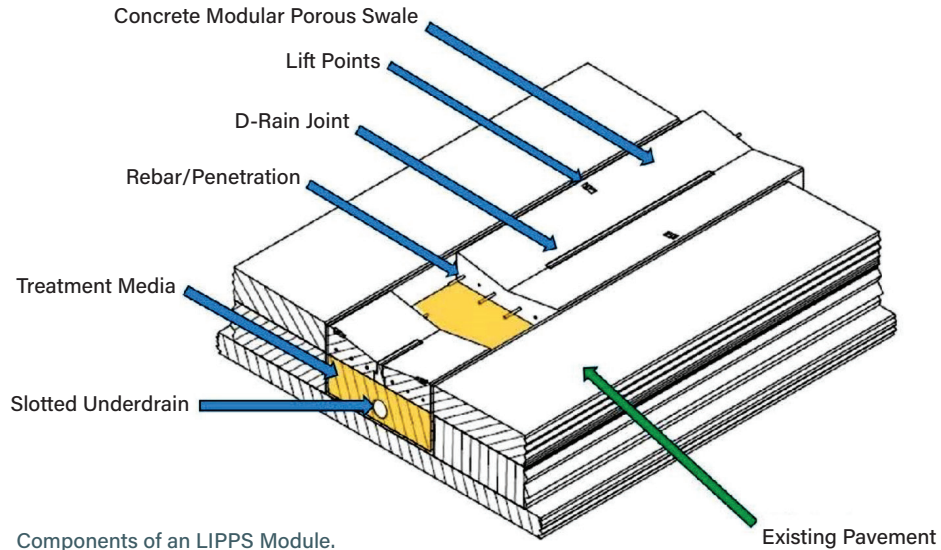




PROJECT ID:  
583

# Low-profile Integrated Porous Pretreatment Swale (LIPPS) for Metals Treatment in Industrial Areas



Components of an LIPPS Module.  
(Schematic Credit: James Pilkington)

## OBJECTIVE

The objective of this effort is to provide a passive, industrial, low-profile and innovative stormwater management solution (LIPPS) that will allow users to target specific pollutants of concern and operate in multiple platforms.

## PROBLEM STATEMENT

The discharge of metal-laden stormwater into harbors presents a large environmental protection issue. The Navy faces fines, regulatory action and operational impacts due to National Pollutant Discharge Elimination System (NPDES) and industrial stormwater permit exceedances. Facilities are struggling to meet current limits, and some face permit renewals with even more stringent effluent limits.

There is a need for a new technology that efficiently removes more metal particulates from stormwater runoff and is robust enough to handle the active industrial environments and tidal influences found at Navy shipyards.

## DESCRIPTION

The proposed best management practice (BMP) focuses on a three-part pretreatment solution—the low-profile integrated porous pretreatment swale (LIPPS). The LIPPS consists of three major components:

- A precast porous concrete top with a reticulated foam drainage slot
- A customizable media bed located below the concrete top
- An underdrain conveyance system

The porous concrete top has sloping sides, much like a natural swale, or drainage ditch. It removes debris and initial total particulates at the surface before the runoff enters the media bed. This concrete top can withstand industrial operations, which does not use up valuable industrial space or impact ongoing operations. The media bed features adsorbable materials that have been proven to remove the common constituents found at Navy shipyards. The bed is customizable to treat constituents of concern for the system installation location.

