FABCO INDUSTRIES, INC
STORMWATER NUTRIENTS: P & N
TEST PROGRAM

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Executive Summary

Under a contract between a local municipality and Fabco Industries, Inc, Bohemia, NY, from October 2006 to December 2007 a series of field tests were conducted on the Fabco StormBasin and StormPod catch basin inserts to evaluate their effectiveness in reducing phosphorus and nitrogen compounds in stormwater runoff. The testing took place at 3 different sites and involved 5 different filter cartridge configurations.

The testing protocol called for testing under realistic field conditions; all test units were installed into existing roadside storm drains, only minimal maintenance was performed during a test sequence and the same filtering cartridge was used from start to finish better simulating expected results. All samples of treated and untreated stormwater were collected during the first 15 minutes – "first flush" of a rain event. Many published studies (example: First Flush Phenomenon, CalTrans, Aug 2005) have concluded that first flush runoff water contains the highest expected concentrations of pollutants during a storm event.

The data presented in the report confirms that the Fabco StormBasin and StormPod units were highly effective in reducing both phosphorus and nitrogen compounds. Specifically:

- Total phosphates were reduced an average 66% - exceeding the 40% required by many states including: New York, Maryland, Virginia and New Jersey.
- Total nitrogen compounds were reduced an average 44%

Additionally, although not required by the study, the report contains information on the type and quantity of solid debris; sediments, trash, leaves, sticks and other material that were collected in the units between tests. Using a separate laboratory analysis on this type

of debris, the report concludes significant concentrations of nutrients maybe stored in this captured material that is not included in the reported reductions.

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Introduction:

At the request of a local municipality, a stormwater monitoring program was initiated by Fabco Industries, Bohemia NY, to investigate the efficacy of using the Fabco StormBasin to reduce the levels of nitrogen and phosphate nutrients in stormwater runoff. These chemical species, which typically result from agricultural/landscaping activities, can give rise to eutrophication and subsequent growth of aquatic plant life in receiving waters. This growth tends to deplete vital dissolved oxygen reserves and can result in fish kills.

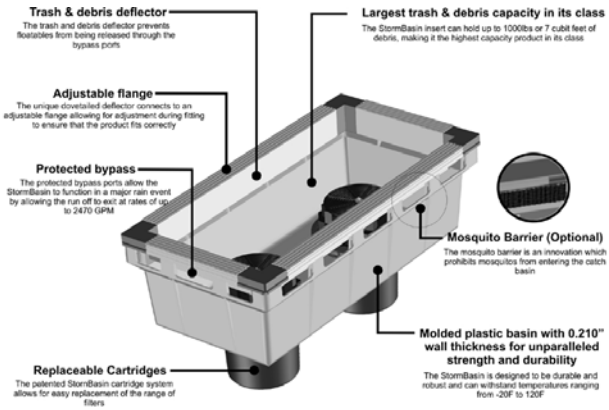
Although both nutrient types are important to plant growth many state stormwater programs require stormwater Best Management Practices (BMPs) to reduce only phosphate levels by a specific amount. For example New York State requires a 40% reduction of Total Phosphates. Specific reductions also come into play within the EPA's TMDL program (Total Maximum Daily Load).

Background:

The Fabco Industries StormBasin is a water treatment system that installs below the iron grate of an existing roadside or parking lot stormwater sewer drain. The StormBasin can be installed into most existing storm water drains without construction or other modifications. In this position the StormBasin intercepts and treats pollutants suspended and/or contained in surface water runoff including: sediments, trash and debris, oils, grease and other toxic hydrocarbon-based chemicals as well as potentially harmful bacteria.

The Technology:

The Fabco StormBasin system consists of a large, injection-molded basin for the collection of raw water, sediments and debris and one or more filtering cartridges located at the bottom of the tub, which treat and discharge the clean water into the storm water system. (Appendix A: StormBasin brochure)



The StormBasin cartridges are selected based on actual pollutant loads expected and are user replaceable.

