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DoD Chesapeake Bay Program Journal

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PROTECTING THE CHESAPEAKE BAY FOR MILITARY READINESS, FOR OUR COMMUNITY, FOR FUTURE GENERATIONS

# DoD Regional Environmental Office Welcomes Trevor Manning

*By Stephanie MacDurmon, Brown and Caldwell*

The Department of Defense (DoD) Regional Environmental Coordination (REC) office in Norfolk, VA is pleased to welcome Trevor Manning as its Outreach Coordinator and Air Compliance Senior Program Manager. Mr. Manning brings an extensive and varied environmental compliance and resourcing background to this position.

Mr. Manning received a bachelor's degree from Virginia Polytechnic Institute and State University and a master's degree from Virginia Commonwealth University. In 2000, Mr. Manning started his career as an environmental scientist at a consulting firm in Virginia Beach where he focused on National Environmental Policy Act (NEPA) and wastewater compliance.

From 2002 to 2007, Mr. Manning worked for several environmental consulting agencies where he managed compliance inspections, implementation of the Emergency Planning and Community Right-to-Know Act, pollution prevention, and sustainability initiatives. He also supported management of air permit compliance and environmental management system integration.

Mr. Manning has been employed by the Naval Facilities Engineering Command (NAVFAC) in various capacities since 2011. During his NAVFAC tenure, he was the EMS Program Manager for NAVFAC Mid-Atlantic and NAVFAC Atlantic. In that role, he managed the EMS program and led the external environmental audit at a subset of nearby installations. In 2012, Mr. Manning transferred to Naval Weapons Station Yorktown as the Installation Environmental Program Director. From 2015 to 2018, Mr. Manning served as the environmental resources and assessments product line leader for NAVFAC Europe, Africa, and Southwest Asia in Naples, Italy.

In 2018, Mr. Manning and his family, his wife, son, and daughter, returned to the Norfolk area, and he started in his new role at the DoD REC office in October 2018. He is an avid golfer and traveler. In his spare time, you might find him on the links or on a train to a new destination. Mr. Manning also enjoys spending time with family and friends on or near the water and watching soccer and college sports.

Having a full staff in the REC office will be a tremendous benefit as the Chesapeake Bay Program Partnership (Partnership) and jurisdictions lay out their Phase III Watershed Implementation Plans (WIP). Because great progress has already been seen, in this issue we wanted to highlight the current status of the Chesapeake Bay's health as it relates to the key indicators found in the Chesapeake Bay Watershed Agreement. It's important that all Partners, including the DoD, maintain momentum. We also explore how the DoD can implement best management practices that offer cost-effective and strategic benefits since nutrient and sediment reduction will be a key challenge developed communities face in the coming years. Keeping our eye on the prize and looking ahead to 2025, whether it be for future generations, economics, or the sustainment of the military, the mission will foster opportunities and grow innovation.

PHOTO BY TREVOR MANNING

*Mr. Manning and his family are shown here visiting Siena, Italy.*

## IN THIS ISSUE

# Celebrating 35 Years of Commitment to the Bay

*By Stephanie MacDurmon, Brown and Caldwell*

The progress achieved through the 2017 midpoint of the Chesapeake Bay total maximum daily load (TMDL) represents decades of cumulative effort by partners in the Chesapeake Bay watershed. The effort first began with leaders recognizing the Chesapeake Bay's declining health, prompting the 1983 Chesapeake Bay Agreement. This month we celebrate the Agreement's 35th anniversary. The document was signed by the representatives from the jurisdictions of Maryland, Virginia, and Pennsylvania; Washington, D.C.; the Environmental Protection Agency; and the Chesapeake Bay Commission on December 9, 1983. The Agreement outlined the negative impact of pollution in the Bay and proposed coordinated action for improvement. The latest Chesapeake Bay Watershed Agreement, signed in 2014, identifies a range of desired results for the restoration of the Bay. As one of the first federal agencies to become formally involved in the Chesapeake Bay restoration in 1984, DoD has been an engaged partner in the Chesapeake Bay restoration effort. Since the early 1990s, we strengthened our participation and role by linking DoD environmental initiatives to the EPA's Chesapeake Bay Program. The DoD CBP joins the Partnership in celebrating 35 years of commitment to the Bay.

PHOTOS BY CBP.

*The first Chesapeake Bay Agreement was signed at George Mason University in Fairfax, Virginia on December 9, 1983.*

## The Partnership Today

Today, the Chesapeake Bay Program Partnership encompasses dozens of organizations, including:

- 19 federal agencies (including DoD)
- Nearly 40 state agencies and programs from the Chesapeake Bay jurisdictions (Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and District of Columbia)
- Approximately 1,800 local governments
- More than 20 academic institutions
- More than 60 non-governmental organizations

These organizations support the Chesapeake Bay Program by providing their expertise, perspective, and effort to a variety of committees, work groups, and teams within the CBP structure. The broad engagement of partners across the watershed is an important element of the CBP's success and the achievement of environmental results. DoD representatives are actively involved in the Federal Facilities Workgroup and other bodies within the Partnership.

