

1. Title
Deal Lake Watershed Protection Plan Implementation Project
Reduction of Phosphorus, Pathogen, Sediment and Floatable Loading to Deal Lake
WMA 12
HUC 14: 02030104090030

2. Waterbody Improved

Encompassing 155 acres and with over 27 miles of shoreline, Deal Lake is Monmouth County's largest lake and the largest of New Jersey's coastal lakes. The lake's watershed encompasses 4,400 acres and is located within USGS HUC 14: 02030104090030 and NJDEP Watershed Management Area (WMA) 12. The overall management of the lake is the responsibility of the Deal Lake Commission (DLC) the State's appointed steward of the lake. Once an estuary the lake was created in the 1800s by the construction of an earthen embankment and integrated flume structure. There are five primary arms of the lake that extend westward from the main lake basin. The arms are boarded by seven municipalities: the City of Asbury Park, the Village of Loch Arbour, the Boroughs of Allenhurst, Deal and Interlaken and the Townships of Neptune and Ocean. Over the years road crossings created distinct sub-impounded sections of the lake that although connected to the main body are separated by weirs. The most notable of these are the Hollow Brook and Colonial Terrace Arms, Lollipop Pond (also referred to the Ditmar Arm) and Fireman's Pond.

3. Problem

Deal Lake suffers from a number of documented water quality impairments typical of a lake situated in a highly urbanized watershed. The lake is highly eutrophic being frequently impacted by intense blue-green algae blooms and excessive densities of invasive aquatic macrophytes. It is also often very turbid due to sediment loading due to the erosion of the bed and banks of the lake's tributaries. Additionally, following every storm large volumes of floatable and particulate pollutants are discharged into the lake. All of these problems are linked to inadequate stormwater management, which again is a common problem for urban lakes. Regardless, the lake continues to be highly used by residents for fishing and boating.

According to the NJ Surface Water Quality Standards (N.J.A.C. 7:9B) Deal Lake is classified as a Freshwater–Non-Trout (FW2-NT) waterbody. Deal Lake is listed in the New Jersey Revised Final 2010 303(d) List of Water Quality Limited Waters because of a number of water quality impairments; chlordane, mercury and PCB in fish tissue, DDE, DDT, DDE and pH (Appendix B). That report identifies stormwater as the lake's leading cause of impairment. As per the NJDEP approved total phosphorus (TP) TMDL, a 79% reduction in TP loading must be attained. Again, improperly treated or managed stormwater runoff is recognized as the primary source of TP loading. With regard to pathogen loading (fecal coliform), the data used to support the TMDL show frequent contravention of the State's water quality standards for contact recreation. Microbial Source Tracking data (MST) developed by the DLC with assistance from Monmouth University shows bacteria loading is linked to a variety of sources including geese. Sampling of

the streams during the WPP routinely documented especially high fecal coliform concentrations measured in the Hollow Brook tributary.

4. Project Highlights

This 319 (h) project resulted in the implementation of three projects, including two which were specifically identified as prioritized pollutant load reduction projects in the 319(h) funded 2010 Deal Lake Watershed Protection Plan (WPP).

- **Asbury Park Comstock Street MTD** – Identified in the 2010 WPP, this project involved the installation of a NJDEP approved manufactured treatment device (MTD) to address pollutant loading to the lake from a major stormwater outfall. The MTD was installed by Precise Construction, Inc., Freehold, NJ for \$124,750.00
- **Colonial Terrace Golf Course Bioretention BMP** - Identified in the 2010 WPP, this project involved the construction of three (3) bioretention stormwater management basins within the boundaries of the Colonial Terrace Golf Course, an Ocean Township-owned and public access facility. These BMPs were designed specifically to decrease runoff volume and decrease the phosphorus, sediment and pathogen loads entering the lake's Colonial Terrace tributary system. The Colonial Terrace sub-watershed is the largest contributor of phosphorus, sediment and related NPS pollutants to the lake on both a unit basis and on a total loading basis. The work was conducted by Down To Earth Landscaping for an approximate fee of \$98,657. An additional element of this project that was completed in the spring of 2013 with assistance from various Deal Lake stakeholders was the restoration of over 300' of eroded shoreline. The project not only stabilized the targeted area but restored a riparian buffer that will help decrease easy passage of Canada geese from the lake onto the golf course. The shoreline planting element was conducted for less than \$10,000 owing to the extensive participation of volunteers.
- **Asbury Park Boat Launch Shoreline Stabilization** – Although not identified in the 2010 WPP, this project utilized funds that were left over from the Comstock Avenue and Colonial Terrace projects to complete a major rehabilitation of the City of Asbury Park's boat launch; the only public boat launch on the lake. This project involved the installation of coir fiber logs to stabilize the eroded shoreline, the control of invasive non-native plants (knot weed - *Fallopia japonica* and common reed - *Phragmites*), the planting of native riparian vegetation, and the creation of a small bioretention rain garden to control the runoff from the boat launch parking area. The total cost of this project was approximately \$25,000 and was conducted by Down To Earth Landscaping.

