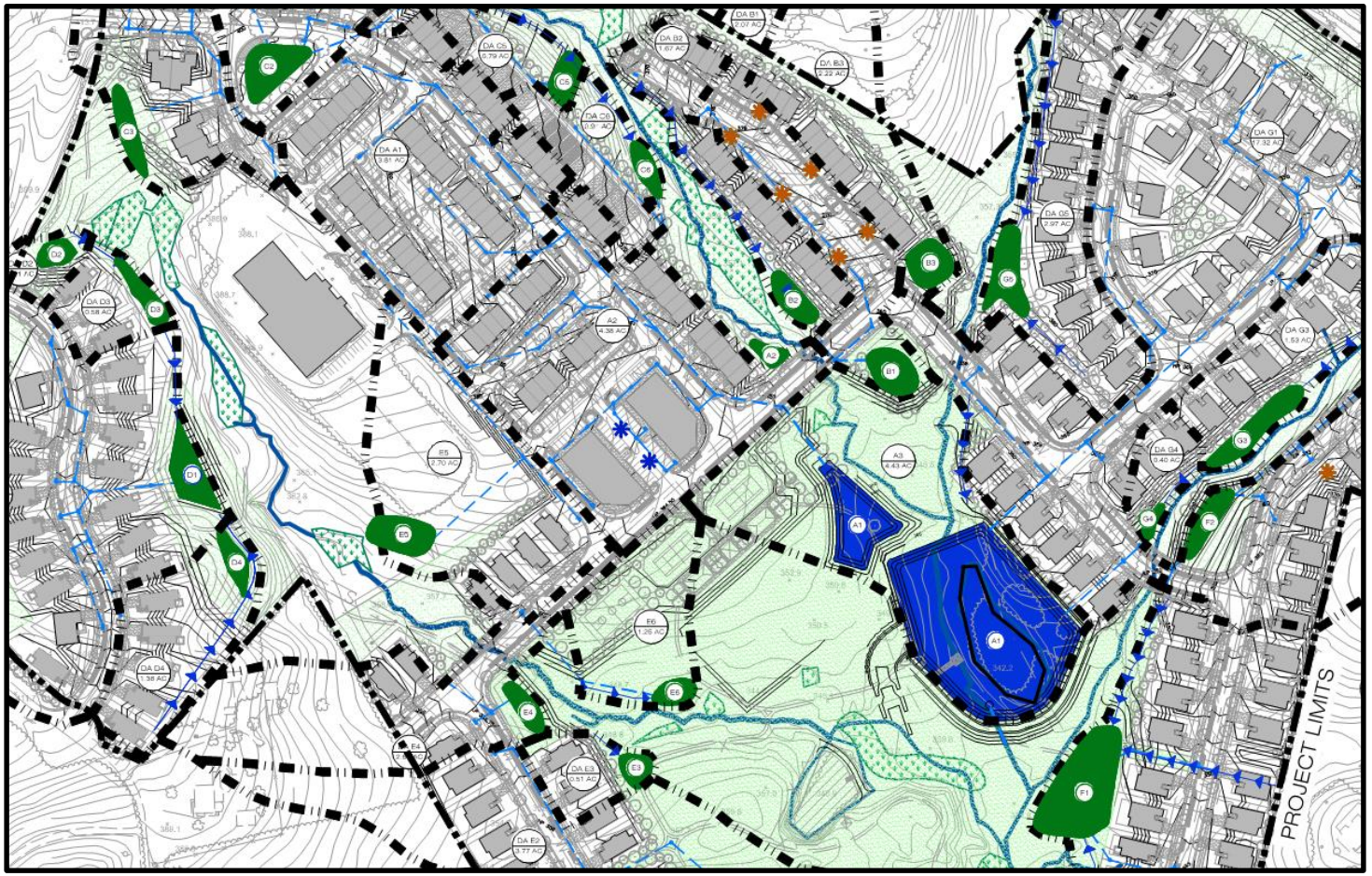
Stormwater Regulations:
Runoff Reduction Method

- **Total Phosphorus (TP)** is used as the target pollutant for compliance with proposed **Water Quality** criteria (4 VAC50-60-63 through 65). Total Nitrogen (TN) is also calculated and BMP designs address TN removal, as well as the removal of other stormwater pollutants.
- Each site also has a **Treatment Volume (Tv)**.
- Stormwater BMPs are assigned **Runoff Reduction (RR)** and **Pollutant Removal (PR)** rates. These rates vary based on the "level of design" used.

Stormwater Regulations:
Energy Balance Method

- Maximum Peak Flow Rate
- Allowable QDeveloped <
- I.F. x QPre-Developed x RVPre-Developed/ RVDeveloped