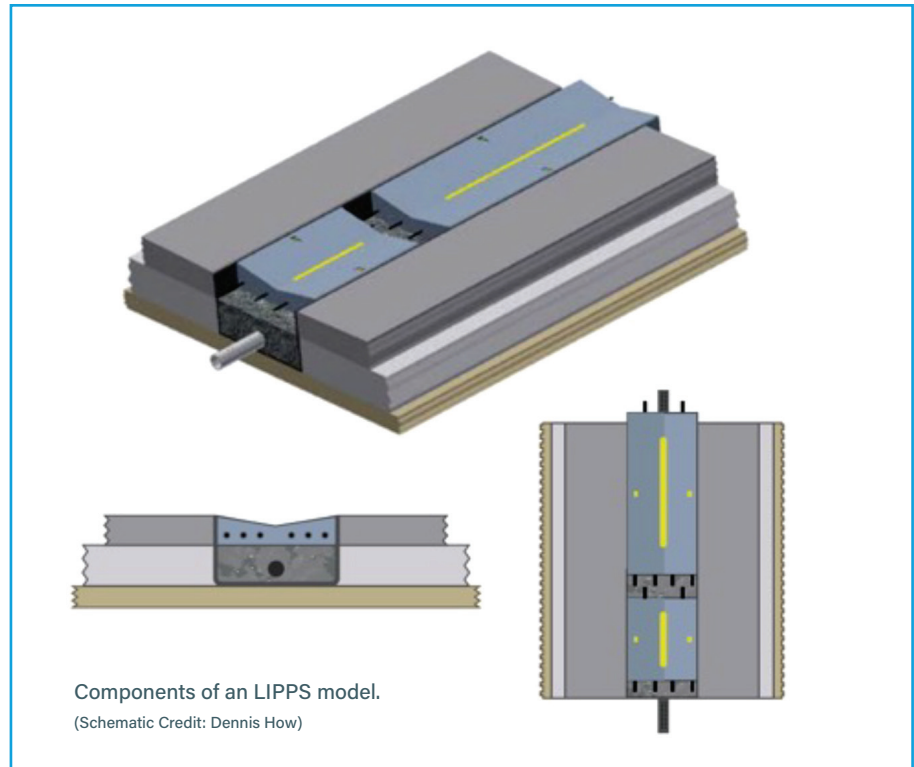


The underdrain conveyance system connects to the existing stormwater drainage network. LIPPS is designed with a very shallow installation depth, which allows for broader applications, and greatly reducing the impact tidal influence and flooding which is common at many Navy facilities and shipyards.

Pretreatment extends the life of the downstream treatment, reduces system maintenance and makes ultra-low discharge levels achievable. The three major system components (porous concrete top, media bed, and underdrain conveyance) all have different testable Technical Performance Measurements (TPM). Each component has previously been field-tested, and the system components will undergo pilot scale and full-scale testing at the Naval Facilities Engineering and Expeditionary Warfare Center in Port Hueneme, CA.

The multimedia bed has one of highest metals removal efficiencies in the industry, and has been validated through multiple private sector and Department of Defense (DoD)-wide research and development projects. Together, this media blend and the correct contact time will provide the operational removal efficiencies required to meet NPDES permits and shipyard goals. Porous concrete has been tested and implemented since the early 1970s. The project team will test multiple concrete blends for flexural strength, density, durability and maintenance.

Contingent upon successful pilot scale testing, the demonstration



phase will take place at Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF). For the demonstration to be successful, the system must treat stormwater from the 85th percentile storm to below NPDES permit limits without impeding operations. The demonstration will focus on removing copper and zinc due to PSNS & IMF's pending permit which reduces the effluent limits of these constituents.

#### RETURN ON INVESTMENT

The National Shipbuilding Research Program published a 2014 report comparing copper removal BMPs. The top two technologies for copper removal had efficiencies of 53.74 percent (Cleanway MetalZorb™) and 25.18 percent (Filtrexx Sediment Control®). LIPPS outperforms these technologies and has lower lifetime maintenance costs. Allowing U.S. Navy shipyards

to meet their NPDES permit requirements would avoid Notices of Violation (NOV) and associated fines that some have been subject to in the past.

The LIPPS technology could be deployed in multiple locations at each of the four U.S. Navy shipyards. Expected operational cost is minimal since LIPPS is a passive system that does not require mechanical components, onsite operators or specially trained technicians.

In addition to meeting current and future NPDES effluent limits and minimizing operation costs, the system will not take up in-demand operating space. At the PSNS & IMF demonstration site, a potential solution is to cover the storage lot with a roofing structure that opens to allow crane access and ultimately eliminates



metals runoff into stormwater. In this situation, implementing LIPPS would achieve a return on investment (ROI) of less than one year while significantly reducing labor hours, resulting in more cost savings. Positive ROI for this technology comes from usable space savings, lower system lifecycle cost and cost avoidances of future noncompliance violations.

### NAVY BENEFITS

This pretreatment BMP extends the life of the downstream treatment, reduces system maintenance and makes ultralow discharge levels achievable. The system provides stormwater program managers with a combination of proven technologies that can target multiple surface water contaminants in multiple

industrial environments. Expected advantages and environmental benefits of this technology include the ability to meet current and future NPDES effluent limits without losing much needed operational space.

### TRANSITION DESCRIPTION

Through the demonstration period at PSNS & IMF, the technology will prove its capabilities, identify areas to reduce build and implementation costs and increase the Navy's commitment to environmental stewardship.

Through stormwater conferences, DoD presentations and interfacing with installation environmental program directors, this technology will be available for users at the other three Navy shipyards, multiple Navy-owned pier facilities and

other installations that have previously expressed interest.

Future plans for this patented technology include a nonexclusive licensing agreement for private sector technology transfer. Pursuit of Technology Assessment Protocol – Ecology (TAPE) certification, an industry-recognized BMP certification program, will be the certification authority for this technology and allow for further technology transfer to the stormwater community at large.

### CONTACT

For more specific information about this project, contact the Principal Investigator at 805-982-1335.



### ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development, demonstration and validation (6.4) program, sponsored by the Chief of Naval Operations, Energy and Environmental Readiness Division (OPNAV N45) and managed by the Naval Facilities Engineering Systems Command (NAVFAC) out of the Engineering and Expeditionary Warfare Center (EXWC) in Port Hueneme, CA.

The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness and lethality. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at [www.navfac.navy.mil/nescdi](http://www.navfac.navy.mil/nescdi) or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or [ken.kaempffe@navy.mil](mailto:ken.kaempffe@navy.mil).

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