Currently there are five standard cartridge configurations to choose from: General purpose, Heavy-hydrocarbons (oils & grease), Bacteria, Metals, and Nutrients. Each cartridge type applies one or more filtering technologies in varying degrees to treat specific pollutants. (Appendix B: Filter cartridge brochure)

At the start of the project, Fabco's original nutrient cartridge, although effective on both nitrogen and phosphorous compounds, would not consistently meet the 40%

phosphorous reduction required by many states, including New York. To improve performance on these nutrient compounds Fabco evaluated the use of ten different commercially available filter media in various combinations. Using a series of preliminary, bench scale experiments five were selected for testing within this program.

The media used in this study are identified as:

CHZ – A granular, highly active zeolite mineral which has proven abilities as an ion exchange media.

IC – A fine granular, iron based material specifically produced for efficient removal of phosphates, arsenic and silicates from fresh and salt water. Developed in Germany for treating main water supplies

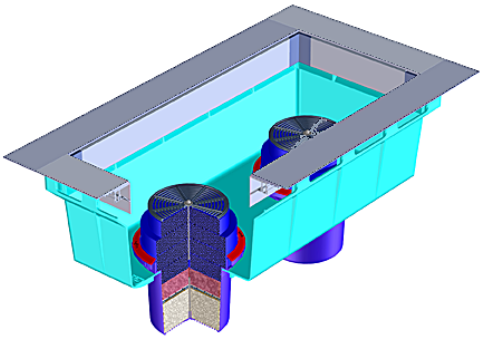
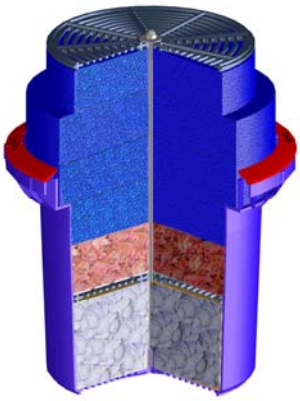
NP – A filter material that has found wide acceptance in large scale commercial aquariums over the past 20 years. NP is effective on ammonia, heavy metals, phosphates and toxic organics.

FP – Fabco's proprietary FabPhos product that combines the effectiveness and many of the properties of the "IC" and "NP" products.

FPAM – Fabco's antimicrobial treatment applied to FabPhos filter media. The antimicrobial surface reduces bacterial build up and slimes.

Using these materials Fabco assembled and tested 4 types of cartridges, which were designated

1. ICCHZ = Combination of layers of IC and CHZ
2. NP = Nutrient Pad material used as sole media type
3. FPCHZ = Combination of layers of FabPhos and CHZ
4. FPAM = Single layer of unique FabPhos material with an additional antimicrobial treatment.

Fabco StormBasin sectional view.	Fabco filtering cartridge. Volume above red ring is considered a "Pre-Filter"
	

Locations:

The sites selected for StormBasin installation were chosen from a list of approximately 15 locations provided by the municipality.

Under the terms of the contract Fabco Industries provided and installed 10 StormBasin units during the spring of 2005 in preparation for the testing. Fabco selected 3 sites for nutrients testing:

Site descriptions:

Site1 community Beach: Base line Nutrient values

The test drain was located in the Northeast corner of the beach parking field and serviced approximately 5900 square feet of black top paving. The parking field was slightly sloped towards the drain causing considerable accumulations of sediments, trash and debris to flow towards the drain. Most importantly for the bacteria study, the parking lot attracts numerous seagulls that leave behind unmistakable evidence of their visits.

Each sewer drain selected at this site had a 24”x48” grate and featured a rear open box inset into the concrete curb. Depth of the vault below the grate was approximately 40”.

Fabco Industries installed a 22”x 44” StormBasins (p/n 9731- 1E) which was configured for the rear open curb box. This configuration features a formed rubber flap that extends from the back edge of the tub into the rear open box. This flap enhances the unit’s ability to capture the very low flows that are generated during the first flush period of a storm. The StormBasin selected featured two (2) Bacteria filtering cartridges p/n 9718-2 (Yellow ring).

As the waterway adjacent to the beach is federally classified as an impacted waterway (303d) due to pathogens/bacteria pollution this was considered an ideal site for Fabco’s bacteria study. The final bacteria report provided by Fabco Industries was completed in December 2006 and is available on the Fabco Industries website (www.fabco-industries.com).