# State of the Bay: Reviewing the Status of Key Indicators of Bay Health

*By Stephanie MacDurmon, Brown and Caldwell*

The 2014 Chesapeake Bay Watershed Agreement outlines overarching goals for the restoration and protection of the Chesapeake Bay. Each goal includes either qualitative or quantitative outcomes that are used to assess if the goal has been met.

Annually, the Partnership publishes collective efforts on Chesapeake Progress (**https://www.chesapeakeprogress.com/**) a website that details each outcome and its current status. In addition, Chesapeake Progress documents the funding reported through the Office of Management and Budget as part of the Chesapeake Bay Accountability and Recovery Act of 2014. According to the latest report, in fiscal year (FY) 2017, federal agencies invested nearly $570 million in watershed improvements.

For FY2017, DoD installations reported over $80 million of funding for projects that provided benefits to the Bay. Continuing the work that began in 1983, the Partnership and DoD are committed to a cleaner Bay for current and future generations. The highlights below demonstrate what has already been achieved by the Partnership and DoD through 2017, as measured by Chesapeake Progress and the results of the 2016-2017 DoD two-year work plan.*

## Progress for the Bay & DoD Through 2017

### Water Quality

**Chesapeake Progress:** Pollution loads in the Bay watershed have declined by 11% for total nitrogen (TN), 21% for total phosphorus (TP), and 10% for sediment or total suspended solids (TSS). These reductions represent 36%, 87%, or 67% of the respective goal for TN, TP, and TSS, respectively.

**DoD Progress:** DoD performed an internal Midpoint Assessment (MPA) to evaluate the reductions of TN, TP, and TSS. The results indicate the DoD installations across the Bay watershed met their goals for total phosphorus and sediment reductions but did not reach the midpoint TN goal.

### Protected Lands

**Chesapeake Progress:** Data collected in 2016 showed that over 1 million acres of land have been permanently protected from development since 2010. This marks an achievement of 50% of the land conservation goal.

**DoD Progress:** DoD tracks the acres of priority landscapes protected around DoD installations through the Readiness and Environmental Protection Integration (REPI) program. Through FY2017, DoD installations have protected 27,478 acres.

### Wetlands

**Chesapeake Progress:** Between 2010 and 2015, 7,623 acres of wetlands were created or re-established on agricultural land. This represents 9% of the 83,000-acre goal.

**DoD Progress:** DoD tracks and shares information on wetland restoration and delineation projects completed at installations. Since tracking started in 2011, the reported acreage of wetlands at DoD installations has increased by 15,953 acres. The notable increase is the product of efforts by installations to restore and track wetlands.

### Public Access

**Chesapeake Progress:** There are now 1,292 public access sites in the Chesapeake Bay. Since 2010, 153 public access sites have been opened on or around the Chesapeake Bay.

**DoD Progress:** The definition of "public access" is slightly different for DoD due to security reasons. Installations do maintain and upgrade public access sites for the military, their families, and the DoD civilian community. Across the Bay watershed there are 197 DoD public access sites for boating, fishing, hunting and hiking.

### Oysters

**Chesapeake Progress:** In Maryland, 716 acres of oyster reefs have been restored, with another 222 acres remaining. In Virginia, 480 acres of oyster reefs have been restored, with another 66 acres remaining.

**DoD Progress:** DoD tracks oyster restoration efforts at five installations throughout Virginia and Maryland. Installations have maintained ongoing partnerships with Maryland Grows Oysters, the Elizabeth River Project, and the Chesapeake Bay Foundation to grow oysters and increase their population in key tributaries.

### SAV

**Chesapeake Progress:** For the first time in modern history, SAV covers more than 100,000 acres, which is 57% of the goal established by the CBP.

**DoD Progress:** DoD tracks the abundance of SAV at installations and provides secure access to military airspace for SAV surveys performed by the Virginia Institute of Marine Science. Since tracking started in 2011, the reported acreage of SAV at DoD installations has increased by 1,200 acres.

**Chesapeake Progress results were collected in November 2018.*

# Counting the Cost: How Stormwater BMPs "Co-Benefit" the Chesapeake Bay Restoration Effort

*By Stephanie MacDurmon, Brown and Caldwell*

There are multiple strategies that can be used to develop Phase III WIPs and reduce the delivery of nutrients and sediment to the Chesapeake Bay. Those strategies primarily involve the implementation of programmatic and structural stormwater best management practices (BMPs). However, those same BMPs used to improve water quality can also provide improvements and services to the nearby ecosystem and natural environment. The Partnership refers to these secondary improvements as "co-benefits." It's well known that installations have multiple priorities that often have to compete with each other due to limited resources. The priorities can include mission readiness, health and safety, environmental compliance, infrastructure improvement, and natural resources management. Therefore, evaluating where programs overlap is vital and necessary to leverage dollars and save money. In the case of stormwater management, expanding the mindset from implementing "BMPs just for water quality" to considering more robust concepts will shed light on how BMPs "co-benefits" overlap and meet multiple priorities of the installation. As a result, installations have the ability to leverage dollars and save money.

