Maryland Port Administration
Water Quality Master Plan

AAPA 2014 Environmental Improvement Award

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Introduction

The MPA is committed to the stewardship of the Chesapeake Bay, including the wildlife that depends on aquatic and shoreline habitat. As part of that effort, MPA is working to reduce the impact of stormwater runoff from its facilities, which was the genesis for this project and the Water Quality Management Plan (WQMP). The goal of the plan is to help the MPA meet anticipated National Pollutant Discharge Elimination System (NPDES) Municipal Separate Stormwater System (MS4) permit requirements and the need for pollutant load reductions from the Chesapeake Bay nutrient and sediment Total Maximum Daily Load (TMDL).

The WQMP was developed to provide a description of existing conditions, potential pollutant sources, existing stormwater controls, recommendations for improvements, and an implementation plan integrated into MPA's Environmental Management System. It provides:

- An inventory of existing stormwater controls, delineation of drainage areas, and calculations of both impervious and pervious treated and untreated area.
- Modeling of existing nutrient and sediment loads and an estimate of pollutant reductions from existing controls using methods compatible with the Chesapeake Bay TMDL.
- Analysis of potential stormwater retrofits and non-structural measures and recommendations for those that are appropriate for MPA facilities.
- Concepts and cost estimates for specific stormwater retrofits and estimates of pollutant load reductions from recommended treatment measures.

Goals and Objectives

- Meet or exceed the minimum stormwater sizing requirements in the jurisdiction in which it was built (for new or redevelopment projects) or demonstrates a unique retrofit solution.
- Use a novel treatment mechanism(s) to promote greater pollutant removal.
- Exceed the standard state design specification for the practice if there is one or modifies an existing state design specification for enhanced pollutant removal.
- Include new or multiple design mechanisms to enhance runoff reduction and/or pollutant reduction. If applicable, some testing, monitoring, assessment has been conducted to confirm that the performance of the practice (water quality monitoring, photo documentation etc.).
- Effectively integrate stormwater management with additional non-stormwater uses or site benefits (i.e. recreational use, pedestrian access, water re-use, and multi-space function).

Discussion

A. Background

The Port of Baltimore is situated at the head of the Patapsco River Estuary on the Chesapeake Bay. It is about 140 nautical miles north of the ports of Norfolk and Hampton Roads in Virginia and about 90 miles southwest of the Philadelphia, the major seaport in Pennsylvania. It is the closest seaport by land to the Midwest, which has been its competitive advantage through the years. The Port was founded in 1706,

predating the founding of Baltimore City. The area near Locust Point was the first point for shipping, while Fells Point, across the harbor, became a shipbuilding center.

Publicly owned port facilities are managed by the Maryland Port Administration (MPA), an agency of the Maryland Department of Transportation. All ten of the MPA-owned facilities discharge into Baltimore Harbor. The Drainage Area of these facilities totals 1779 acres, of which 1204 acres are considered impervious. Various waters in the Harbor have been listed as impaired for a number of pollutants, and TMDLs have been established for several of them. In addition, the Port facilities are subject to the Chesapeake Bay TMDL for nitrogen, phosphorus, and sediment.

Stormwater runoff, especially from nearby urban areas, is a problem throughout the Chesapeake region because it carries trash, sediment, and other pollutants into local waterways and ultimately the Chesapeake Bay. Stormwater and septic discharges continue to increase in Maryland, and may soon eclipse discharges from wastewater treatment plants. The MPA's Environmental Management System sets a high bar for stormwater management practices on its terminals through the use of the best management practices and stormwater control devices. Overall, the MPA is currently treating 16 percent of its impervious area with structural controls. The controls range in pollutant removal effectiveness from sand filters, wet ponds, and a shallow marsh; to hydrodynamic structures and inlet filters; to underground dry detention storage. That being said, the WQMP was developed in recognition of the fact that more can be accomplished.