During the bacteria testing phase Fabco engineers had two sets of water samples analyzed for nutrients. It is important to remember that the cartridges used at the beach were optimized for bacteria treatment and as such had no nutrient treatment media in the filter cartridge. The purpose of this sampling was to identify and measure the baseline nutrient values at that site. With virtually no surrounding lawns or landscaped yards in the vicinity, low nutrient levels were expected

Site 2 community beach:

The drains at this site were located at the bottom of a steeply sloped driveway entering a popular beach front park. The driveway is narrow, heavily shaded, and does not attract any seagulls. Runoff entering the drains flows very quickly and contains considerable sediment loads. The drains empty directly into the harbor located approximately 400 feet away.

The two (2) storm drains selected had the same configuration and size as the drains at Site 1. However the two grates were situated next to each other and shared a common underground vault.

Fabco Industries installed two (2) 22”x 44” StormBasins (p/n 9731-1E) which were configured similarly to the units at Site 1 except for the cartridges.

As this site was similar to many other sites located along the north shore of Long Island New York it was considered a good site for nutrient testing.

Site 3: Residential neighborhood adjacent to waterway

A relatively short dead-end road was selected for the test as it had four well-landscaped properties running parallel to the road surface and the installed storm drains empty into a nearby pond located at the end of the road. Based on direct observations, it is suspected that the vegetation on these properties receives a considerable amount of fertilizer. Inasmuch as the storm drains on this road are routed to an estuarial body of water that ultimately drains to Long Island Sound, the impacts associated with the discharge of nutrients in stormwater are potentially significant.

The drain selected for testing was a 24” round grated inlet very similar to the ones you would see in commercial parking lots. This drain had sufficient depth for the unit and the testing apparatus.

Fabco installed a Round StormPod unit, p/n 9734-1A, which would accept a single Nutrients cartridge.

Methods

The sampling protocol called for the simultaneous collection of both an untreated and treated sample during a rain event. The samples collected were then transported to an independent laboratory[1] for analysis of the following analytes:

3 nitrogen compounds

- Total Kjeldahl or organic nitrogen: animal or human waste, decaying organic matter
- Nitrates (NO_3): inorganic nitrogen from two (2) sources breakdown of nitrites (NO_2) by nitrifying bacteria and chemical fertilizers
- Total Nitrogen: representing the sum of inorganic and organic nitrogen

Two types of phosphates

- Total phosphates: Combined organic and inorganic phosphates
- Ortho-phosphates: inorganic, soluble phosphates

Explanation of phosphate analytes:

Phosphorous is usually present in water in the form of phosphates. Phosphates can be organic or inorganic. Organic phosphate is phosphate that is bound to plant tissue, waste solids or other organic material. Inorganic phosphate is not bound to organic material. It can exist as free ions available for immediate plant uptake or attached to sediments. However, plants can only use inorganic free ions also called Ortho-phosphates directly. Organic phosphates must be decomposed into inorganic phosphate before plants can use it for growth.

The monitoring would take place over an indefinite time period with little or no maintenance being performed on the unit during the monitoring period. All samples represent a first flush capture.

Automatic sampling at sites 1 & 2

Water samples at sites 1 and 2 were collected automatically using a battery powered, Global Water, Model SS201 Storm water sampler (Appendix C).

The Global unit features a large, watertight plastic case and dual individually controlled peristaltic sampling pumps with 2 sample bottles. For this test, the standard 1-gallon sampling bottles were replaced with smaller 1 liter bottles.

To collect the effluent samples special collection “pails” or “buckets” were designed to attach and seal directly to the bottom of the standard Fabco Cartridge body.

[1] Ecotest Laboratories, Inc, 377 Sheffield Ave, N. Babylon, NY 11703, Tel: 631/422-5777

In the pictures on the right, the standard cartridge body is dark blue. The collection pail area is a light green color and is sealed to the cartridge body with a sealing adhesive.

Collection pail features:

Each collection pail was constructed with the following features:

1) A vertical over-flow pipe – To maintain approximately 2 liters of water in the pail while allowing excess water to escape.
2) A quick connect coupling – Connects pail to the supply line of the peristaltic pump and sample bottle.
3) A sensor switch - Activates pumps when the minimum level of water has accumulated in the pail.

