WRECK POND
MANUFACTURED STORMWATER TREATMENT DEVICES
POST INSTALLATION REVIEW

BOROUGHS OF SEA GIRT, SPRING LAKE,
SPRING LAKE HEIGHTS & TOWNSHIP OF WALL
MONMOUTH COUNTY, NEW JERSEY

November 2015

Prepared For:
Monmouth County

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Project Description

This report presents a post installation review of the Manufactured Stormwater Treatment Devices (M.S.T.D.) around Wreck Pond in Monmouth County, New Jersey. Najarian has contacted the public works department for each municipality and inspected the devices to determine recommendations for future maintenance requirements, the effectiveness of the devices and any differences in function between different devices.

From July 2010 to January 2011, Monmouth County installed Manufactured Stormwater Treatment Devices around Wreck Pond to prevent sediment from entering into the pond. Fourteen (14) devices were installed within four (4) municipalities. A General Area Map that depicts the municipal boundaries and device locations is attached in the appendix of this report. The municipalities were the Borough of Sea Girt, Borough of Spring Lake, Borough of Spring Lake Heights and the Township of Wall. After the installation of the devices, an Operation and Maintenance Manual along with training was issued to each municipality on the cleaning of the structures. The recommended cleaning frequency of the devices is twice a year.

Borough of Sea Girt

The Borough of Sea Girt has two M.S.T.D.s as part of the Monmouth County project. Device 7 is a Vortsentry VS70 and is located on Sixth Avenue. Device 10A is a Stormceptor OSR-250 located at the end of Second Avenue. Both devices had minimal debris and had mostly sand in the devices with a few floatables. The depth of sediment was a few inches at the time of the last cleaning. The Public Works Director stated that the Borough cleans out the devices twice a year with the storm drain cleanout program. He also stated that the OSR-250 was a little easier for maintenance because of the size of the unit was smaller and the amount of water to pump out was less than the VS70 device. The Borough of Sea Girt shares a Vac Truck with Manasquan and Brielle. The Borough of Sea Girt did not keep any maintenance logs of the amount of sediment removed or the frequency.

Borough of Spring Lake

The Borough of Spring Lake has eight M.S.T.D.s as part of the Monmouth County project. Six devices are around Wreck Pond, one device is around Black Creek and one device is around Spring Lake. Device 13 is a Vortechs 3000 and is located on Brown Avenue. The debris found was mostly sand. Device 15 is a Vortsentry VS70 and is also located on Brown Avenue. The debris found was mostly sand. Device 19 is an Aqua-Swirl AS-12 and is located on Passaic Avenue with little debris in the structure. Device 21 is a Vortechs 16000 and is located on Salem Avenue. The debris found was mostly decomposing leaves and grass clippings. Device 22A is a Vortechs 11000 and is located on Ocean Road. The debris found was mostly decomposing leaves and grass clippings. Device 24A is an Aqua-Swirl AS-9 and is located on Ocean Road with little debris in the structure. Device 25A is a CDS Unit Model 2015 and is located on Ocean Road with little debris in the structure. Device 25B is a Stormceptor OSR-065 and is located on Ocean Road with little debris in the structure.

The devices were last cleaned in July of 2015 and prior to that in 2012 after Superstorm Sandy. The Borough stated that the Vortechs 3000 is the easiest to clean because of the size of the unit was smaller and the location is in the parking lot compared to the off the road devices. The Borough of Spring Lake owns a Vac Truck for the maintenance of the devices. Spring Lake stated that due to staffing cuts they do not have the personnel for a yearly maintenance program. The Borough of Spring Lake did not keep any maintenance logs of the amount of sediment removed or the frequency.

Najarian observed the cleaning of three structures until the Vac Truck broke down. The structures were 13, 15 and 22A. All three devices had a significant amount of sediment in them. Structures 13 and 15 were in a parking lot by the beach off of Brown Avenue. These two structures were filled with sand. The ease of cleaning was not difficult because it was just sand but the size of the structures caused the Vac Truck to fill up quickly. Structure 22A was completely full with decomposing leaves, grass and sand. The decomposing material made it extremely difficult to remove from the Vac Truck. The Vac Truck started having some malfunctions on this structure that could have been from the weight and consistency of the material being removed.