The primary goal of these projects was to demonstrate that even though Deal Lake is located within a highly urbanized watershed, it is possible to retrofit the existing stormwater system and even construct new BMPs to decrease pollutant loading to the lake. The Comstock Avenue and Colonial Terrace Golf Course projects represent "key-stone" projects of the type needed watershed-wide to improve the lake's water quality on a sustainable basis and in a manner consistent with the goals of the TMDL and WPP. Because all three implementation projects are

highly replicable, the DLC can capitalize on the experience gained through these projects to implement similar projects elsewhere in the watershed.

5. Results

The improvements associated with the Comstock Avenue MTD installation were quantified by means of actual water quality sampling and record keeping of the volume of trapped material removed from the MTD by the Asbury Park Department of Public Works. Conversely, the Colonial Terrace project improvements were quantified by means of the USEPA STEPL (4.1) Model.

Table 1 shows the reductions in total phosphorus (TP), soluble reactive phosphorus (SRP), E. coli and total suspended solids (TSS) loading attributable to the MTD. It is apparent that with the exception of SRP on one date, measurable reductions in the concentrations of the targeted pollutants were achieved by the MTD. The reductions in E. coli were especially rewarding given the impact that bacterial loading has on the overall use of the lake. The data also show that the MTD's performance was similar over storm event of differing rainfall totals, but seems to increase with larger sized storms.

Table 1 -Comstock Avenue MTD Performance Sampling – Comparison of In-Flow and Out-Flow Data					
Sampling Event - 2/29/2012					
<u>SPL ID</u>	<u>E. COLI</u> (cols/100 mls)	<u>SRP</u> (mg/L)	<u>TP (mg/L)</u>	<u>TSS (mg/L)</u>	<u>Rainfall</u> (inches)
Comstock Ave MTD - IN	9600	0.012	5	618	1.0
Comstock Ave MTD - OUT	4300	0.03	0.76	68	
Sampling Event - 5/9/2012					
<u>SPL ID</u>	<u>E. COLI</u> (cols/100 mls)	<u>SRP</u> (mg/L)	<u>TP (mg/L)</u>	<u>TSS (mg/L)</u>	<u>Rainfall</u> (inches)
Comstock Ave MTD - IN	10000	0.07	0.66	127	1.47
Comstock Ave MTD - OUT	8500	0.053	0.49	39	
Sampling Event - 10/19/2012					
<u>SPL ID</u>	<u>E. COLI</u> (cols/100 mls)	<u>SRP</u> (mg/L)	<u>TP (mg/L)</u>	<u>TSS (mg/L)</u>	<u>Rainfall</u> (inches)
Comstock Ave MTD - IN	3400	0.499	1.1	27	0.25
Comstock Ave MTD - OUT	1400	0.11	0.59	16	

Table 2 provides the results of the USEPA STEPL modeling of the Colonial Terrace Golf Course BMPs. Due to the fact these basins function as bioretention/infiltration basins, it is not practical to conduct post-construction field sampling. This is because during most storms there is no direct discharge from these BMPs into the lake. As such the STEPL model was used to quantify the projected improvements that these basins have on the lake's overall nutrient, BOD

and sediment loading. As shown in Table 2, the Colonial Terrace Golf Course BMPs have very good performance characteristics. The percent reductions for phosphorus and total suspended solids (TSS), two of the pollutants that most greatly impact the lake, are very good; 69% for phosphorus and 89% for TSS. As based on current land use and watershed data for the contributing sub-watershed within which the Colonial Terrace Golf Course BMPs were constructed, this translates to annual load reductions of 8 lbs. of phosphorus and 6 tons of sediment.