B. Objectives and Methodology

The WQMP assessment of potential retrofit sites conducted for each terminal resulted in seven recommended projects. All of the proposed Best Management Practices (BMP) provide high removal rates for all pollutants of concern.

Following the assessment for conventional stormwater management practices, a set of alternative techniques were analyzed that were anticipated to be more feasible to implement given the constraints from the nature of Port facilities and operations. These area-wide alternatives were assessed and sized based on treating a unit impervious area, without siting them at specific locations. They included underground wet vaults, permeable pavers, hydrodynamic separators, catch basin filters, a proprietary underground filter, street sweeping and catch basin cleaning, and floating treatment wetlands.

There are any number of methods to define priorities for stormwater retrofits. Given the goal of this effort is to reduce runoff pollution, the cost and modeling data, coupled with area-wide approaches allowed evaluation on a cost per pound of pollutant removed basis in order to determine the most cost effective approach.

C. Award Criteria

1. Benefits to Environmental Quality

The facility-wide WQMP successfully identifies the amount of pollutant loading to be addressed as well as measures which can reduce the loads. It provides the roadmap for a comprehensive overhaul of stormwater management on MPA facilities. The assessment of potential retrofit sites conducted for each terminal resulted in seven

recommended projects, providing treatment for an additional 28 impervious acres. Area-wide alternatives were analyzed to determine the effectiveness of implementing hydrodynamic structures, catch basin filters, street sweeping, and catch basin cleaning. An example of innovative existing treatment is a state-of-the art stormwater vault at the Seagirt Marine Terminal implemented through MPA's partnership with Ports America Chesapeake that will collect and treat stormwater before releasing it to the harbor.

2. Level of Independent Involvement and Effort

MPA voluntarily developed the facility-wide WQMP in advance of regulatory requirements with regulatory agencies, industry, NGOs and community organizations. As part of the WQMP implementation, MPA has already begun assessing potential non-port related offsite areas for pollutant removal credit. The initial approach involved looking at a number of sites located in southeastern Baltimore County that have already gone through a public review process under Baltimore County's Small Watershed Action Plans (SWAPs). The MPA has also engaged with local NGOs through Baltimore City's Offsite Mitigation Workgroup meetings to identify potential partnership opportunities, and will have similar discussions soon with officials from Anne Arundel County. The MPA also recognizes the broader approach necessary to contribute to water quality improvement in the region. To assist in this effort, and to support a greater understanding of regulatory requirements to other Port interests, the MPA recently joined with the Baltimore Port Alliance (BPA) to host a Stormwater Forum featuring the Director of the Maryland Department of the Environment's Water Management Administration, as well as Department Heads from three surrounding local jurisdictions with responsibility of implementing Watershed Improvement Plans to restore the Chesapeake Bay. This well attended forum provided a unique opportunity for BPA