Two collection pails were fabricated. The first was attached to the standard Fabco filtering cartridge under test. The second was attached to an empty cartridge body. These two filters were then installed into the bottom of the StormBasin unit with the supply lines routed to the Global Sampler.

Sample collection:

During a storm event surface water enters the StormBasin, flows into and through the cartridges and collects in the pails. When approximately two liters of water has collected, the sensor switch activates the pumps and two **First Flush** water samples are collected. The cartridge with the media left in place would supply a sample of treated water. The empty cartridge would collect a sample of untreated raw water.

Semi-Automatic Testing /Sampling at Site 3

The sampling program was set-up to simultaneously collect both the untreated and treated streams of stormwater flowing through the unit. The equipment used was the NALGENE (I-CHEM) Storm Water Sampler (Appendix D). The use of this device permits the remote collection of a sample from the first flush of a qualifying event.

The Nalgene sampler assembly consists of a round black mounting tube and a translucent one liter, plastic sampling bottle that is inserted down into the mounting tube.

Two samplers were used per unit; one was attached to the plastic collection tub and a second was attached to the bottom of the cartridge.

Prior to attaching the mounting tubes, a small hole (3”dia) was drilled in the bottom of the StormPod tub to allow water to pass out and into the sample bottle. This sampler would collect raw untreated water entering the StormPod

To prepare the cartridge a piece of round plastic material with a four inch diameter hole in the center was glued to the bottom of the filter cartridge. This flat plastic washer-like

device insured that water leaving the cartridge would be directed out of a central hole into the mounting tube and to the sample bottles.

The black Nalgene tubes were mounted vertically (extending downwards) from the bottom of the StormPod basin and filter cartridge using clevis pins so that they could be removed when required.

After completing these preparatory steps the white sample bottles were then inserted into the mounting tubes and the assembly was fixed, using the clevis pins, to the StormPod basin and cartridge body. In this configuration the bottle under the Basin would collect the sample of untreated water whereas the bottle under the cartridge would catch a sample of treated water.

Sediment Analysis:

As part of the contract, Fabco provided maintenance between testing cycles on the StormBasins to remove collected sediments and debris.

Numerous studies including the National Urban Runoff Program (NURP), which was used as the basis for the NPDES amendments to the Clean Water Act, sight the variety of pollutants, including nutrients that are attached to sediments in runoff.

As part of this study Fabco will include data from one of the maintenance visits.

Additionally, although we did not request a lab analysis of this particular collected waste, we will provide an analysis of a similar waste collected at a Fabco StormBasin site located along the water in Bayville, NY (Appendix E)

Field testing

Testing/sample collections took place during 5 time periods spanning 2006 and 2007.

Table 1: Stormwater sampling

Test	Site	Cartridge	Start Date	End Date	# Samples
1	Site 1 (2006)	Bacteria	10/2/06	10/17/06	2
2	Site 3 – Test 1 (2006)	ICCHZ	9/18/06	10/20/06	3
3	Site 3 – Test 2 (2006)	NP	11/16/06	12/19/06	2
4	Site 2 (2007)	FPCHZ	7/06/07	8/02/07	3
5	Site 3 (2007)	FP-AM	11/01/07	11/27/07	3

This section provides a brief discussion of the testing that took place during each of the 5 tests. For a quick overview, see individual appendices for each location/Test.

1. **Site 1:**

Testing was performed at this site in October of 2006. As expected the bacteria cartridges installed in the unit during the test were ineffective on these chemicals. Again the purpose of the test was to obtain a baseline for the runoff concentrations at the site.

Analysis of the raw samples verified that the runoff contained both Phosphorous and Nitrogen compounds in excess of the National median concentrations. The site recorded the highest levels of organic nitrogen (Kjeldahl) in the test. This is probably attributable to the large number of mostly seagulls that inhabit the site. (See appendix F for data)

2. **Site 3 (2006): Test 1**

Testing was performed during October of 2006. Analysis of the raw samples verified that the runoff contained both Phosphorous and Nitrogen compounds in excess of the National median concentrations.