Table 2 – Results of StepL Modeling of Colonial Terrace BMP Performance			
Percent N Reduction	Percent P Reduction	Percent BOD Reduction	Percent TSS Reduction
55.7%	69.1%	13.7%	89.2%
Annual Load Reduction Nitrogen	Annual Load Reduction Phosphorus	Annual Load Reduction BOD	Annual Load Reduction TSS
36.5 lb/year	8.1 lb/year	17.1 lb/year	6.2 tons/year

Overall the data for the Comstock MTD and Colonial Terrace Golf Course BMPs show that such pollutant management measures yield very positive results. As such, not only are these BMPs having a positive effect in their specific location of installation/construction, but the data show that the use of similar BMPs elsewhere in the Deal Lake watershed would be valuable and in keeping with the goals of the WPP and the TMDL.

5. Partners and Funding

The Deal Lake Commission worked closely in the implementation of this project with Ocean Township and the City of Asbury Park. The City of Asbury Park was instrumental in providing in-kind engineering services associated with the installation of the Comstock Avenue MTD. Since its installation the City’s DPW has routinely maintained the unit. The City DPW was also instrumental in the majority of the improvements associated with the Asbury Park boat launch, in particular with the removal and control of the invasive plants that had colonized the shoreline. Ocean Township Engineering Department, DPW and in particular the Department of Human Services and Recreation aided in the technical review, contractor bidding and implementation phases of the Colonial Terrace project. For all three projects the DLC was provided technical assistance by Princeton Hydro, LLC and Leon S. Avakian, Inc. Princeton Hydro, LLC served as project manager for all three projects and lead engineer for the Colonial Terrace and Asbury Park boat launch shoreline restoration projects. Leon S. Avakian served as the lead engineer for the Comstock Avenue project, but also provided technical assistance for both the Colonial Terrace and Asbury Park boat launch projects. The funding for these projects was provided through the NJDEP by means of a Section 319(h) grant.