Borough of Spring Lake Heights

The Borough of Spring Lake Heights has two M.S.T.D.s as part of the Monmouth County project. Device 20 is a Vortechs 16000 and is located on Sixth Avenue. Device 34A is a Vortechs 11000 located on Ninth Avenue. Both devices were full to the top with debris and floatables and were cleaned up in August 2015. The debris was mostly leaves and grass clippings. The debris has been breaking down for a while; the color was black and clumping together. Prior to the August 2015 cleaning, the cleaning of the devices was unknown. Spring Lake Heights has a new public works director. The Public Works Director stated that he will clean them out once or twice a year in the future. He also stated that Vortechs 11000 was a little easier for maintenance because of the size of the unit was smaller and the amount of water to pump out was less than the Vortechs 16000 device. Spring Lake Heights does not own a Vac Truck; the public works director says he has to try to borrow a truck from neighboring municipalities for maintenance. The Borough of Spring Lake Heights did not keep any maintenance logs of the amount of sediment removed or the frequency.

Township of Wall

The Township of Wall has two M.S.T.D.s as part of the Monmouth County project. Device 5A is a Vortsentry – VS80 and is located on West Chicago Boulevard. Device 5B is an Aqua-Swirl AS-6 located on West Chicago Boulevard. Both devices had some debris and floatables and were cleaned up in August 2015. Device 5A had about 41" of sediment and Device 5B had around 28" of sediment. The debris was mostly sand with a few leaves and grass clippings. Prior to the August 2015 cleaning, the devices were last cleaned out in the fall of 2011 and the Township periodically checks the depth of sediment. Wall Township has a new public works director. The Township stated that the Aqua-Swirl AS-6 is easier for maintenance because of the size of the unit was smaller and the location is in the road compared to off the road. The Aqua-Swirl AS-6 is not as deep as the Vortsentry – VS80 which also makes the maintenance easier. The Township of Wall did own two Vac Trucks at the end of this project but now only has one, the Township water and sewer department is

constantly using the Vac Truck for their operations. Because of this, The Township of Wall does not have a Vac Truck that is readily available for the maintenance of the devices. Wall Township also stated that due to staffing cuts they do not have the personnel for a yearly maintenance program. The Township of Wall did not keep any maintenance logs of the amount of sediment removed or the frequency.

Wreck Pond Manufactured Stormwater Treatment Devices Table

Device Number	Municipality	Type	Sediment Depth	Sediment Type	Date Cleaned	Prior Date Cleaned
5A	Wall Township	Vortsentry - VS80	41"	Sand, Leaves, Grass	8/2015	Fall 2011
5B	Wall Township	Aqua-Swirl AS-6	28"	Sand	8/2015	Fall 2011
7	Sea Girt	Vortsentry - VS70	1-3"	Sand	8/2015	Spring 2015
10A	Sea Girt	Stormceptor OSR-250	1-3"	Sand	8/2015	Spring 2015
13	Spring Lake	Vortechs 3000	36"	Sand	7/2015	2012
15	Spring Lake	Vortsentry – VS70	Full to Top	Sand	7/2015	2012
19	Spring Lake	Aqua-Swirl AS-12	Minimal Sediment	Sand, Leaves, Grass	2012	Unknown
20	Spring Lake Hts.	Vortechs 16000	Full to Top	Sand, Leaves, Grass	8/2015	Unknown
21	Spring Lake	Vortechs 16000	Full to Top	Sand, Leaves, Grass	7/2012	2012
22A	Spring Lake	Vortechs 11000	Full to Top	Sand, Leaves, Grass	7/2015	2012
24A	Spring Lake	Aqua-Swirl AS-9	Minimal Sediment	Sand, Leaves, Grass	2012	Unknown
25A	Spring Lake	CDS Unit Model 2015	Minimal Sediment	Sand, Leaves, Grass	2012	Unknown
25B	Spring Lake	Stormceptor OSR-065	Minimal Sediment	Sand, Leaves, Grass	2012	Unknown
34A	Spring Lake Hts.	Vortechs 11000	Full to Top	Sand, Leaves, Grass	8/2015	Unknown

Conclusions/Recommendations

It is the conclusion that the Manufactured Stormwater Treatment Devices are working in all of the locations they were installed. Maintenance is the major issue with the devices. The only municipality that is cleaning their devices on a regular basis is Sea Girt and they are not maintaining records of the dates of cleaning and amount of sediment encountered as recommended by the O&M manual. The structures themselves are hard to maintain, due to their size and locations. The devices are easier to maintain in a roadway or parking lot instead of a grass areas. The smaller, shallower devices are easier to clean compared to the larger, deeper devices. The deep and large devices require multiple trips with the Vac Truck to the public works yards because the capacity of the trucks does not hold a large volume. This is a timely activity because the truck has to be mobilized and demobilized for each trip. The deeper the devices the harder it is for the Vac Truck hose to reach all of the areas within the structure. With all of these constraints maintenance is not an easy task when not kept up with as stated in the Operation and Maintenance Manual. The structures that were not cleaned on a regular basis had sediment that had hardened and was difficult to remove and consisted of decaying organic matter that had odors and was messy.