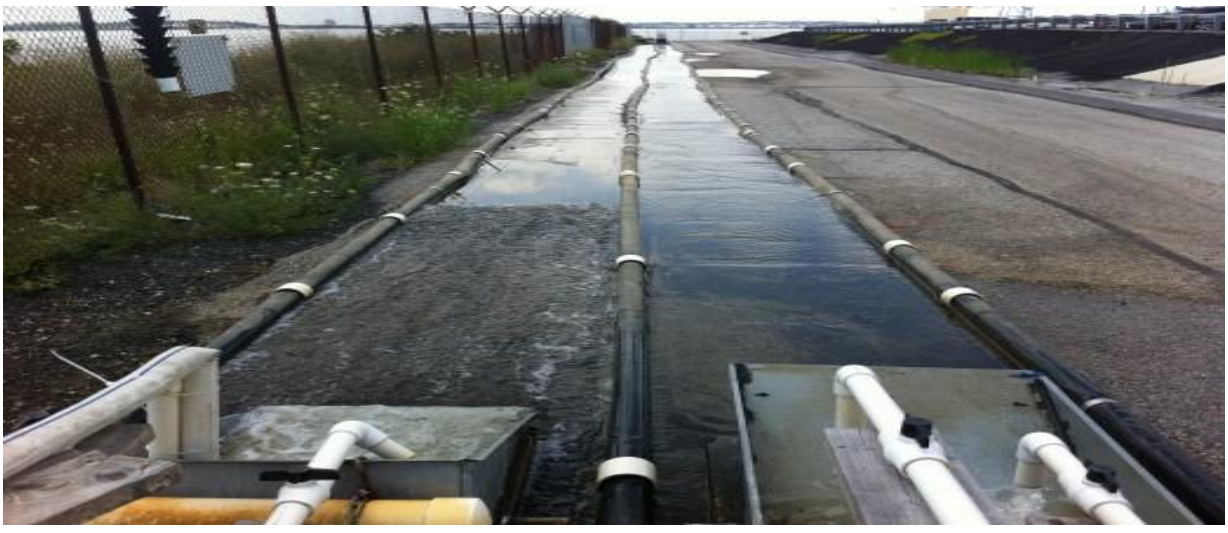
members to better understand available restoration options to improve water quality, which aligns with MPA's efforts to develop a comprehensive forward looking approach to addressing water impairment.

3. Creativity of the Solution

Innovative solutions were evaluated on their ability to meet one or more of the following criteria. Examples of creative solutions include:

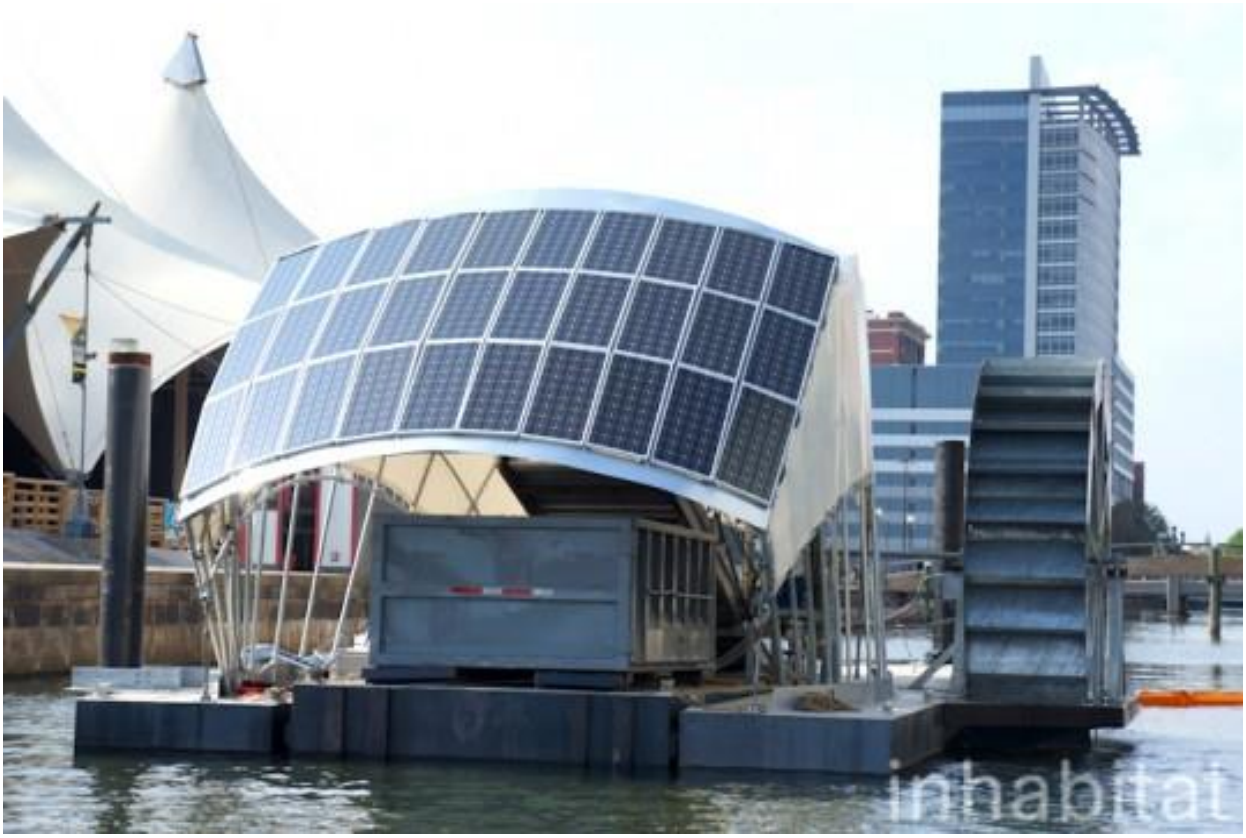
Algal Turf Scrubber

This project uses a nontraditional method to treat stormwater using the natural function of photosynthesis in algae to efficiently remove nutrients and other pollutants from impaired water. The scrubber allows filamentous algae to rapidly grow on horizontal thin screen media. The algal biomass is harvested regularly, removing the nutrients from the water. As an added benefit the photosynthetic activity injects high levels of dissolved oxygen into receiving waters.