The cartridge being used for test 1 was a combination of a commercially available Iron rich compound (IC) normally used for Phosphorous control and a zeolite compound (CHZ), which had shown an affinity for nitrogen compounds during in-house testing. Both filtering compounds were granular particles. (Cartridge designated ICCHZ)

Analysis of the results shows good performance on both phosphorus compounds with Total phosphorous being reduced an average 63% and Ortho phosphates being reduced by 69%.

Performance on nitrogen compounds was lower than expected due to poor results obtained in sample set #2.

Sample set 2			Untreated	Treated	% Change
Tot. Kjeldahl N.	mg/L		11.00	19.0	-72.73
Nitrate as N	mg/L		0.49	0.49	0.00
Nitrogen, total as N	mg/L		11.00	19.0	-72.73

Based on an analysis of the filtering cartridge, the poor results were probably related to the CHZ compound.

If we disregard this data point, nitrogen compounds were reduced by the ICCHZ cartridge as follows:

Tot. Kjeldahl reduced an average 36.63%
Nitrate reduced an average 29.2%
Nitrogen reduced an average 38%

Review of test 2:

The IC compound applied in the cartridge consistently reduced phosphorus compounds by greater than 40%. This supports traditional claims regarding the use of Fe compounds in waste water applications and large aquariums.

Results on the nitrogen compounds although encouraging were erratic. Additional testing on the CHZ filter compound is required to confirm effectiveness. (Appendix G for data)

3. Site 3 (2006): Test 2

The second set of tests performed at Site 3 was completed in November-December of 2006. For this test a commercially available filter pad called a Nutrient Pad (NP) was tested in the Fabco filter. The NP pad is a woven, mat-type product made up of bonded thin filaments that have been treated with a proprietary technology. (Cartridge designated NP)

This filter media performed very well in the first sampling for all compounds

First sampling	0330 (OUT)	Value	% reduction
Tot. Kjeldahl N.	mg/L	3.00	25.00%
Nitrate as N	mg/L	0.49	59.17%
Nitrogen, total as N	mg/L	3.00	42.31%
Ortho Phosphate as P	mg/L	0.02	96.36%
Tot. Phosphate as P	mg/L	0.15	72.73%

However, there was a decrease in performance during the second sampling set

Second sampling	0338 (OUT)	Value	% reduction
Tot. Kjeldahl N.	mg/L	9.20	8.00%
Nitrate as N	mg/L	2.00	4.76%
Nitrogen, total as N	mg/L	11.00	8.33%
Ortho Phosphate as P	mg/L	0.35	18.60%
Tot. Phosphate as P	mg/L	0.45	50.00%

Review of test 3:

Testing with the Nutrient pad verified that a product of this type has the potential to treat both phosphates and nitrogen compounds. It would be ideal if it could be improved or enhanced to offer more treatment ability/capacity. For the two tests reductions were: Tot Phosphate 61%; Ortho Phosphates 57%; Tot Kjeldahl 16%; Nitrate 31%; Nitrogen 25%. (Appendix G for data)

4. Site 2 (2007):

Testing on nutrients commenced in July of 2007. The cartridge under test contained the new Fabco enhanced Nutrient Pad, FabPhos (FP) that had been under development.

.since 2006. A secondary layer of the CHZ zeolite filter media was also added to the cartridge to aid in Nitrogen compound treatment. (Cartridge designated FPCHZ)

Testing verified good reductions on phosphorous with Total phosphorous (TP) being reduced an average 62% and Ortho-phosphates reduced 40%. Performance on Orthophosphate was a little less than the previous tests using the IC compound but over all effectiveness was good.

The reductions for nitrogen compounds although better than the first test with the CHZ granular media again were less than expected.

One aspect that affected the nitrogen results was the very rural, heavily wooded nature of the site. Unlike Site 3, Site 2 has virtually no landscaped lawns or properties on its perimeter. As a result, soluble nitrates, commonly found in commercial fertilizers were undetectable in 3 out of 4 samples resulting in zero percent reductions being included in the average.

Reductions on Total Kjeldahl and Total nitrogen were an unexceptional 16.7% and 2.5% respectively. Data for Nitrates was inconclusive.