Najarian recommends that the M.S.T.D. be cleaned at least twice a year and the township municipal storm water collection inlets be cleaned twice a year of leaves, grass and debris. Adding Type "N-Eco" curb pieces to the inlets to prevent floatables from entering into the storm system. With these practices the operation of the devices and maintenance will be much more successful. The comparison of the effectiveness of the various structures is very difficult because of the many variables involved. The structures have not been maintained on a regular basis so it is impossible to be able to determine how long they take to fill up. The structures are all different sizes and located in different areas. Structures located adjacent to trees seem to fill with leaves and those next to the beach fill with sand. All of the structures appear to function well. Municipalities adjacent to Wreck Pond need to prioritize the water quality of the pond and watershed and purchase the required equipment to be able to successfully maintain these structures. Another alternative would be to hire an outside company to clean the structures on a semi-annual basis.

APPENDIX
MTD TSS Monitoring Results.

NJDEP conducted some limited water quality monitoring of the MTDs after installation. Figure 1 shows the MTDs installed and the monitoring locations. Table 1 summarizes the monitored units. The goal of the monitoring was to compare removal efficiencies from different manufacturers.

Table 1: MTDs Monitored

Map ID	NJDEP Station	Lat	Long	Manufacturer Model
MTD 10	NPSWP-10In&Out	40.13808	-74.0307	Stormceptor Model OSR-250
MTD 15	NPSWP-15In&Out	40.13911	-74.0266	Vorsentry Model VS70
MTD 19	NPSWP-19In&Out	40.15183	-74.0321	Aqua-Swirl Model AS-12
MTD 22	NPSWP-22In&Out	40.14289	-74.0332	Vortechs Model 11000

These structures are designed to remove suspended sediments and associated pollutants. Thus, TSS was the parameter investigated to evaluate removal efficiencies.

DEP monitored one MTD from each of four manufacturers. The data were collected during storm events with three samples taken from the inflow and three from the outflow, timed to try to obtain the same water flowing in and out.

The sample events are shown by number on the graphs below. The sampling occurred:

Event 1	Samples 1 to 3	October 19, 2011
Event 2	Samples 4 to 6	February 29, 2012
Event 3A	Sample 7 to 9 (MTD 19& 22)	October 7, 2013
Event 3B	Samples 7 to 9 (MTD 10&15)	December 23, 2013

The monitoring attempted to collect the "first flush" of stormwater through the structures, as this often contains the highest level of pollutants. However, it is very challenging to do this type of sampling for several reasons. First, rainfall is often spotty so the rainfall at one station may vary from that at another. Second, rain may abruptly start or stop and typically varies from reported forecasts. The use of such samples to draw conclusions on water quality must be viewed with caution.

The sampling appeared to collect three samples around the same time from the inflow and the outflow. As the data were reported at one time for the inflow and another (or sometimes the same) for the outflow, the samples were numbered for ease of graphing. The graphs below show the data, while Table 2 provides the average inflow and outflow concentrations for each event at each location. As noted above, however, these

represent three separate sampling events at each station and four separate sampling events overall.

Rainfalls given here were taken from the Weather Underground for a station in Belmar and thus may not be completely accurate for the sub-watershed containing each monitored structure.

The October 2011 sampling (samples 1 to 3 on the graphs) took place between around 9 and 10 am. According to rainfall data for the area, 0.03 inches of rain had fallen in the 8 am hour. An additional 0.15 inch fell by 09:35 and another 0.1 inch by 09:55 with lighter rain of about 0.06 inch by 10:15. The monitoring times are reported as 09:55 at MTD 22, 10:05 at MTD 19; 09:45 at MTD 10, and 09:35 at MTD 15. The latest sample, Sample 3 at MTD 19, was the only one to show elevated TSS in the inflow.

For this event, the inflow TSS was around 20-30 mg/l for all samples except the third sample at MTD 19. For the low TSS inflows, the outflow concentrations are similar or in some cases higher than the inflow. For the last sample at MTD 19, the outflow TSS dropped by about 50% compared to the inflow.