PHOTO BY CBP.

*Urban forest buffers have a high BMP impact score in categories such as stream health, tree canopy, and habitat.*

To understand the extent of BMP co-benefits, the Partnership conducted an extensive literature review of certain BMPs. The review identified the range and value of co-benefits for BMP categories available in the Phase 6 Chesapeake Bay Watershed Model (Bay Model). This effort resulted in the development of a scoring matrix that describes how each type of BMP impacts other outcomes within the Chesapeake Bay Watershed Agreement.

## BMP Impact Scores

As jurisdictions begin selecting suites of BMPs to include in their Phase III WIPs, impact scores were developed to assist in understanding the BMPs' co-benefits. The score measures the relevant value of a BMP to one of 28 co-benefits (see call-out box on right margin). Even at a small scale, the resulting matrix of impact scores can help decision makers optimize the outcome from BMP implementation. Using BMP impact scores, environmental managers can narrow a long list of potential BMPs to those that offer the most strategic, the largest number, or the most valuable co-benefits and outcomes that align with their individual agendas or missions.

### The 28 Co-Benefit Categories:

**Fostering Stewardship:**
Citizen Stewardship*
Protected Lands*

**Habitat:**
Biodiversity & Habitat
Black Ducks
Brook Trout
Fish Passage*
Stream Health
Submerged Aquatic Vegetation*
Wetlands*

**Maintain Healthy Watersheds:**
Healthy Watersheds
Land Use Methods & Metrics

**Sustainable Fisheries:**
Blue Crab Abundance
Fish Habitat*
Forage Fish
Oysters*
Air Quality

**Water Quality:**
Bacteria Loads
Climate Adaptation
Drinking Water Protection/Security
Economic Development/Jobs
Energy Efficiency
Flood Control/Mitigation
Forest Buffers
Groundwater Recharge/Infiltration
Property Values
Recreation
Toxic Contaminants
Tree Canopy*

*Goals supported by DoD work

Because the matrix was designed to assist with the development of jurisdiction WIPs, its inputs were adapted from two Bay-specific sources: the Bay Model and 2014 Bay Agreement. The CBP used a subset of the BMP types in the Bay Model for the matrix and selected 18 strategies from the 2014 Bay Agreement as "co-benefits" to develop impact scores. They also identified ten other co-benefits important to communities and watershed health that were not included in the Bay Agreement. In total, impact scores were assigned for 28 co-benefit categories. For each co-benefit important to communities and watershed health, the CBP developed guidelines and narrative criteria for scores ranging from -5 to 5. The score indicates the extent to which a BMP contributes to (positive value) or undermines (negative value) the management strategy.

## Management Strategy Fact Sheets

The CBP also developed a series of fact sheets for 12 of the 28 co-benefits to support Phase III WIP development. The fact sheets include a description of the importance of the management strategy, optimal BMPs that best address specific objectives, and guidance on how to incorporate the management strategy in WIP development and implementation. They also provide a snapshot of the BMPs with the greatest impact for that management strategy. Included below is an example matrix for BMPs that achieve stream health benefits. Using this example, agricultural stream restoration provides the greatest benefit for Stream Health. The table also highlights several urban BMPs, including urban forest buffer and stream restoration. The fact sheets can also be useful for planners and natural resource managers considering conservation practices in the context of their own particular restoration or protection efforts.

Decision makers should be aware of BMP impact score limitations. The scores do not account for cost-effectiveness or site-specific factors that might impact a BMP's co-benefit effectiveness. Additionally, the scores are not directly proportional to the relative impact of a BMP. For example, a BMP with a score of 4.0 is not twice as effective as one with a score of 2.0. Furthermore, the scores are not comparable across goal categories; they are relative values within the category. A BMP with a score of 4.0 for tree canopy and a BMP with a 4.0 for air quality do not necessarily provide equivalent contribution to their categories.

| | BMP Impact Score by Co-Benefit | | | | | |
|---|---|---|---|---|---|---|
| Best Management Practice | Stream Health | Brook Trout | Healthy Watersheds | Forest Buffers | Flood Control/ Mitigation | Protected Lands |
| Ag Stream Restoration | 5.0 | 3.0 | 1.0 | 1.0 | 0.0 | 1.0 |
| Alternative Water System | 5.0 | 2.0 | 3.5 | 1.0 | 0.0 | 1.0 |
| Forest Harvesting Practices | 4.0 | 2.0 | 3.5 | 3.5 | 2.5 | 0.5 |
| Forest Conservation | 4.0 | 4.0 | 5.0 | 4.0 | 3.5 | 5.0 |
| Ag Forest Buffer | 4.0 | 4.0 | 4.0 | 5.0 | 3.5 | 3.5 |
| Urban Forest Buffers | 4.0 | 5.0 | 3.5 | 5.0 | 3.5 | 3.5 |
| Urban Stream Restoration | 3.5 | 4.0 | 4.0 | 3.5 | 3.5 | 3.5 |

*The figure above shows a matrix of impact scores of certain BMPs that contribute most to the co-benefits associated with Stream Health. Source: Stream Health Fact Sheet.*

### How to use the scores?

Within a category, the highest score indicates the BMP with the greatest impact for that co-benefit. In that way, the matrix allows decision makers to compare the value of BMP types based on a secondary environmental objective. What if you want to prioritize one co-benefit over another? If Flood Mitigation/Control is an important service to consider for a potential BMP, add +1 to all scores in the Flood Control/Mitigation column and re-evaluate the best BMP across all categories. With that change, Urban Stream Restoration is a more competitive option across multiple co-benefit categories in the example above.