Runoff Reduction Example



Hybrid Approach

Runoff Reduction Example

TABLE 3: RUNOFF REDUCTION CALCULATIONS

DRAINAGE	NEW IMPERVIOUS	TREATMENT VOLUME	TN LOAD	TP LOAD	REQUIRED TP REDUCTION	PROPOSED TREATMENT	RUNOFF REDUCTION	TP REMOVAL	ESTIMATED TP REDUCTION
	(%)	(CU.FT.)	(LB/YR)	(LB/YR)	(LB/YR)		(%)	(%)	(LB/YR)
A1 (3.81 AC)	74	10,489	47.14	6.59	5.03 (76%)				4.94
A2 (4.38 AC)	82	12,958	58.24	8.14	6.35 (78%)				6.10
A3 (4.43 AC)	5	1,436	6.45	0.90	0.00 (0%)	LEVEL 2 WETPOND (A1)		75	0.39
A4 (33.93 AC)	0	27,096	121.79	17.02	3.11 (14%)				12.75
A5 (16.01 AC)	0	12,786	57.47	8.03	1.47 (18%)				6.02
B1 (2.07 AC)	43	4,038	18.15	2.54	1.69 (67%)	LEVEL 2 BIORETENTION (B1)	80	60	2.28
B2 (1.67 AC)	44	3,268	14.69	2.05	1.37 (67%)	LEVEL 1 WETSWALE (B2)		20	0.41
B3 (2.22 AC)	15	2,674	12.02	1.68	0.77 (46%)	LEVEL 2 BIORETENTION (B3)	80	60	1.51
C1 (0.77 AC)	18	986	4.43	0.62	0.30 (48%)	LEVEL 1 WETSWALE (C1)		20	0.12
C2 (2.44 AC)	58	5,685	25.55	3.57	2.57 (72%)	LEVEL 2 BIORETENTION (C2)	80	60	3.21
C3 (3.28 AC)	23	4,660	20.94	2.93	1.58 (54%)	LEVEL 1 WETSWALE (C3)		20	0.58
C4 (1.04 AC)	23	1,205	5.42	0.76	0.33 (43%)	LEVEL 1 WETSWALE (C4)		20	0.14
C5 (0.79 AC)	35	1,210	5.44	0.76	0.44 (58%)	LEVEL 2 BIORETENTION (C5)	80	60	0.66
C6 (0.94 AC)	37	1,489	6.69	0.94	0.55 (59%)	LEVEL 1 WETSWALE (C6)		20	0.18
D1 (5.90 AC)	32	8,407	37.79	5.28	2.86 (54%)	LEVEL 1 BIORETENTION (D1)	40	40	2.80
D2 (0.31 AC)	6	203	0.91	0.13	0.00 (0%)	LEVEL 1 WETSWALE (D2)		20	0.02
D3 (0.58 AC)	29	914	4.11	0.57	0.34 (60%)	LEVEL 1 WETSWALE (D3)		20	0.11
D4 (1.38 AC)	21	1,505	6.76	0.95	0.38 (40%)	LEVEL 1 BIORETENTION (D4)	40	40	0.32
E1 (5.30 AC)	26	6,549	29.44	4.11	1.94 (47%)	LEVEL 1 WETSWALE (E1)		20	0.79
E2 (3.77 AC)	20	4,045	18.18	2.54	1.00 (39%)	LEVEL 1 WETSWALE (E2)		20	0.48
E3 (0.51 AC)	25	628	2.82	0.39	0.19 (49%)	LEVEL 1 BIORETENTION (E3)	40	40	0.21
E4 (2.61 AC)	28	3,378	15.18	2.12	1.05 (50%)	LEVEL 2 BIORETENTION (E4)	80	60	1.83
E5 (2.70 AC)	16	8,145	36.61	5.12	4.01 (78%)	LEVEL 1 BIORETENTION (E5)	40	40	1.15
E6 (1.25 AC)	25	1,513	6.80	0.95	0.44 (46%)	LEVEL 1 WETSWALE (E6)		20	0.18
F1 (9.75 AC)	19	10,200	45.85	6.41	2.41 (38%	LEVEL 1 WETLAND (F1)		50	3.02
F2 (4.43 AC)	32	6,261	28.14	3.93	2.12 (54%)	LEVEL 2 BIORETENTION (F2)	80	60	3.41
G1 (17.32 AC)	29	27,320	122.80	17.16	10.06 (59%)	LEVEL 2 WETPOND (A1)		75	12.86
G2 (5.14 AC)	6	4,953	22.26	3.11	1.00 (32%)	LEVEL 1 WETSWALE (G2)		20	0.62
G3 (1.53 AC)	30	2,095	9.41	1.32	0.69 (52%)	LEVEL 1 WETSWALE (G3)		20	0.25
G4 (0.40 AC)	35	690	3.10	0.43	0.27 (63%)	LEVEL 1 WETSWALE (G4)		20	0.09
G5 (2.97 AC)	23	4,174	18.76	2.62	1.40 (53%)	LEVEL 1 WETSWALE (G5)		20	0.52
TOTAL	**19**	**180,960**	**813.34**	**113.67**	**55.72 (49%)**				**67.95**

RR Summary

Mixed Use Development:
Runoff Reduction Example

Land Cover Summary	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	1.00
Weighted Rv(turf)	0.22
% Managed Turf	26%
Impervious Cover (acres)	2.81
Rv(impervious)	0.95
% Impervious	74%
Total Site Area (acres)	3.81
Site Rv	0.76
Post-Development Treatment Volume (acre-ft)	0.24
Post-Development Treatment Volume (cubic feet)	10,489
Post_Development Load (TP) (lb/yr)	6.59
Total Load (TP) Reduction Required (lb/yr)	5.03

Site Results

Phosphorous

TOTAL TREATMENT VOLUME (cf)	10,489
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	5.03
RUNOFF REDUCTION (cf)	0
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	4.94
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	1.65
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	0.09

Drainage Area and BMP Specific

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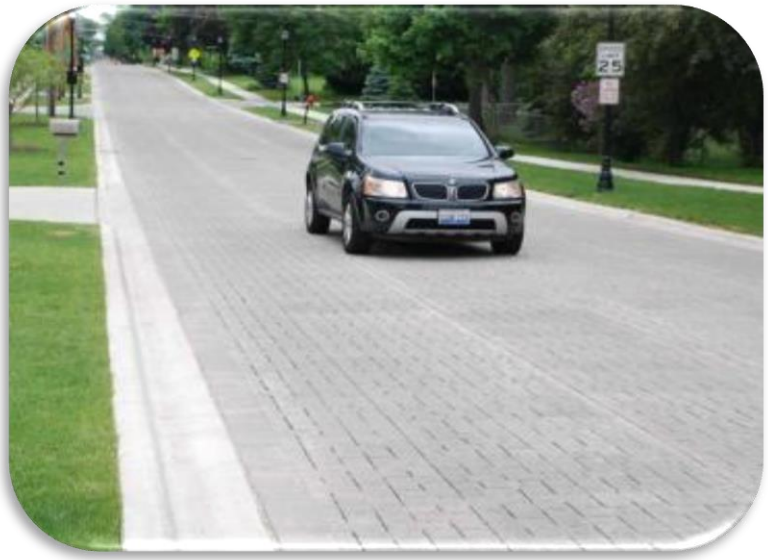
4 Best Management Practices

Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7



Summary of Stormwater Functions [1]

Stormwater Function	Level 1 Design	Level 2 Design
Annual Runoff Volume Reduction (RR)	45%	75%
Total Phosphorus (TP) EMC Reduction[1] by BMP Treatment Process	25%	25%
Total Phosphorus (TP) Mass Load Removal	59%	81%
Total Nitrogen (TN) EMC Reduction[1]	25%	25%
Total Nitrogen (TN) Mass Load Removal	59%	81%
Channel Protection	• Use VRRM Compliance spreadsheet to calculate a Curve Number (CN) adjustment[2]; ***OR*** • Design extra storage in the stone underdrain layer and peak rate control structure (optional, as needed) to accommodate detention of larger storm volumes.	
Flood Mitigation	Partial. May be able to design additional storage into the reservoir layer by adding perforated storage pipe or chambers.	

[1] Change in event mean concentration (EMC) through the practice. Actual nutrient mass load removed is the product of the removal rate and the runoff reduction rate (see Table 1 in the *Introduction to the New Virginia Stormwater Design Specifications*).

[2] NRCS TR-55 Runoff Equations 2-1 thru 2-5 and Figure 2-1 can be used to compute a curve number adjustment for larger storm events based on the retention storage provided by the practice(s).

Sources: CWP and CSN (2008) and CWP (2007)

Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Permeable Pavement Design Criteria

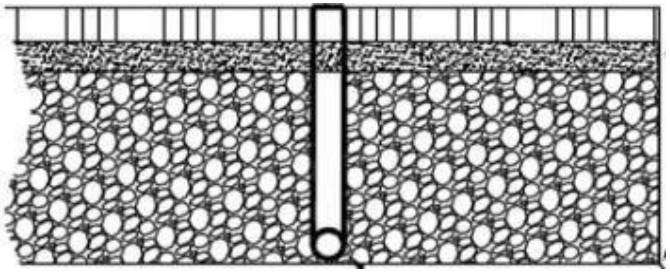
Level 1 Design	Level 2 Design
Tv_{BMP} = (1)(Rv)(A) / 12 + any remaining volume from an upstream BMP(s) [1]	Tv_{BMP} = (1.1)(Rv)(A) / 12
Soil infiltration is less than 0.5 in./hr.	Soil infiltration rate exceeds 0.5 in./hr to remove underdrain requirement, or a drawdown design in accordance with **Section 6**.
Underdrain required	1. No underdrain; ***OR*** 2. If an underdrain is used, a 12-inch (minimum) stone reservoir infiltration sump below the underdrain invert that meets the drawdown requirements of Section 6 must be provided; ***OR*** 3. The Tv stone reservoir volume has at least a 48-hour drain time, as regulated by a control structure.
CDA[1] = The permeable pavement area plus upgradient parking, as long as the ratio of external contributing area to permeable pavement does not exceed 2:1.	CDA = The permeable pavement area;

[1] The contributing drainage area to the permeable pavements should be limited to paved surfaces in order to avoid sediment wash-on, and. When pervious areas are conveyed to permeable pavement, sediment source controls and/or pre-treatment must be provided. The pre-treatment may qualify for a runoff reduction credit if designed accordingly.

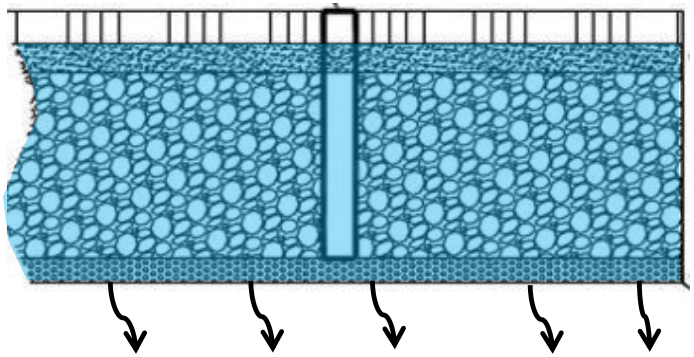
Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

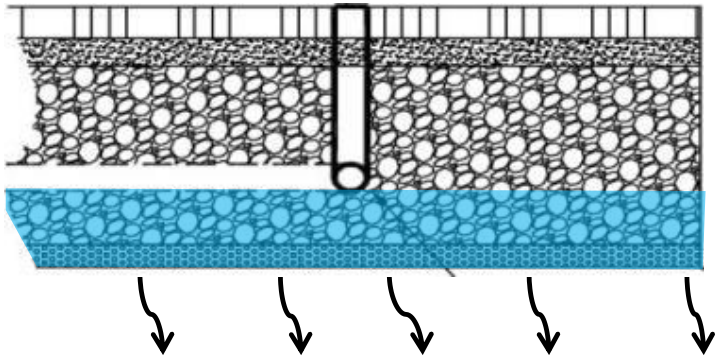
Level 1



Level 2 (infiltration)



Level 2 (infiltration sump)



Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Type of pavement materials

Concrete Grid Pavers

Pervious Concrete

Porous Asphalt

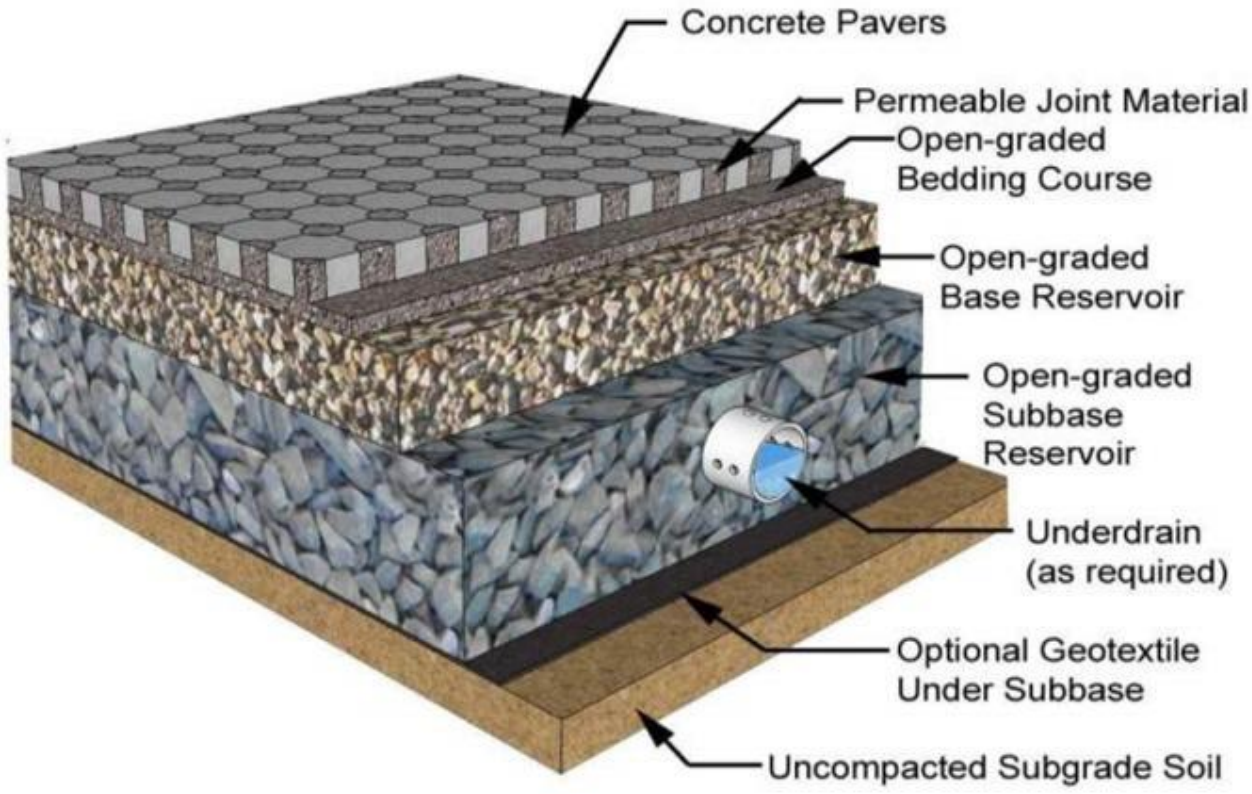
Permeable Interlocking Concrete Pavers

Pervious Composites

Permeable Rubber Overlays

Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7



Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

- **Key Design Consideration:** stone reservoir depth, d_p

$$d_p = \frac{\left\{(d_c \times R) + P - (i/2 \times t_f)\right\}}{V_r}$$

Where:

d_p = Depth of the stone reservoir layer (ft.)

d_c = The depth of runoff from the contributing drainage area (not including the permeable paving surface) for the Treatment Volume (Tv/A_c), or other design storm (ft.)

R = A_c/A_p = The ratio of the contributing drainage area (A_c, not including the permeable paving surface) to the permeable pavement surface area (A_p)

P = The rainfall depth (in feet) for the Treatment Volume (Level 1 = 1 inch (0.08 ft); Level 2 = 1.1 inch (0.09 ft)) or other design storm

i = The field-verified infiltration rate for native soils (ft./day)