For the February 2012 sampling (samples 4 to 6), samples were collected at noon for inflow at both MTDs 15 and 19 and at 12:05 for both of these outflows. At the other two MTDs, the reported sampling times were 12:15 for the inflow and 12:20 for the outflow. Thus, the reported times for outflow samples are about 5 minutes after the inflow sample. In this case, the rainfall started after 11:55 and 0.05 inches had fallen by 12:35. However, it appears the rainfall started earlier at the sampling locations since samples were collected even when only minimal rainfall had been reported.

Interestingly, the TSS inflow concentrations at MTD 22 and MTD 19 both were very low, even though the sample at MTD 22 was taken about 10 minutes later. However, in MTD 10 and MTD 15, inflow TSS levels were the highest of any of the sampling. MTDs 10 and 15 are located in the lower, eastern watershed and thus the stormwater flow pattern in that area may have differed from that a little farther inland at MTD 19 and 22. It could also be that MTD 10 and MTD 15 are closer to the beach, stormwater in this area may have contained higher levels of TSS. However, that pattern was not consistent over the three events. For the higher inflow concentrations at MTDs 10 and 15, the outflow concentrations were 1/2 to 1/3 of the inflow concentrations. For MTD 19, the concentrations of the outflow were similar to the inflow, and both were quite low. For MTD 22, the outflow was higher than the very low inflow.

For the October 2013 sampling, (samples 7-9 at MTD 19 and MTD 22) the samples at MTD 19 were collected at 16:21 and 16:27 for inflow and outflow and at MTD 22 were collected at 16:38 and 16:49, suggesting 6 to 11 minutes elapsed between inflow and outflow samples. Rainfall started around 16:15 and by 16:35 about 0.13 inches were reported with an additional 0.04 inches by 16:55. Thus, this would seem to be a good rainfall event to catch first flush at the sampling times, particularly in MTD 22. However, the inflow TSS concentrations remained below 20 mg/l at both stations.

For the December 2013 (samples 7-9 at MTD 10 and MTD 15) monitoring, samples were collected around 09:45. About 0.12 inches of rainfall was reported by 08:55, with only another 0.01 inch by the sampling time. The inflow TSS was below 20 mg/l at both locations, and the outflow concentrations were higher than the inflow. The first flush may have passed prior to the sampling.

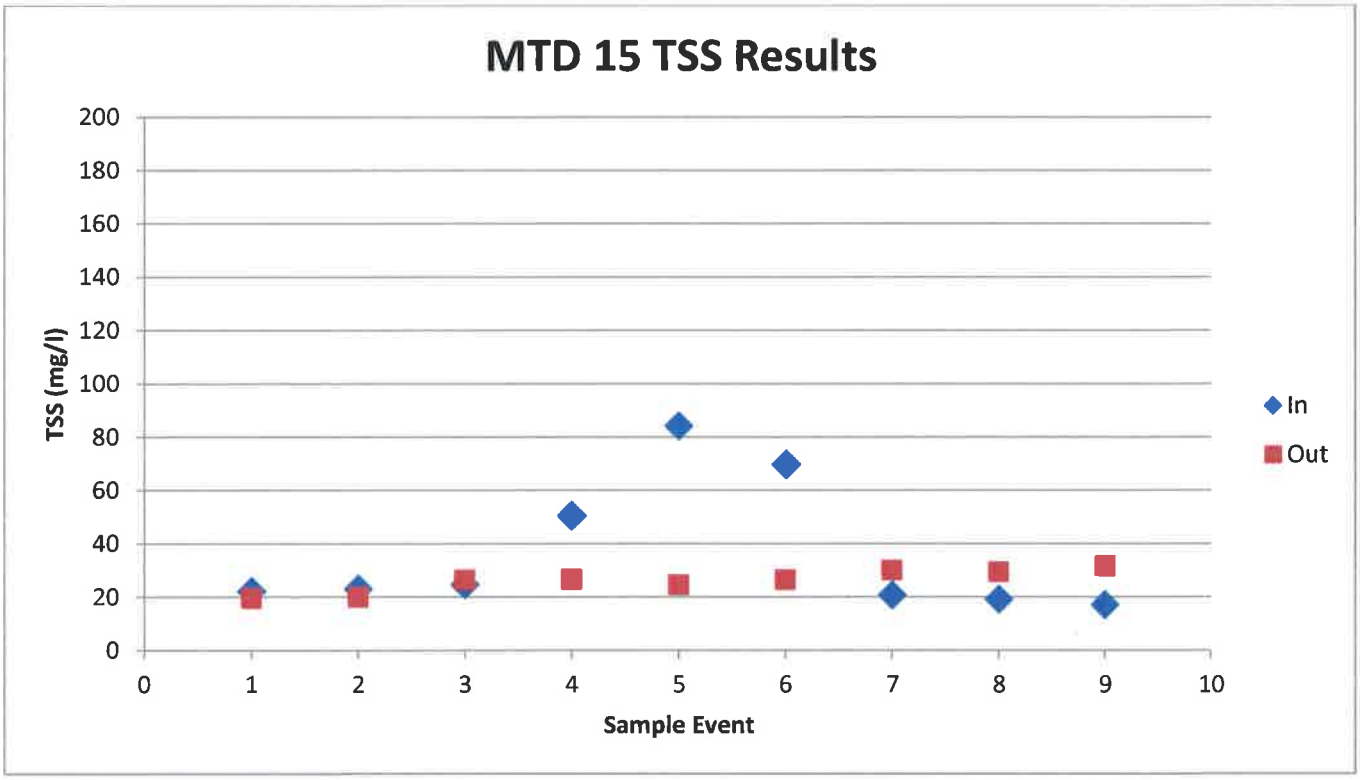
Overall, in most of the samples, the TSS concentrations in the inflow were below 30 mg/l and often below 20 mg/l. The outflow concentrations were also low, but were not consistently below the inflow concentration. When the inflow concentration was above 50 mg/l, however, the outflow concentration was below the inflow and the devices functioned as expected.