## Relevance for DoD

At DoD installations, BMPs are typically implemented to fulfill regulatory requirements for water quality. Building BMPs with co-benefits into Phase III WIPs may increase support for those strategies by prioritizing secondary objectives that achieve other outcomes, like Integrated Natural Resources Management Plan objectives. Using BMP impact scores and their associated fact sheets is a great way to compare BMPs, understand their potential for collateral improvements, and select strategies that simultaneously achieve water quality and installation natural resources objectives for the restoration of the Chesapeake Bay. For a PowerPoint on co-benefits and copies of the fact sheets, go to **https://www.chesapeakebay.net/what/publications/27666.**

# Urban Nutrient Management Plans in Action

*By Stephanie MacDurmon, Brown and Caldwell, with input from Ron Holcomb, JBLE and Alaina Armel (AECOM) on behalf of MCB Quantico*

In 2018, the Department of Defense Chesapeake Bay Program (DoD CBP) developed a 2025 Implementation Plan, outlining one potential strategy for DoD installations in Maryland, Virginia, Pennsylvania, and Washington, D.C. to meet their federal facility water quality targets. As part of that plan, both programmatic and structural BMPs were considered. The amount and type of remaining reductions projected by the DoD CBP and Partnership influenced the BMPs selected for future implementation. More specifically, the DoD CBP recognized through the Partnership's MPA that significant reductions of TN would be necessary if each of the jurisdictions are to meet their 2025 Planning Targets.

For consistency with the Partnership, the DoD CBP reviewed the "Everything Everywhere by Everyone" (E3) scenario that represents the maximum extent practicable implementation of BMPs in the Chesapeake Bay for the developed sector. The E3 scenario also specified the type and extent of the E3 BMPs. From that suite, the DoD CBP investigated urban nutrient management (UNM) plans and runoff reduction BMPs. UNM plans were an attractive option due to their relatively low cost (no structural components), ease of implementation, and high reductions for TN.

The choice of UNM plans was also supported in that the Bay Model automatically adds nutrient loads from fertilization to certain types of land cover. In the Phase 5.3.2 version of the Bay Watershed Model, all pervious acres received uniform fertilizer inputs. In the Phase 6 Bay Model, applications of fertilizer in the Urban land cover group are based on the reported turf acres. During development of the Phase 6 Bay Model, federal facilities had the opportunity to revise each facility's turf acres, which would have more accurately characterized where fertilizer is applied. However, federal facilities provided limited input due to knowledge gaps. Many federal facilities also were not aware of the implications of their response in the Bay Model. Therefore, the Phase 6 Bay Model likely overestimates federal and DoD turf acres and leads to increased nutrient loads from DoD installations (regardless of whether those areas are actually fertilized). Based on this information, UNM plans were a logical choice for future BMP implementation to meet federal facility targets.

Upon development of this article and additional research about how UNM plans are reported to and by jurisdictions, questions arose about who (if anyone) may receive credit for UNM plans. We explore this question and some of the issues to consider as the DoD CBP provides guidance to installations on the best approaches to meet stormwater compliance and revised 2025 federal agency planning goals.

PHOTO BY SESILIA KHOE, RELEASED ON FLICKR, AND CROPPED BY DOD CBP.

*Turf areas include managed grass surfaces, like athletic fields, golf courses, lawns. The Bay Model assumes these areas are fertilized.*

## State-Specific Regulation and Requirements

It seems as though jurisdiction regulations impact if an installation can receive credit beyond permit compliance and how much credit non-regulated installations or portions of non-regulated lands on an installation can receive. In the cases of Maryland and Virginia, they appear to limit TMDL credit for UNM implementation in their states, but what is not clear is how the UNM plans developed for permit compliance are accounted for in the Bay Model and who should actually receive credit for their implementation.

**Maryland** regulates individuals and companies that apply fertilizer to 10 or more acres of non-agricultural lands. As a result, urban land managers are required to conduct soil tests and document compliance with the University of Maryland Extension recommendations. The Fertilizer Act of 2011 (effective October 1, 2013) specifies limits and criteria for the application of nutrients to managed lawns and landscaped areas by certified commercial applicators and do-it-yourself applicators. As a result of the state regulation, localities do not receive credit for UNM plans, and UNM plans are not included in the BMP reporting spreadsheet from the Maryland Department of the Environment. This is supported by a closer evaluation of the BMP inputs provided by Maryland to the Bay Model. The state of Maryland receives credit for implementation of UNM across a significant portion of the state's available land area. Therefore, because state regulation (rather than individual plans) limit nutrient application, sites like DoD installations do not receive any credit for UNM plan development or implementation.