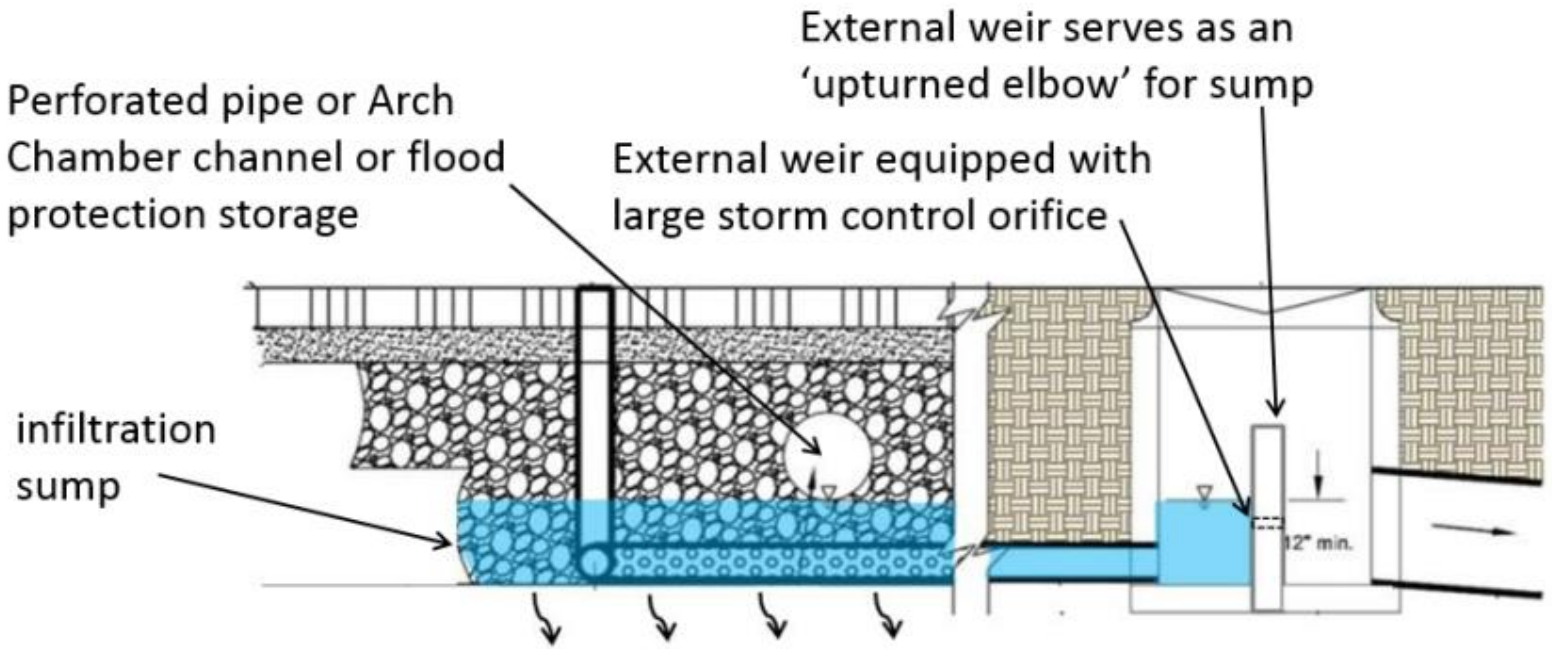
t_f = The time to fill the reservoir layer (day) – typically 2 hours or 0.083 day

V_r or η_r = Porosity (or void ratio) of reservoir layer (0.4)

Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Key Design Consideration: 'Upturned Elbow'



Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Key Design Consideration: External Drainage Areas

- **The maximum external drainage area is limited to ratio with area of permeable pavement: 2:1**

- In all cases, external drainage areas should be limited to impervious surfaces to reduce potential sediment loading

Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Key Design Consideration: Pavement Structural Design

Thickness of permeable pavement and reservoir layer must be sized to support structural loads

Four primary design elements:

- Anticipated traffic loads
- Underlying soil properties
- Environmental/climate factors
- Surface, bedding, and reservoir strength coefficients and layer thicknesses (strength coefficients vary for materials used)

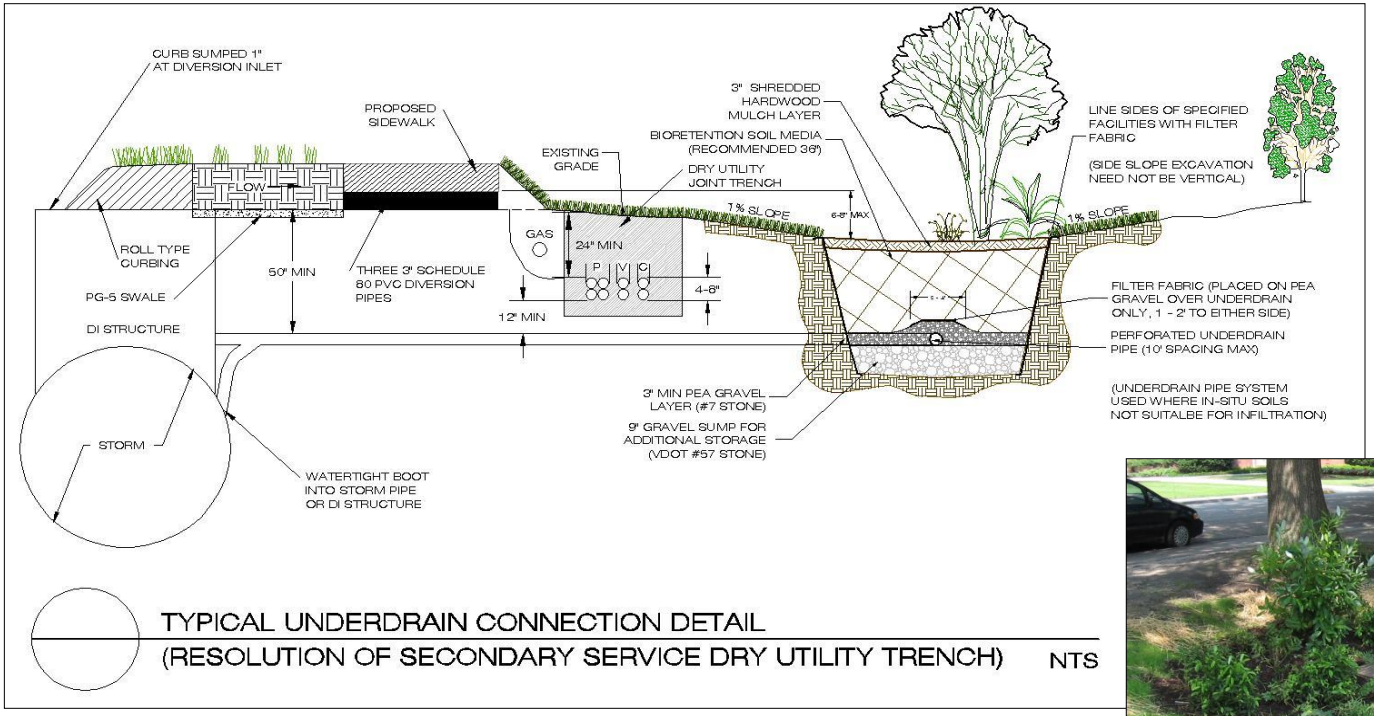
Permeable Pavement

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7

Key Design Consideration: Maintenance Agreements

Permeable Pavement (like all BMPs) must have a maintenance agreement, and should include provisions for owner awareness of routine (frequent) and infrequent maintenance requirements.