Review of Test 4:

The 3rd set of samples with an iron enriched filter media demonstrated that this media is capable of effectively reducing Phosphate levels by greater than 40%. The FabPhos has more capacity than the NP and performed as well as the IC media. Therefore, additional testing by Fabco would be focused on the optimization of the FabPhos media.

For Nitrogen compounds, testing of the CHZ zeolite media had demonstrated that effectiveness could vary greatly from sample set to sample set. One theory from a micro-biologist suggested that natural bacteria captured in the granular media bed would continue to thrive inside the cartridge, using entrapped organic material for food. This continued growth between rain events would result in an increase of nitrate and Total nitrogen levels stored within the media. As a result first flush samples of the treated effluent could have nitrogen concentrations significantly higher than the raw untreated samples.

To test this theory additional field trials outside the scope of this report, using a cartridge of mainly CHZ zeolite, were completed. In these tests, a new cartridge performed well but subsequent testing over a twenty day period, showed as predicted, substantial increases in both Nitrates and Total Nitrogen. The collected data supports the theory that using granular zeolite media may actually promote the growth of bacteria. As a result CHZ was removed from further testing. (Appendix H for data)

5. Site 2 (2007):

Final testing at this site took place in November 2007. In this test we returned to the concept of a single media technology to isolate effectiveness. Based on the previous results the cartridge consisted of the standard antimicrobial treated pre-filter and FabPhos filter media only.

Previous data collected in the first four tests, confirmed the ability of the iron rich FabPhos material to reduce Total Phosphates and Ortho Phosphates by greater than 40%. Its ability on nitrogen compounds was so far untested.

Earlier in these trials the original Nutrient pad had shown some ability to reduce both nitrogen and phosphate concentrations. As a related product with many of the same properties as the NP media, this testing implied the FabPhos material by itself may be effective on Nitrogen compounds.

To reduce the possibility of bacterial action within the cartridge, the FabPhos material was also treated with our proprietary antimicrobial solution.

Review of test 5:

Table 2: Tests results at Site 3 - 2007

Site 3		IN	OUT	% Change
Tot. Kjeldahl N.	mg/L	3.80	2.40	36.84%
Nitrate as N	mg/L	1.40	0.49	65.00%
Nitrogen, total as N	mg/L	5.20	2.90	44.23%
Ortho Phosphate as P	mg/L	0.58	0.17	70.69%
Tot. Phosphate as P	mg/L	0.57	0.34	40.35%
Site 3		IN	OUT	% Change
Tot. Kjeldahl N.	mg/L	0.80	0.60	25.00%
Nitrate as N	mg/L	0.49	0.49	0.00%
Nitrogen, total as N	mg/L	0.80	0.60	25.00%
Ortho Phosphate as P	mg/L	0.49	0.09	81.63%
Tot. Phosphate as P	mg/L	0.33	0.09	72.73%
Site 3		IN	OUT	% Change
Tot. Kjeldahl N.	mg/L	3.00	1.00	66.67%
Nitrate as N	mg/L	1.00	0.50	50.00%
Nitrogen, total as N	mg/L	4.00	1.50	62.50%
Ortho Phosphate as P	mg/L	1.90	0.26	86.32%
Tot. Phosphate as P	mg/L	2.10	0.30	85.71%

In average the data shows excellent reductions for each of the 4 chemicals

Tot. Kjeldahl N.	Reduced	42.84%
Nitrate as N	Reduced	38.33%
Nitrogen, total as N	Reduced	43.91%
Ortho Phosphate as P	Reduced	79.55%
Tot. Phosphate as P	Reduced	66.26%

These tests demonstrate that the FabPhos material far exceeded the 40% TP reduction required by New York State. And, more importantly the soluble phosphate, which is directly available for plant growth, is reduced by nearly 80%.

Nitrogen levels of all types were also reduced an average of nearly 40%. This data confirms the initial test data obtained in 2006 at Site 3, where the nutrient pad by itself, was very effective on Nitrogen compounds.

Starting with the technology of the Nutrients pad, the iron infused FabPhos offers better performance on phosphates while still treating nitrogen compounds effectively.