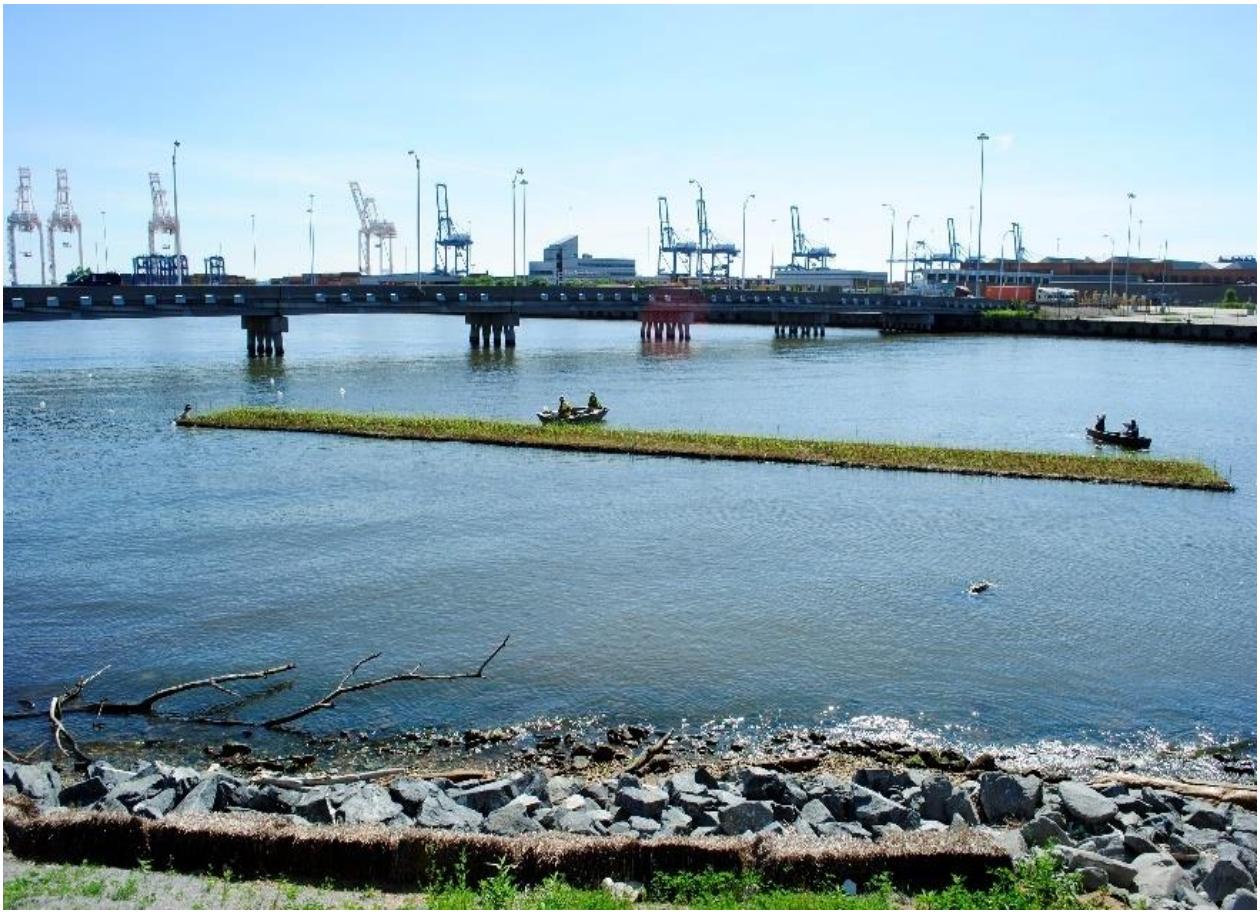
Inner Harbor Water Wheel

Trash is a major pollutant in the harbor and adds to the sewage leaks, stormwater runoff and other pollution that renders the harbor and area streams largely unfit for human contact. The unique and innovative Jones Falls water wheel is capable of removing 50,000 pounds of trash daily. The flow of water in the Jones Falls powers the wheel, which in turn moves a conveyor that lifts trash into a dumpster for disposal. Backup power is supplied by solar panels.



Floating Wetlands

MPA has installed a floating wetland system in a wet pond to study the biological activity in their root mass that acts as a natural filter for nutrients. At the Dundalk Marine Terminal, a pilot project is being installed in Colgate Creek to get a better understanding of feasibility and maintenance needs for potential expansion to other sites.



4. Project Results

The WQMP provides the detailed processes and procedures that allow the MPA to analyze, control, and improve the environmental impacts of its activities and dovetails with the overarching Environmental Management System. Beyond the existing metrics and tracking tools embedded in the EMS, the WQMP identified a number of opportunities for improvements including the development of a BMP Inspection and Maintenance Manual as well as a Mobile Application for Inspection Data Collection.

BMP Inspection and Maintenance Manual

Storm drain mapping and records research showed there were a significant number of BMPs for which periodic inspection and maintenance is recommended. A set of manuals has been develop which summarize information on each BMP and provide routine maintenance and periodic inspection procedures for each type of stormwater control.

Mobile Application for Inspection Data Collection

MPA is interested in automating data collection so their field inspectors can accurately and efficiently capture inspection information using devices such as smartphones, tablets, etc. Currently information is captured on paper inspection forms in the field and then entered into a database in the office using a previously developed ArcGIS tool for data entry and association of photos. MPA is developing a mobile inspection application. The goal is to have a consistent mobile framework for the

inspection process which will initially cover environmental inspections but which can later be extended to engineering, planning, and maintenance activities.

Stormwater Pollution Prevention Plan (SWPPP) Update

As part of the WQMP, MPA reviewed potential stormwater pollution sources and mitigation measures to update the Stormwater Pollution Prevention Plan (SWPPP) for the MPA's materials storage site. An environmental site inspector toured the facility and confirmed drainage patterns and sources of pollutants, and documented existing control measures for pollutants. Sources of pollutants that currently did not have adequate control measures were identified and mapped, along with potential areas where controls could be established. Recommendations included realignment of material storage areas to minimize runoff and structural controls at inlets to minimize sediment discharge.

5. Cost-Effectiveness

The WQMP provides the cost effectiveness analysis for recommended practices and management on a site specific basis and provides priority rankings based on a cost per ton of pollutant removed. The plan provides the analytical data from which the most cost effective solutions can be selected and reductions can be efficiently achieved.