Integrated Management Practice:
Biofiltration



Site Design Techniques:
Architectural Green Roofs

Orkny Isles of Scotland – 2500 B.C.

Hanging Gardens – 500 B.C.

Vidimyri Church – 1834

Incas, Peru – 1450

Kansas Prairies – 1903

Clam House - 2001

"Evolution of a Historic Technology"

Site Design:
Green Roofs

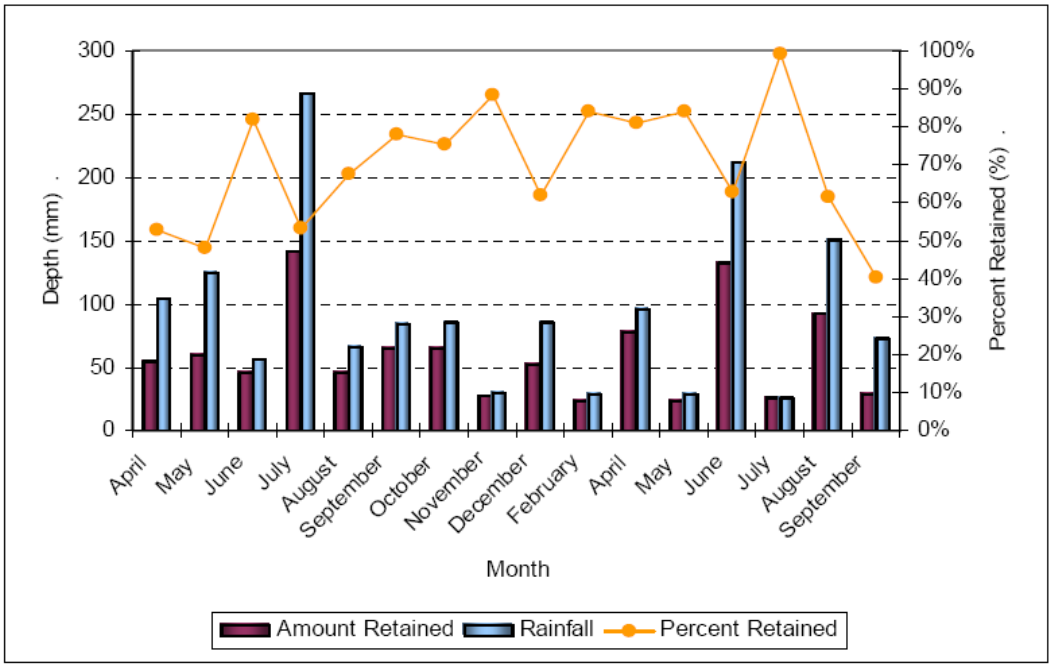
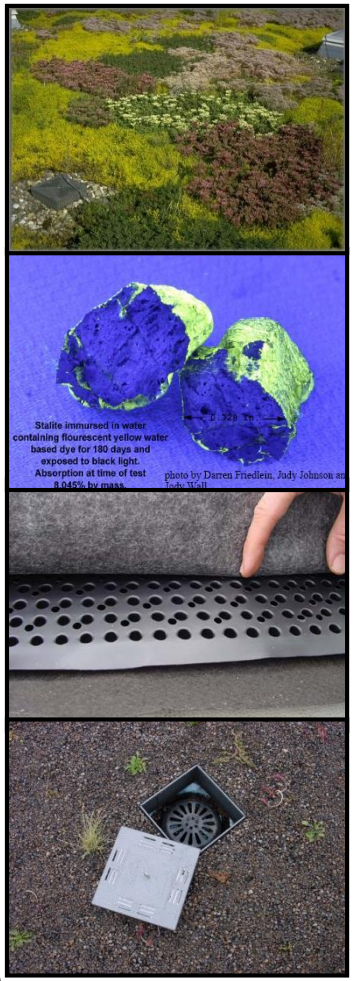