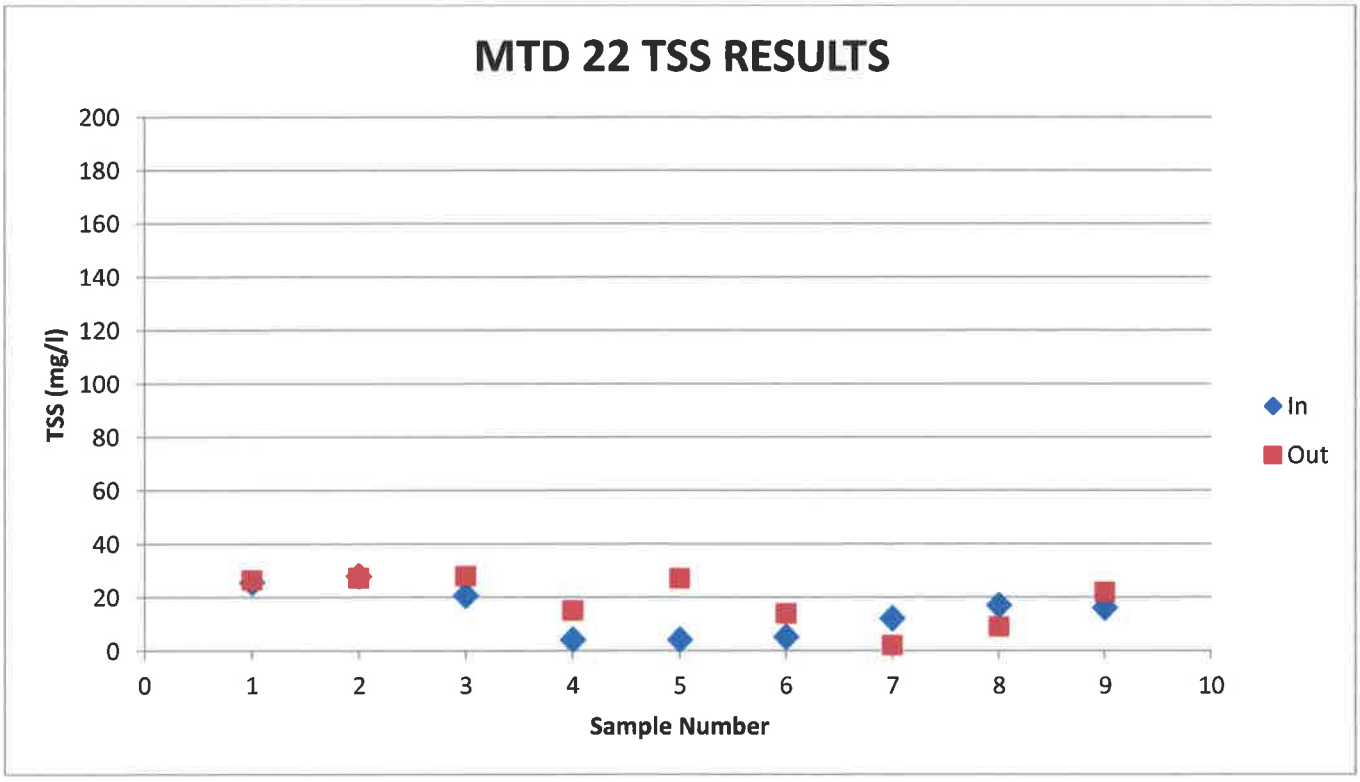
A goal of the monitoring was to evaluate differences among the devices, but that was not possible, given the limited results.