The antimicrobial treatment will continue to maintain effectiveness of the filter media by reducing the growth of bacteria and slimes within the cartridge, improving the longevity and service cycle. (Appendix I) (Appendix J summary of all results)

Conclusion

Under the terms of the contract a total of ten (10) StormBasin or StormPod units were installed at designated locations within the town. Fabco Industries was contracted to install, maintain/service and provide testing at three sites. Testing was broken up into two phases: 1) Effectiveness on pathogens/bacteria and 2) treatment of nutrients: phosphorous and nitrogen.

In the first half of the testing program "Beach/Harbor stormwater test program" StormBasin effectiveness was measured using 3 common bacteria indicator organism: E.coli, Fecal Coliform and Enterococcus. This study completed in 2006 is available on the Fabco website www.fabco-industries.com. This report focuses on Test Phase 2: Nutrient treatment and reductions.

Testing for effectiveness on nutrients:

3 sites in the Town were designated for evaluation:

Site 1: a popular and busy town beach
Site 2: another popular beach with different terrain and environmental conditions than Site 1
Site 3: a small, affluent community with highly landscaped and maintained yards located near a sensitive waterway.

Testing process: 5 independent tests were run at the 3 sites; each test lasted about one (1) month in duration

Site 1 – Base line nutrient levels only
Site 2 – filtering effectiveness using 1 filter configuration
Site 3: 3 tests – evaluating filtering effectiveness with 3 types of filter media

A total of 13 sets of influent and effluent samples were collected and analyzed by:

Ecotest Laboratories, Inc.
377 Sheffield Ave
North Babylon, NY 11703
Tel: 631/422-5777

Baseline concentrations at each site:

Analysis of untreated raw samples from all three sites confirmed that nutrient values in nearly every case, exceeded the National Median Concentrations as indicated in Chapter 2, pg 2-3 in the New York State Stormwater design manual.

Table 3: Nutrient concentrations at test sites (Appendix K baseline values)

	mg/l	Nat'l Median	Site 1	% > median	Site 3	% > median	Site 2	% > median
Tot. Kjeldahl N.		1.47	**7.40**	**403%**	5.73	290%	4.60	212.93%
Nitrate as N		0.53	**1.15**	**117%**	1.06	100%	0.50	-5.66%
Nitrogen, total as N		2.00	8.55	328%	6.67	233%	4.60	130.00%
Ortho Phosphate as P		0.10	0.03	-75%	**0.94**	**836%**	0.50	400.00%
Tot. Phosphate as P		0.26	0.16	-40%	**1.22**	**369%**	0.78	200.00%

(Appendix L National Median Concentrations, NYS Stormwater Manual)

StormBasin and StormPod effectiveness

Based on the raw nutrient analysis, the majority of the sampling was performed at Site 3. This site provided the second highest nitrogen levels and the highest measured phosphorous concentrations in the study.

All samples were first flush samples which typically contain the highest levels of contamination during a single storm event.

3 tests were run at the Site 3 location. A total of 3 cartridge types were evaluated.

The final cartridge featured Fabco's new proprietary filtering media FabPhos-AM. In November 2007, the StormPod unit installed on the site reduced Total nitrogen compounds by over 40% and Total Phosphorous compounds by over 66%

Table 4 Final results:

Average of 3 events	Units	**Unfiltered**	**Filtered**	**% Reduction**	**Nat'l Median**
Tot. Kjeldahl N.	mg/l	**2.53**	**1.33**	42.84%	1.47
Nitrate as N		**0.96**	**0.49**	38.33%	0.53
Nitrogen, total as N		**3.33**	**1.67**	43.91%	2.00
Ortho Phosphate as P		**0.99**	**0.17**	79.55%	0.10
Tot. Phosphate as P		**1.00**	**0.24**	66.26%	0.26

The results show that the Fabco Industries StormBasin and FabPhos-AM reduced nutrients in stormwater flowing from fertilized, landscaped properties down below the median national average. **The 66% reduction in Total Phosphorous comfortably exceeds typical State requirements of 40%.**

It is important to realize that these reductions do not include the nutrients attached to sediments and bound to organic matter that are captured and stored in the StormBasin/StormPod collection tub. Maintenance records show over 750 pound of trash, debris and sediments being removed from the site 1 unit annually. With Site 2 contributing over 1100lbs. 100 similar installed units would collect between 37.5 and 55 tons of sediments annually.