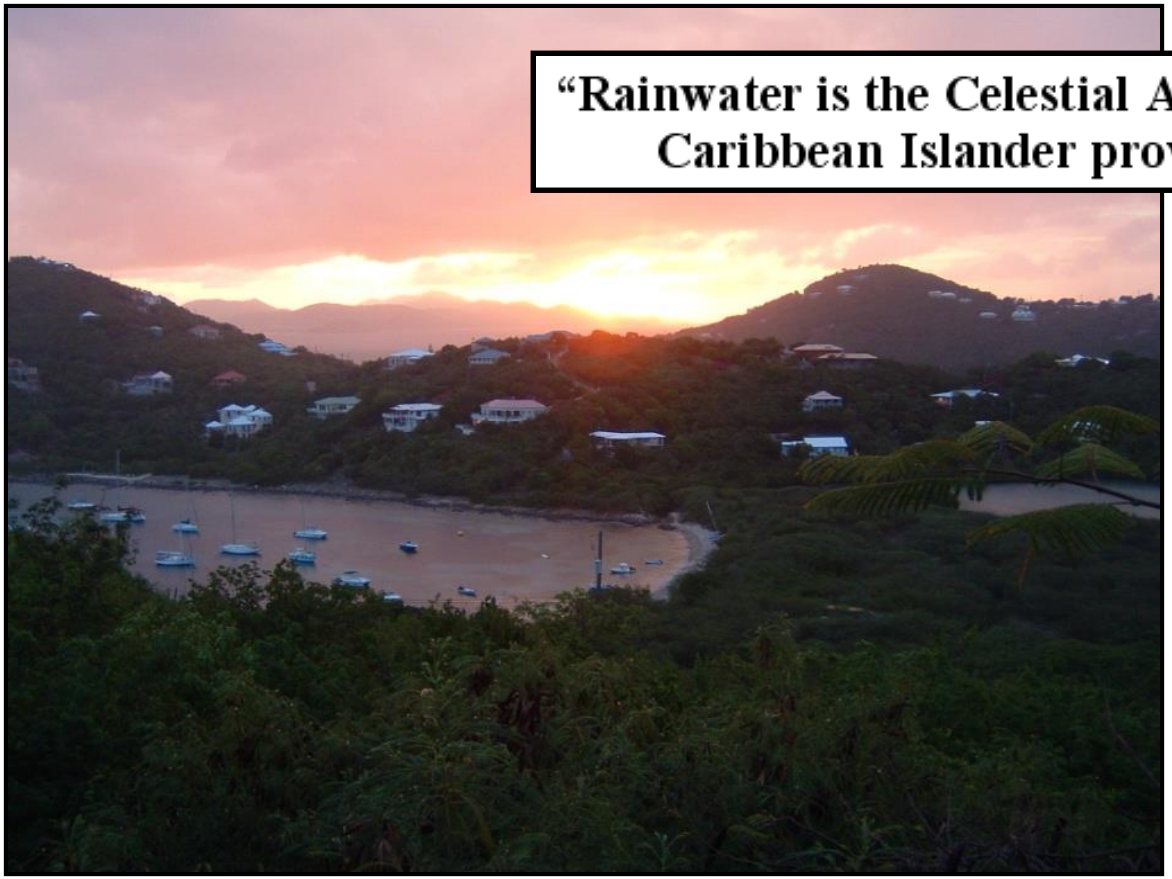
Figure 4: Monthly retention rates at WCC green roof from April 2003 to September 2004.



Source: Test Results - NC State: "Hydrologic & Water Quality Performance From Greenroofs in Goldsboro and Raleigh." (Extensive: 3 inch depth, Sedum album)

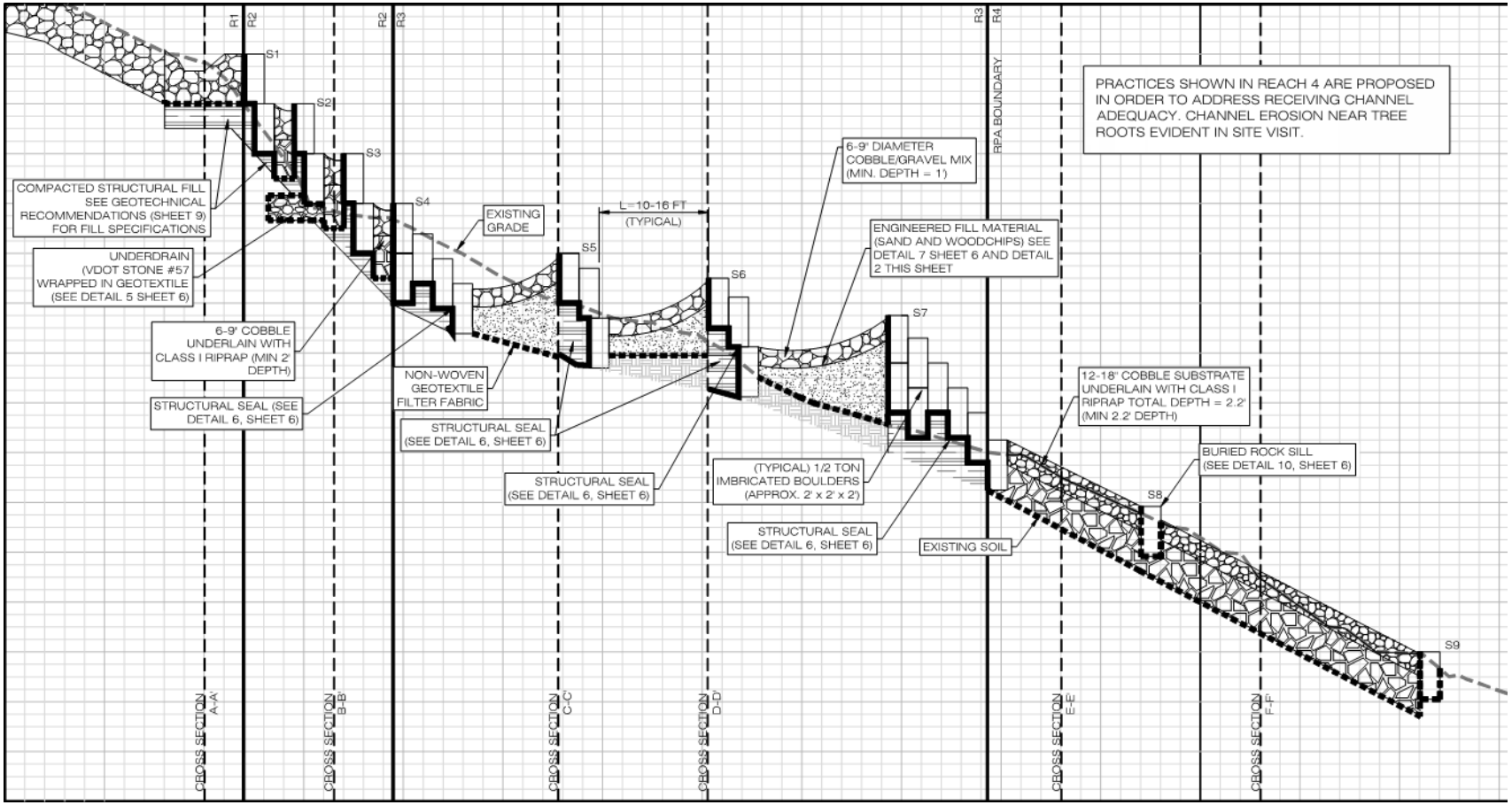
Note: Relationship and Importance of rainfall patterns, intensities etc.