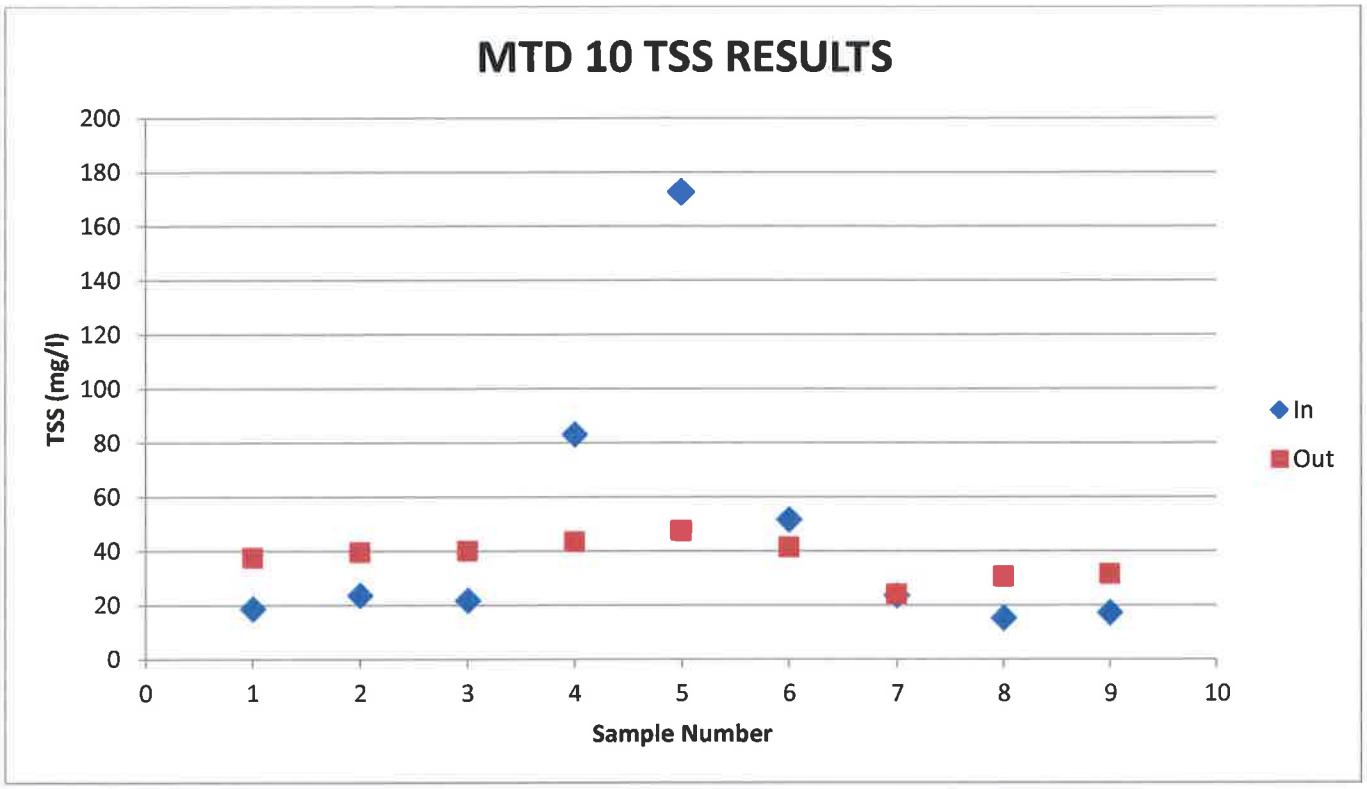
This limited study allows for limited conclusions. As noted, when the inflow concentrations were high, the MTDs showed reduced TSS in the outflow. However, when the inflow concentrations were low, the structures did not show much removal and some cases, the outflow concentrations were greater than the inflow. Additional data, including continuous sampling over a storm event, would be helpful in determining the efficacy of these units.