Nutrient contributions from Sediments and Organic matter:

A coarse analysis of the debris captured at Site 3 showed approximately 150 pounds of trash and debris along with 950 pounds of sediments.

The trash component contained mostly leaves, twigs and grass. In his Nov 2007 article (Stormwater, Nov/Dec 2007, Vol. 8, No. 8, Stormwater pollution: Getting at the Source) L.A Baker estimates a single Maple leaf would contribute 0.3 kilograms of phosphorous per year and that a tree lined road could have greater input than lawns. Capturing and retaining this organic material relatively dry in the StormBasin will significantly reduce the availability of these stored nutrients to the environment. To further aid effectiveness, maintenance activities should be coordinated to clean out the units in the fall months.

Due to the quantity of sediment collected Fabco investigated the size distribution and chemical composition of the load both of which are reported.

Sediment reductions are mandated by most states including New York and for good reason. Many studies have identified nearly every type of pollutant attached to the particles including nutrients.

In our study, Fabco Industries evaluated typical sediments collected in StormBasins located in two Long Island communities

Table 5: Analysis of sediments collected in Fabco StormBasins

Time period 3-4 mo	Location 1	Location 2
Sediments	120.65 Kg	70.3 Kg
Tot. Kjeldahl	590 mg/Kg	780 mg/Kg
Nitrate	8.2 mg/Kg	< 1.0 mg/Kg
Nitrogen	600 mg/Kg	780 mg/Kg
Tot Phosphate	200 mg/Kg	180 mg/Kg

Using the total weights and concentrations indicated in the chart above, the total amounts of nitrogen and phosphorous retained in the captured sediment is shown below.

Location	Total Nitrogen/Total Phoshorous	Yearly (3 cleanout)
1	2.55 / 0.85oz	7.65 / 2.55oz
2	1.93 / 0.45oz	5.79 / 1.35oz

Using the average of these two sites (6.72 TN / 1.95 TP) if we had 100 units the amount of nutrients stored in the captured sediments (yearly) would be equal to 42 pounds of nitrogen and 12 pounds of phosphorous. The State Environmental Resource center (www.serconline.org) suggests that one pound of phosphorous can result in the growth of 350-700 pounds of green algae. 12 pounds would grow 2 ½ to 4 ½ tons of algae.

Again, the nutrient reductions reported earlier reflect reductions in the water samples only and do not include these substantial amounts collected in the debris and in this sediment load.

Recommendations:

As part of a series of simple Best Management Practices the StormBasin can assist the stormwater manager in complying with State and Federal water quality goals in terms of nutrient reductions.

1) StormBasins can be installed quickly at impacted sites using existing drains without additional construction costs. (As an added benefit, pre-installation site surveys can be used to inspect for illicit dumping activities which is also a suggested Stormwater BMP).
2) The StormBasin can help meet State Stormwater and Federal TMDL regulations by reducing nutrients using three methods:
    a. Capturing sediments which can contain many pollutants including nutrients.
    b. Treating the important soluble nutrient compounds including the Ortho-phosphates, which are immediately available to plant growth and have potentially the biggest impact on waterways.

c. Retaining organic debris, keeping it dry and available for easy cleanout before decomposition, and subsequent release of stored nutrients

3) The StormBasin will improve existing street sweeping and spill prevention programs by treating the soluble pollutants and capturing sediments and debris that collect or are deposited between scheduled sweeping.

   The sweeping program would also keep the StormBasin cleaner, maintaining effectiveness and reducing the maintenance frequency. And in terms of servicing, many new sweepers are equipped with catch basin cleaning attachments that can quickly service the units. This eliminates additional staffing and equipment.

   Used as a total solution, spill prevention, sweeping and StormBasin inserts, would keep the paved areas cleaner, minimize the pollutants loads available to first flush action, and reduce the pollutants entering waterways either through the drains or directly from sheet flow off surrounding surfaces.