6. Figures and Photographs

Figure 1 –Shoreline Restoration Specifications for Colonial Terrace Golf Course

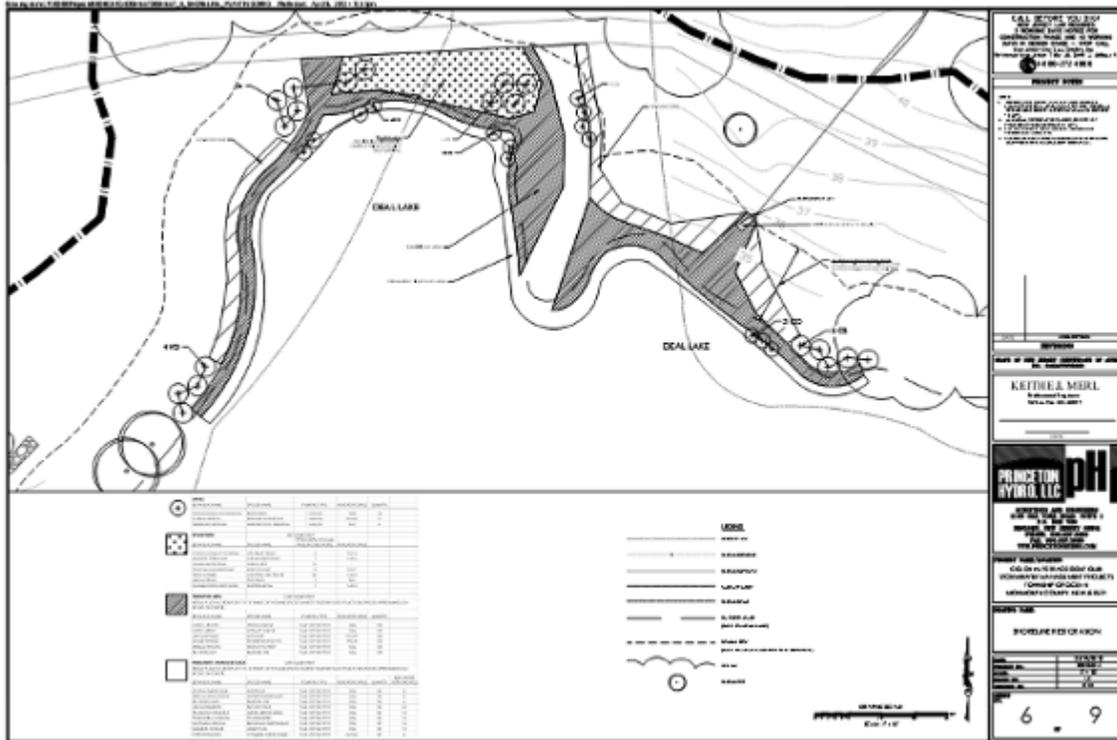


Figure 2- Typical Plan Specification for One of Colonial Terrace BMPs

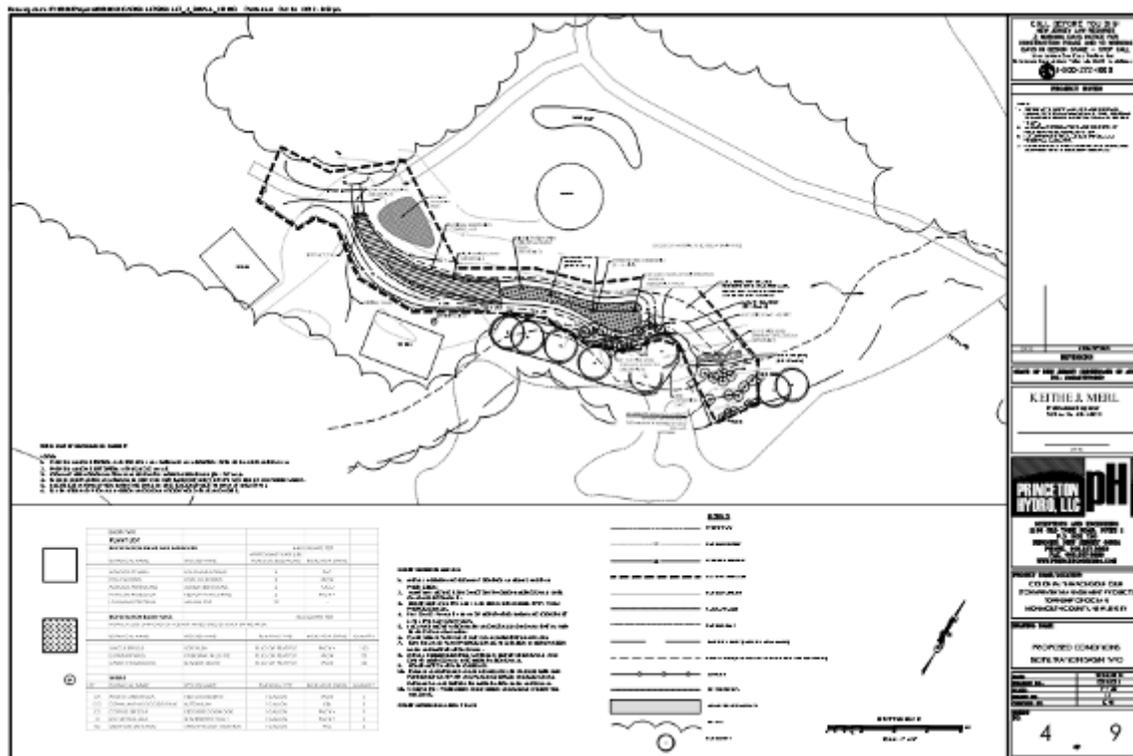


Figure 3 – Informational Sign Installed at Colonial Terrace Golf Course



Project Partners:



Deal Lake
COMMISSION



Photograph 1 – Typical Bioretention BMP Installation at Colonial Terrace Golf Course



Photograph 2 – Asbury Pak Boat Launch Rain Garden



Photograph 3 - Before and After (Pre-Planting) – Restored Shoreline at Asbury Park Boat Launch



Photograph 4 – Comstock Avenue MTD Installation



7. Contacts

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