The **Virginia** Nutrient Management Standards and Criteria define the amount of nutrients that may be applied to turf acres. The state requires UNM plans for all golf courses, state-owned land, and entities with municipal separate storm sewer system (MS4) permits. MS4 permittees must develop UNM plans for publicly-

owned land where nutrients are applied that are greater than one acre. Installations do not receive credit for UNM plans developed for an MS4 permit; however, partial credit is available for UNM plans on non-regulated land and regulated land where nutrients are applied to an area less than one contiguous acre.

## Existing UNM Plans from the Field: MCB Quantico and JBLE-E

If UNM seems like a good option for your installation, there is still good news: Many installations are part of the MS4 regulated community and are therefore implementing UNM. Thanks to Marine Corps Base Quantico (Quantico) and Joint Base Langley-Eustis (Eustis) (JBLE-E) for providing helpful insight and feedback on their experiences with UNM plan implementation for other installations to learn from and consider. Though these installations don't receive TMDL credit for their UNM plans, their experience demonstrates some of the other advantages that may come from UNM.

### What's in your UNM plan?

State requirements specify the content of a UNM plan and when one should be developed. To comply with Virginia requirements, which require UNM for golf courses, MCB Quantico developed a UNM plan for the Medal of Honor Golf Course, which covers 149 acres. The plan identifies the site as high risk (having features that make it likely that there is polluted runoff from the golf course) and includes the following:

- A description of the site and environmentally-sensitive features;
- Site maps;
- Soil sampling and test results; and
- Nutrient application guidelines for lime, nitrogen, phosphorus, and potassium on different types of surfaces (greens, roughs, fairways) differentiated by grass species

As part of the plan, the land manager must analyze the soils at the site and determine the appropriate level of fertilization based on the needs of the soil. Per state requirements, MCB Quantico's plan was developed by a Virginia-certified nutrient management planner and approved by the Department of Conservation and Recreation, fulfilling the installation's permit requirements and ensuring compliance through the 5-year life of the plan. In other states, common plan requirements include the location of the site, the acres covered, the date of the plan, how long it is valid, and the pollution risk level.

PHOTO FROM JBLE FORCE SUPPORT WEBSITE (HTTP://NEW.JBLEFORCESUPPORT.COM/EAGLEWOOD-GOLF-COURSE)

*Eaglewood Golf Course at JBLE-E is covered by a nutrient management plan, as required by the installation's MS4 permit.*

### What cost savings have you seen through UNM implementation?

When asked if he would recommend UNM plans for other installations, Ron Holcomb, JBLE-E stormwater program manager, said "Definitely," because they help ensure that landscaping companies working on the installation do not over-apply fertilizer where it isn't needed. In the long run, over-fertilization directly influences the size of the Bay's dead-zone or no-oxygen conditions. In the case of the installation's privatized housing facility, the UNM plan was a win-win scenario for JBLE-E and the company operating the housing complex: JBLE-E met their permit requirements and deadline, and the company saved money on their grounds maintenance contract. The Chesapeake Bay is also a winner: the UNM plan ensures that just the right amount of nutrients is applied, limiting excess runoff to the Bay and its tributaries.

In total, JBLE-E has four UNM plans that cover a total of 117.9 acres at the installation's golf course, athletic fields, and housing facilities. The most recent plan, developed in 2018 for 8.2 acres, cost about $4,000 to develop.

## Final Considerations

Installations should make sure they are compliant with their permit requirements regarding UNM. Furthermore, the DoD CBP recommends that installations annually report all UNM plans, required by regulation or voluntarily implemented, in the annual datacall. Having this information will allow the DoD CBP to resolve the inconsistency between the state and the Bay Model regarding fertilizer application and UNM credit. Our position is that those who are implementing the management practice should receive the credit directly.

# Bioretention: Design Innovation for Enhanced Nutrient Removal

*By Mira Micin, Brown and Caldwell*

Necessity is the mother of invention, and in the case of the Chesapeake Bay watershed, land owners, including DoD installations, need to reduce nutrients and sediment delivered to the Bay. With 2025 just around the corner, BMP innovation can't be timelier. During the past 30 years, we have seen innovation through the transition of BMP design from water retention and storage to water quantity and quality improvements through infiltration.