Rainwater Harvesting



St. Thomas: United States Virgin Islands

Regenerative Techniques



Engineered Soil Medium, EPA Protocols

Stantec

Regenerative Techniques

Engineered Soil Medium, Swale Design,
BANCS

Restoration and Nutrient Banking

WEG (now Stantec) is a leader in Ecosystem Banking with unparalleled experience in design of mitigation compensation areas.

- 1,000 miles of stream assessment
- 30,000 acres of wetland mitigation assessment and feasibility
- ~ 41.93 lbs of Total Phosphorus reduction generated/certified on the Virginia Nutrient Credit Exchange; WEG employee serves on the Nutrient Credit Exchange Study Committee

...WEG (now Stantec) has entitled 20 mitigation banks with 7 additional banks nearing final approval

Stantec

5 Case Studies

…team of exceptional professionals with extensive experience supporting federal clients in their efforts to achieve objectives

Stantec

Undisclosed DoD Location

WEG (now Stantec) is providing on-going environmental engineering, LID, BMP, and planning support at this 1000+ acre Department of Defense (DoD) location

- Stormwater and Pollution Prevention
  - Total Maximum Daily Load (TMDL)
  - Municipal Separate Storm Sewer System (MS4)
- Living Shoreline (Innovative Design Approach)

...WEG (now Stantec) is integrating Low Impact Development (LID) design and practices without disrupting everyday activities

Ft Belvoir - History

Full service inventory and inspection

- What is on base and what is the current performance?
- Integrated GIS database
- User Friendly decision making
- MS4 Documentation

...WEG (now Stantec) is currently under contract

Upper Machodoc Creek
NSF Dahlgren

WEG (now Stantec) is providing stormwater retrofit and constructed wetlands for a 6-acre project area on this Naval Support Facility.

- Designs are compliant with:
  - Current State Standards
  - Section 438
  - Executive Order 13514
- Innovative retrofitting for nutrient reduction with habitat component

...WEG (now Stantec) has provided detailed stormwater BMP and LID engineering services for NAVFAC

FBI Building

WEG (now Stantec) pursued a Design Build contract as part of a team proposing on this LEED Gold Facility

- Security Buffer
- “Covered” Parking
- Meet SFO & POR
- GSA Design Excellence Program

… renderings prepared by Skanska and SOM

U.S. Virgin Islands

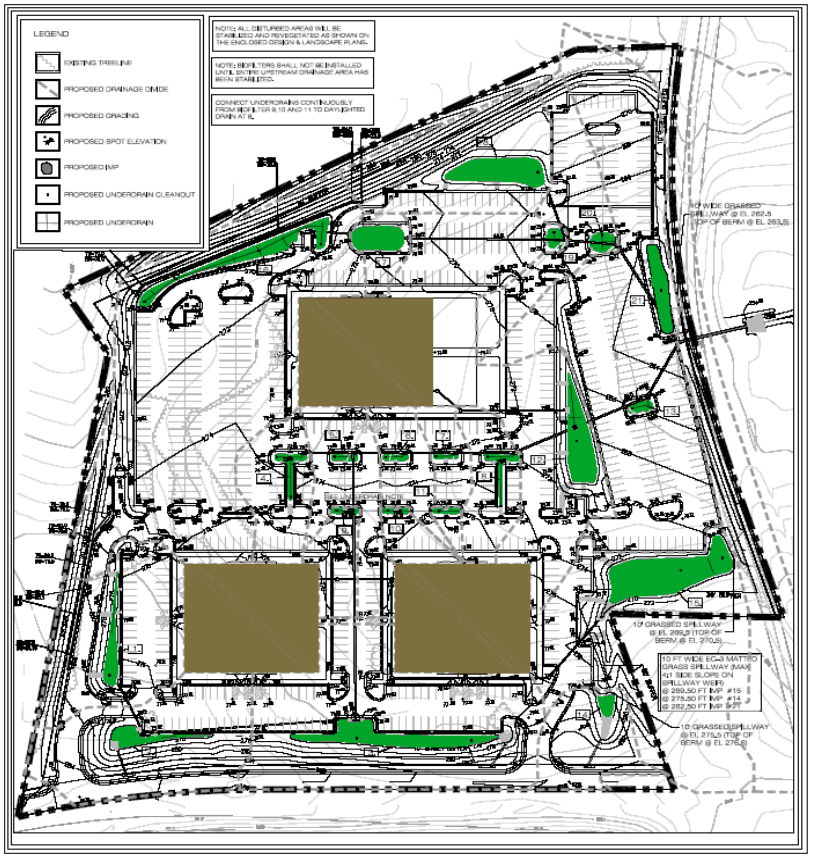
- WEG (now Stantec) is part of a team providing sustainable and innovative building design using green development techniques.
- Design plans included:
  - Bioswales
  - Permeable Pavements
  - Rainwater Harvesting
  - Photovoltaics
  - Local Building Materials
  - Recycled Products
  - Innovative Wastewater Technologies
  - Daylighting Strategies
  - Climate Needs

... registered with the United States Green Building Council for the Leadership in Energy and Environmental Design (LEED) program and is considering Gold Level Certification.

Stantec

Development/Re-Development

15 Acre Site, ½ Acre IMPs, ($20/S.F.)*



Reclaimed area for a third building

Thank you

Questions?

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