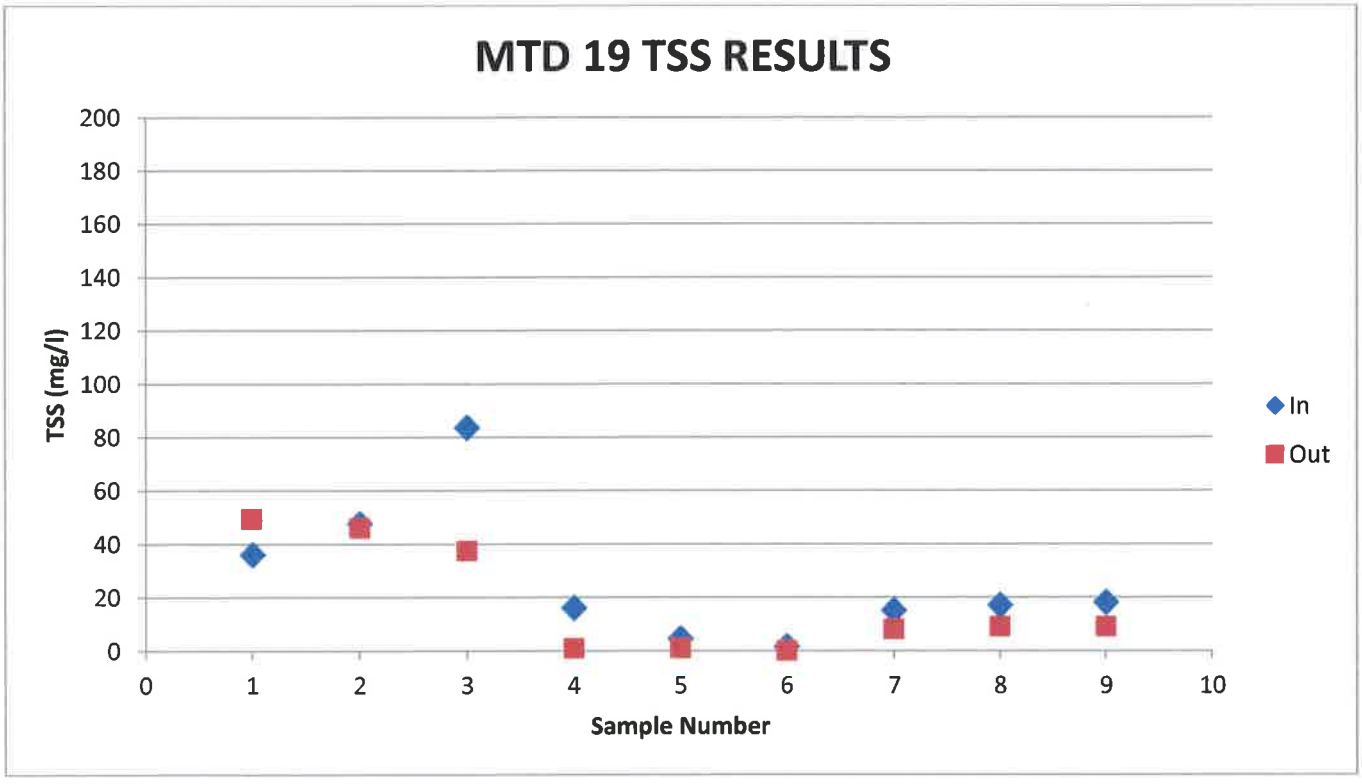
Table 2: Monitoring Results

		Avg TSS Conc (mg/l)	
Event	**Date**	**IN**	**Out**
MTD 15			
1	10/19/11	23.2	22.0
2	02/29/12	68.0	25.8
3A	12/23/13	18.8	30.3
MTD 22			
1	10/19/11	24.7	27.3
2	02/29/12	4.3	18.7
3B	10/07/13	15.0	11.0
MTD 10			
1	10/19/11	21.2	39.0
2	02/29/12	102.3	44.2
3B	12/23/13	18.5	28.7
MTD 19			
1	10/19/11	55.7	44.3
2	02/29/12	7.3	0.7
3A	10/07/13	16.7	8.7