Across the country, states and the Environmental Protection Agency have recently added numeric nutrient and sediment reduction requirements to municipal separate storm sewer system (MS4) permits. Similarly, the Chesapeake Bay TMDL calls for reductions in pollutant loads for TN, TP, and TSS. Through their WIPs, many jurisdictions in the region have incorporated reduction requirements in MS4 permits to meet their planning targets in the developed/urban sector. Because much of the low hanging fruit has already been accounted for, those responsible for reducing these pollutants are looking to innovation and emerging science for solutions.

| Design Era | |
|---|---|
| Era 1 | Initial Practice Development (1990s) |
| Era 2 | Mainstreaming Bioretention (2000 - ~2007) |
| Era 3 | Design to Increase Runoff Reduction (2007 - Present) |
| Era 4 | Design to Enhance Nutrient Removal |

*The evolution of bioretention design. Source: Center for Watershed Protection May 19, 2018 presentation titled "Bioretention Design Modifications"*

Since the practice was developed in the 1990s, bioretention has become a common BMP selection because of its ability to store and treat stormwater runoff. After 2007, changes to bioretention design emphasized enhanced runoff reduction. However, with new stormwater permit requirements, nutrient removal has quickly become the new design priority. The figure to the bottom left explains the evolution of bioretention design. Now that nutrient removal is the focus, the Center for Watershed Protection (CWP) recently presented three advancements in design that can help improve bioretention performance for MS4 permit requirements.

## Soil Media Amendments

The first advancement is the incorporation of soil media amendments in bioretention facilities. Soil amendments are added compounds or materials that change the soil's physical and chemical properties. Because microbes are responsible for processing nutrients in the soil and because they are significantly affected by the soil media type and depth, soil amendments can affect the rate of removal of some nutrients by the microbes. Several soil amendments evaluated by researchers include aluminum and ferric water treatment residuals, iron filings, steel wool, and biochar. Field application of these soil amendments has shown favorable results and some amendments have increased dissolved phosphorus removal up to 90 percent. Many of the soil amendments being tested are easy to source in most locations, but further testing is needed to better understand the hydraulic conductivity, nutrient removal efficiency, maintenance needs over time, potential for leaching materials, and flow rate impacts of soil amendments.

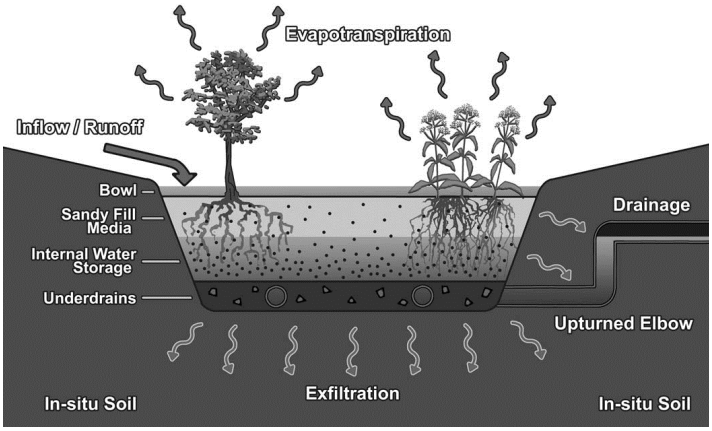
PHOTO BY CBP.

*Changes to the design of bioretention cells, such as the one shown here, can enhance the infiltration or nutrient removal that occurs in the system.*

## Internal Water Storage Nitrogen Removal

With the Midpoint Assessment and Phase 6 Bay Model outputs, the Partnership is learning that nitrogen is the limiting pollutant in meeting overall reduction goals. In addition, neither jurisdictions nor the DoD met 2017 goals for TN. For facilities struggling to meet their TN TMDL goals, internal water storage (IWS) offers an increase in nitrogen removal efficiency.

In a typical bioretention, water infiltrates the soil and whatever is not adsorbed is ultimately discharged through an underdrain. Retrofitting a bioretention with an IWS system allows the stormwater to collect for a short time before it is discharged to the underdrain. The figure below shows how the inclusion of an upturned elbow in the drainage system allows water to collect beneath the soil surface. The underground pooling creates an environment that mimics the nitrogen removal that commonly occurs in wetlands. The IWS layer remains saturated and forms an anaerobic environment where nitrogen is removed through microbial activity and denitrification. Denitrification is an important chemical process through which nitrogen in the runoff is converted to a gas and released to the atmosphere. The IWS feature also increases infiltration into the soil layers below and around the system. In studies, bioretention facilities with IWS provided additional nitrogen removal up to 60 percent beyond a traditional bioretention system. This is a significant improvement on the performance of conventional bioretention facilities.




*Upturned elbow installed in bioretention to create IWS.*

IMAGE FROM CWP PRESENTATION.

## Organic Removal and Nutrient Uptake

Another promising feature that has been shown to increase nutrient removal is the selection of plant type and their location in the bioretention treatment area. Traditionally, plants were added for aesthetic purposes, and nutrient removal was found to be a secondary benefit. Research is shedding new light on the ability of plant root systems to interact with and enhance the nutrient removal capabilities of the soil. By releasing small amounts of sugars, the plant feeds microorganisms found in the soil forming a living layer of microbes around the roots. The organisms perform chemical reactions that result in nutrient removal and create conditions for further chemical processes.

PHOTO BY WILL PARSON, CBP.

*The selection and placement of plants can provide increased removal of nitrogen*

Research has identified some plant species as "hyperaccumulators." These plants can absorb select nutrients at a rate up to 100 times higher than other species. Most hyperaccumulators target nitrogen, chlorinated solvents, or petroleum. Though phosphorus is an essential nutrient for plant health, plants have not yet been identified that can absorb phosphorus at the same rate as some hyperaccumulators absorb nitrogen.