6. Transferability to the Port Industry

The comprehensive approach to identify cutting-edge cost effective strategies to protect the Chesapeake Bay as well as the detailed assessment, modelling and technology-based cost-effectiveness analysis can serve as models for other ports as they aim to reduce impacts from pollutants on their effected water bodies. In addition, specific innovative BMPs like the algal turf scrubber, the inner harbor water wheel, and floating wetlands are transferrable.

Conclusion

Through MPA's Water Quality Master Plan and the overall Green Port initiative, port leaders, employees, tenants, and community volunteers are increasingly delivering the benefits of a thriving port through the critical framework of sustainability. From implementing innovative stormwater best management practices and increasing clean-diesel equipment to increasing wildlife habitat and community greening, the Port of Baltimore is actively pursuing its commitment to a thriving and sustainable port.

Project Summary
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The MPA is committed to the stewardship of the Chesapeake Bay, including the wildlife that depends on aquatic and shoreline habitat. As part of that effort, MPA is working to reduce the impact of stormwater runoff from its facilities through the development of the Water Quality Master Plan (WQMP).

The WQMP was developed to provide a description of existing conditions, potential pollutant sources, existing stormwater controls, recommendations for improvements, and an implementation plan. The goal of the WQMP is to help the MPA meet National Pollutant Discharge Elimination System (NPDES) Municipal Separate Stormwater System (MS4) permit requirements and pollutant load reductions from the Chesapeake Bay nutrient and sediment Total Maximum Daily Load (TMDL) in advance of regulatory requirements.

The comprehensive Water Quality Master Plan meets the AAPA Environmental Improvement Award Criteria:

1. The facility-wide WQMP successfully identifies the amount of pollutant loading to be addressed as well as measures which can reduce the loads. The assessment of potential retrofit sites conducted for each terminal resulted in seven recommended projects, providing treatment for an additional 28 impervious acres. Area-wide alternatives were analyzed to determine the effectiveness of implementing hydrodynamic structures, catch basin filters, street sweeping, and catch basin cleaning.
2. MPA voluntarily developed the facility-wide WQMP in advance of regulatory requirements.
3. Port facilities are unique in their degree of imperviousness (approaching 100% in MPA's case) and in the difficulty of locating sites for retrofit of conventional stormwater management (SWM) facilities. The WQMP reflects a comprehensive assessment of Best Management Practices (BMP) and management alternatives to retrofit untreated impervious areas at ten terminals. For example, the MPA's partnership with Ports America Chesapeake has delivered a state-of-the art stormwater vault at the Seagirt Marine Terminal that will collect and treat stormwater before releasing it to the harbor. MPA's offsite treatment process involves looking at potential sites that have already gone through a public review process such as Baltimore County's Small Watershed Action Plans (SWAPs). The MPA has also engaged with NGOs through Baltimore City's Offsite Mitigation Workgroup meetings, and participated in the Baltimore Port Alliance's Stormwater Forum featuring the Director of the Maryland Department of the Environment's Water Management Administration, as well as Department Heads from three surrounding local jurisdictions with responsibility of implementing Watershed Improvement Plans to restore the Chesapeake Bay.
4. The WQMP is part of the overall MPA Environmental Management System which provides the detailed processes and procedures that allow the MPA to analyze, control, and improve the environmental impacts of its activities. For example, there are a set of manuals and training efforts to summarize information on each BMP and provide routine maintenance and periodic inspection procedures for each type of stormwater control.
5. The WQMP provides the cost effectiveness analysis for recommended practices and management on a site specific basis and provides priority rankings based on a cost per ton of pollutant removed. The plan provides the analytical data from which the most cost effective solutions can be selected and reductions can be efficiently achieved.
6. The comprehensive approach of the WQMP can be replicated by other ports, and other ports can draw upon the detailed assessment and modelling techniques.

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