MTD 15 TSS Results
TSS (mg/l)
200
180
160
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
Sample Event
In
Out


MTD 22 TSS RESULTS
TSS (mg/l)
200
180
160
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
Sample Number
In
Out


MTD 10 TSS RESULTS
TSS (mg/l)
200
180
160
140
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10
Sample Number
In
Out


MTD 19 TSS RESULTS
TSS (mg/l)
200
180
160
140
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10
Sample Number
In
Out

DEVICE LOCATIONS		
DEVICE	NORTHING	EASTING
19	480561.5840	622913.5323
5A	475552.7099	619101.0760
5B	475542.2387	619284.4242
7	476017.0317	621363.3475
10A	475572.5676	623330.2237
22A	477325.2124	622604.2561
21	478069.4400	622084.6424
34A	476728.3772	618990.2003
20	478445.9756	621151.1208
25B	477284.1539	622783.4741
25A	477255.7472	622924.8076
24A	477068.8719	623604.3291
15	475919.0624	624482.3682
13	475986.1582	624230.6070

CONTROL POINTS				
POINT NUMBER	ELEVATION	DESCRIPTION	NORTHING	EASTING
44	7.75	PK NAIL	476005.7604	624466.5334
68	8.69	PK NAIL	476767.5281	618994.2983
2001	6.00	AAS – DISK	477212.7770	623123.7260
2002	5.99	AAS – DISK	477420.0550	622586.2560
2003	13.95	AAS – DISK	479043.2560	622966.3040
2004	15.71	AAS – DISK	479463.7190	623053.7000
2340	6.52	PK NAIL	477088.6924	623639.9826
2347	7.29	PK NAIL	478103.2500	622092.6954
2349	8.97	PK NAIL	478479.2974	621136.7766
2360	14.91	PK NAIL	475542.8165	619223.1652
2361	10.61	PK NAIL	476043.8452	621297.7973
4358	11.14	IRON PIN W/CAP	475688.1373	622703.8624

LEGEND

- 00 PRIORITY A LOCATIONS
- 00 PRIORITY B LOCATIONS
- 00 PRIORITY C LOCATIONS
- 00 PRIORITY D LOCATIONS
- APPROX. PROJECT LIMITS
- C4 CONSTRUCTION PLAN SHEET#
- 2001 5.99 CONTROL POINTS

NOTE:

CONTRACTOR SHALL IMMEDIATELY NOTIFY THE COUNTY ENGINEER IF THEY ENCOUNTER ANY DISCREPANCIES WITH THE SURVEY CONTROL INFORMATION SUPPLIED ON THESE PLANS AND EXISTING STORM SEWER ELEVATIONS WHICH ARE BEING MODIFIED BY THESE CONSTRUCTION PLANS.

1"=400' scale 400 0 400 800 feet

DESIGNED P.A.C.
APPROVED P.A.C. CHECKED R.B.K.

ROBERT B. KUHNE
N.J. PROFESSIONAL ENGINEER NO.41367

GENERAL AREA MAP 4

MANUFACTURED STORMWATER TREATMENT DEVICES
WRECK POND BROOK WATERSHED
BOROUGHS OF SPRING LAKE,
SPRING LAKE HEIGHTS, SEA GIRT &
TOWNSHIP OF WALL, MONMOUTH COUNTY, NEW JERSEY

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Certificate of Authorization Certificate # 24GA27993300

DRAWN BY: AUTOCAD | SCALE: 1"=400' | DATE: 9/4/09 | DRAWING NO: 6373.M00 | SHEET NO: 4 of 20

Last Edited: 03/01/11 – 8:37 AM, By: jfortino
File: T:\6373.M00\dwg\MISC\Final\area_map.dwg

N

MTD 19

AqSwirl AS12

Vortechs 16000

Vortechs 16000

Vortechs 16000

Vortechs 11000

MTD 22

Stormcept OSR065

CDS 2015

AqSwirl AS-9

Vortechs 11000

Vorsentry VS70

Vortechs 3000

MTD 15

Vorsentry VS70

Vorsentry VS800

AqSwirl AS6

Strmcept OSR250

MTD 10

0 500 1,000 Feet

Legend

MTDs

MTD_Monitoring Station

- MTD 10
- MTD 15
- MTD 19
- MTD 22

Figure 1
MTD Locations and Samplng Point

Najarian Associates
30 years
The Science of Engineering