## The Next Era of Bioretention Design

Unfortunately, these enhancements are not currently approved for Chesapeake Bay TMDL credit. However, the research is promising, and compelling evidence supports consideration of these alternatives as future TMDL credit is being evaluated through the expert panel process. For example, in North Carolina, IWS is already part of state design standards and has been shown to increase TN and TP removal. The science supports the effectiveness of these enhancements, and the Chesapeake Stormwater Network has proposed methods to credit these design improvements together (as a single practice) and separately (as three practices). With the significant nutrient reductions needed to meet the TMDL, enhanced bioretention designs offer better return on investment and improved pollutant removal. BMP design will continue to evolve with our scientific understanding of nutrient removal processes, and, to the benefit of all, we march towards a new era in bioretention design with innovations such as media amendments, IWS, and strategic plantings. With opportunities for retrofit and regulatory credit, these are modifications that all DoD installations should consider.

# Chesapeake Bay Action Team Updates

*By Hee Jea Hall, Brown and Caldwell*

Members of the Chesapeake Bay Action Team (CBAT) convened for their quarterly meeting on October 30, 2018, to discuss the Environmental Protection Agency's (EPA) expectations for federal agencies' participation in the Chesapeake Bay TMDL Phase III WIPs, the results of the DoD Midpoint Assessment (MPA) and the 2025 Implementation Plan, MS4 electronic reporting requirements in Virginia, and overall Chesapeake Bay Program (CBP) updates.

## Federal Agencies and the Phase III WIPs

Ms. Lucinda Power, EPA, presented on the Chesapeake Bay Partnership Midpoint Assessment and Phase III WIP expectations. The results of the MPA, summarized in the table below, show that across the Bay watershed, reductions in TP and TSS between 2009 and 2017 exceeded the 60 percent reduction target (TP and TSS are at 87 percent and 67 percent of their goals, respectively). Jurisdictions only made 36 percent progress toward the 2025 target for TN.

EPA released the final expectations for federal facilities and lands in August 2018. These expectations support the development of Phase III WIPs by jurisdictions. EPA will support federal agencies with technical assistance, dispute resolution, and coordinated development of water quality milestones. Members also added that EPA support will be needed to help ensure BMPs are appropriately credited to DoD.

**Percent of Goal Achieved by Jurisdictions**

| Jurisdiction | TN Percent Progress Toward 2025 Target | TP Percent Progress Toward 2025 Target | TSS Percent Progress Toward 2025 Target |
|---|---|---|---|
| Pennsylvania | 15% | 55% | 38% |
| Maryland | 47% | 100% | 100% |
| Virginia | 79% | 99% | 54% |
| West Virginia | 84% | 93% | 100% |
| Delaware | 32% | 100% | 100% |
| Washington, D.C. | 100% | 100% | 100% |
| New York | 0% | 66% | 36% |

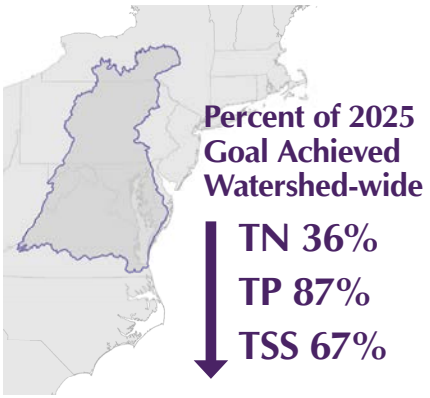



*TABLE 1. Progress of the Chesapeake Bay jurisdictions toward 2025 targets for TN, TP, and TSS through the end of 2017 progress. Cells are colored according to if the jurisdiction achieved their goal (>60%), are within 5% of their goal (55-60%) or did not achieve the goal (<55%).*

PHOTO BY CBP.

## DoD 2017 Midpoint Assessment and 2025 Implementation Plan

Ms. Stephanie MacDurmon presented the results of the two major efforts by the DoD CBP in support of Phase III WIP development. In 2018, DoD conducted an internal MPA, which quantified nutrient and sediment reductions by installations since 2010. The results of the DoD MPA showed that DoD is on track to meet EPA expectations for 2025. DoD met the 2017 targets for TP in all jurisdictions, for TN in Maryland, and for TSS in Maryland and Washington, D.C. The tables on the next page summarize the results of the DoD MPA. Additionally, reductions from the wastewater sector indicate that DoD has significantly reduced pollutant loads. Since 2010, DoD WWTPs reduced pollutant loads by 81,720 lbs TN/year, 6,665 lbs TP/year, and 82,968 lbs TSS/year.

To identify the additional reductions necessary to meet 2025 goals, the DoD CBP used planned 2018 and 2019 BMP implementation data collected from installations during the annual datacall. Planned BMPs for the 2018 and 2019 progress years, which align with the current DoD work plan period, resulted in further reductions of pollutant loads in all jurisdictions. However, not surprisingly, additional implementation was necessary for the 2020 through 2025 progress years. Therefore, the DoD CBP investigated UNM plans and runoff reduction (RR) BMPs to fill implementation gaps and achieve the 2025 goals, as defined in 2015 in the *Protocol for Setting Targets, Planning BMPs and Reporting Progress for Federal Facilities and Lands* (see Table 4).

Between now and 2025, other factors will affect DoD goals, such as new science in the Phase 6 Bay Model, climate change, growth and development, and planned revisions to federal facility goals. The DoD CBP remains engaged with EPA and the Partnership on behalf of installations and plans to update and refine annual DoD Progress and develop a revised 2025 Implementation Plan to assess DoD progress and future needs.

## MS4 Electronic Reporting and DoD Chesapeake Bay Program

Beginning in 2019, Virginia installations with MS4 permits will be required to report BMPs through the Virginia Department of Environmental Quality (DEQ) BMP Warehouse. Members discussed and considered alternative ways to coordinate data collection and reporting for MS4 permittees and the DoD CBP.

The DoD CBP will develop and send an official request to Virginia installations for additional information to prepare for future e-reporting. Members agreed to prepare for discussion on the structure of next year's datacall during the January 2019 CBAT meeting.

## Additional DoD CBP Updates

The following program updates were discussed:

- The DoD CBP submitted comments on the draft local area planning goals to the District Office of Energy and the Environment in Washington, D.C. and the Virginia DEQ in November.
- Federal Leaders meeting held on November 20, 2018.
- The next CBAT meeting is scheduled for January 24, 2019.

**Difference in loads between 2010 and 2017 DoD scenarios (in lb/year EOS)**

| Jurisdiction | TN | TP | TSS |
|---|---|---|---|
| Maryland | ▼ 16,038 | ▼ 14,142 | ▼ 2,666,286 |
| Virginia | ▼ 1,158 | ▼ 15,899 | ▲ (7,513,972) |
| Pennsylvania | ▲ (4,846) | ▼ 761 | ▼ 114,717 |
| Washington, D.C. | ▲ 1.59 | ▼ 24 | ▼ 21,281 |

*TABLE 2. The DoD MPA determined the difference in loads between 2010 and 2017.*

**2015 Protocol and DoD MPA Progress Evaluation Summary**

| Jurisdiction | 2017 TN Target Met? | 2017 TP Target Met? | 2017 TSS Target Met? |
|---|---|---|---|
| Maryland | ✓ | ✓ | ✓ |
| Virginia | ✗ | ✓ | ✗ |
| Pennsylvania | ✗ | ✓ | ✗ |
| Washington, D.C. | ✗ | ✓ | ✓ |

*TABLE 3. Based on the difference in loads, the DoD MPA assessed if the Protocol goals were met.*

**BMPs Included in 2025 DoD Scenarios**

| Jurisdiction | UNM Plan (acres) | RR BMPs |
|---|---|---|
| Maryland | 13,775 | 1,000 acres (500 impervious acres, 40 acre-feet) |
| Virginia | 15,712 | 2,500 acres (1,250 impervious acres, 100 acre-feet) |
| Pennsylvania | 6,620 | 2,500 acres (1,250 impervious acres, 100 acre-feet) |
| Washington, D.C. | 420 | N/A |

*TABLE 4. Recommendations of the 2025 Implementation Plan based on the level of implementation needed to meet 2025 targets for DoD installations in the Chesapeake Bay Watershed Model.*

DoD/DoN Chesapeake Bay Program Office

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## Check it Out

**FY2018 Annual Progress Report Photo Contest.** The cover photo for the FY2018 annual progress report will be selected through a photo contest. Send in your best project photos to Hee Jea Hall (hhall@brwncald.com) by January 31, 2019, to enter! Photos featuring military components, personnel, or activities are preferred.

**Chesapeake Bay Watershed Forum.** Presentations and materials from the 2018 Chesapeake Bay Watershed Forum are available online at: https://www.chesapeakenetwork.org/resources/2018-chesapeake-watershed-forum-resources/. More information about the forum is available from the Alliance for the Chesapeake Bay website.

**The National Military Fish and Wildlife Association (NMFWA) Annual Training Workshop.** March 4 to 8, 2019, in conjunction with the 83rd North American Wildlife and Natural Resources Conference in Denver, Colorado. https://www.nmfwa.org/workshop2019.html

**CBAT Quarterly Conference Call.** April 18, 2019, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact Sarah Diebel at: sarah.diebel@navy.mil or 757.341.0383

Attend: Norfolk Naval Station, Building N-26 Room 3303
Call in: 1.866.749.3638/Passcode: 7362645
Web connect: https://conference.apps.mil/webconf/quarterlyCBAT

**4th National Climate Assessment Released.** The report is an extensive scientific assessment of climate change impacts, risks, and adaptation in the United States. It is now available online at: https://nca2018.globalchange.gov/.

**Marsh Resilience Summit: From Science to Management.** February 5-6, 2019. The summit will share the latest science of tidal marsh resilience against sea level rise as a guide for local government, land managers, and academics to integrate ecological processes with societal needs. http://chesapeakebayssc.org/marsh-summit/

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