FABCO INDUSTRIES, Inc
STORMBASIN FILTER CARTRIDGE TEST REPORT:
CLEAN FLOW RATE
OILS AND GREASE EFFECTIVENESS

Prepared by:

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Executive Summary

To confirm flow rates and treatment capabilities of its' StormBasin storm water filtering system, Fabco Industries, a manufacturer located on Long Island, NY, designed and constructed a High-Flow hydraulic test fixture. The Test fixtures concept was based on other test fixtures utilized by various state and federal certification agencies during there own testing of competitive catch basin insert filters. The design goals of the Fabco test fixture called for accurate, continuous flow rates from 0 to approximately 400 gpm and the ability to inject precise concentrations of specified pollutants in order to best simulate actual storm water concentrations and homogeneity.

The report confirms that the test fixture was able to meet the required specifications in terms of flow rate and pollutant concentrations. The standard test cartridge was able to achieve a continuous clean flow rate of 100 gpm (+/- 15%). And, finally, oil and grease contamination contained in the simulated flow were reduced by greater than 90% at flow rates in excess of 80 gpm.

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1.0 Purpose of the testing:

1. To describe a hydraulic test fixture and conditions used to perform high flow and performance testing on Fabco's StormBasin filter cartridges.
2. To define flow characteristics of the standard Fabco replaceable filter cartridge identified as Fabco part number 9718-1
3. Acquire performance data (hydrocarbon removal efficiencies) obtained from the hydraulic test fixture and confirmed by an independent laboratory, (EcoTest Laboratory)

2.0 Objective:

The objective of the testing described herein is to verify flow capacity and hydrocarbon removal efficiency for the standard Fabco filter cartridge, at nominal flow rates of 80-gpm and 100-gpm.

3.0 Description:

Fabco Industries has developed a line proprietary storm water filtering unit trade mark name StormBasin that utilizes replaceable filtering cartridges that are optimized to treat the majority of pollutants associated with surface water runoff. This report focuses on:

1. Confirming the approximate clean flow rate through a typical filter cartridge and

2. Defining the efficiency of this cartridge for treating hydrocarbons at flow rates that approximate real world velocities encountered during a significant rain event.

In this test the cartridge effectiveness was verified using a synthetic stormwater matrix which approximated the solution used in the "In-Drain Treatment Technologies Equipment Verification" report published in September 2003 by NSF International under a cooperative agreement with the U.S. EPA (see Appendix A for NSF Stormwater Matrix).

3.0 description: (continued)

Actual hydraulic testing was performed at Fabco Industries Inc, Bohemia NY, using a test fixture designed to regulate a steady supply of water to the cartridge under test (see Appendix B) from 0 to 400 gpm. The hydraulic test fixture was equipped with a peristaltic pump that was used to accurately inject the concentrated hydrocarbon matrix into the flowing water entering the cartridge under test. Manual before and after grab samples were taken in accordance with EPA method 413.1
(see Appendix C for sampling protocols).

1. All testing performed on the cartridges revealed no failures or breakdown of components.

2. Each cartridge tested met or exceeded the flow requirement of 100-gpm ±15%.

3. Independent laboratory testing verified that at 80-gpm and 100-gpm, the standard filter cartridge removed greater than 90% of the infused oils and greases from the simulated stormwater.

4.0 The Standard Cartridge:

1. The 9718-1 standard replaceable cartridge is designed to be inserted into Fabco StormBasin units.
2. The cartridge housing is made polypropylene polyethylene plastic, which is extremely durable and engineered to handle temperature extremes.

3. The cartridge body features an integrated locking mechanism that keeps the cartridge fixed into the bottom of the StormBasin unit even through backflow events.
4. Each cartridge is a sealed unit containing a combination of proprietary filter media configured for high flow, anti-blinding and effectiveness on: fine suspended solids, low level hydrocarbon compounds, heavy metals and pathogens.

5.0 Hydraulic Testing of Standard Cartridge:

Prior to performing "Flow" and "Oil and Grease" testing on the 9718-1 standard cartridges, the calibration of 2 digital flow gauges built into the hydraulic test fixture were verified using a separate 300-gallon calibration tank. Simulated stormwater flow (no pollutants added) was diverted, using a single gate valve, from the test cartridge holding fixture into an external 300-gallon calibration tank. Using a calibrated external sight-tube attached to this calibration tank, flow gauge accuracy was verified by precisely determining the time to fill 100-gallons into the calibration tank and then comparing this actual flow rate to the readings displayed on the 2 digital flow gauges. Using this method the digital flow gauges proved to be accurate to within a 1% error. After calibration the simulated storm water flow was redirected back to the cartridge under test.

After flow stabilization/calibration the peristaltic infusion pump was turned on thereby injecting the oil/grease matrix into the water flow that was piped to the cartridge under test. Thorough mixing of the synthetic storm water matrix was accomplished through natural water turbulence and a diverter mounted at the end of the pipe entering the cartridge testing chamber.

All contaminated water was directed through the cartridge at the stated flow rates. The contaminated water was allowed to flow into the test fixture and cartridge for approximately 1 minute, at the desired flow rate,

prior to any sampling. This provided sufficient time for the injected matrix to mix and migrate down to the cartridge.

The test fixture permitted easy access for both BEFORE and AFTER grab samples. The samples were stored in accordance with NSF and EPA guidelines prior to being sent to the laboratory for analysis.

6.0 Conclusion:

1) The hydraulic test fixture designed by Fabco engineering was calibrated and able to accurately operate at flow rates ranging between 0 and 400+ gpm. The test fixture was also capable of consistently injecting metered amounts of a concentrated, liquid matrix into a clean flowing water stream thereby creating a realistic simulated storm water flow.

2) Hydraulic testing confirmed a cartridge, clean, flow through rate of 100-gpm ±15%.

3) Hydraulic testing performed on the Fabco standard replaceable cartridge confirmed a greater than 90% reduction in Oils and Greases at flow rates of 80-gpm and 100-gpm. See Appendix C for additional sampling and report data.

Appendix A

NSF Recommended Stormwater Matrix

Table 3-2 of NSF report

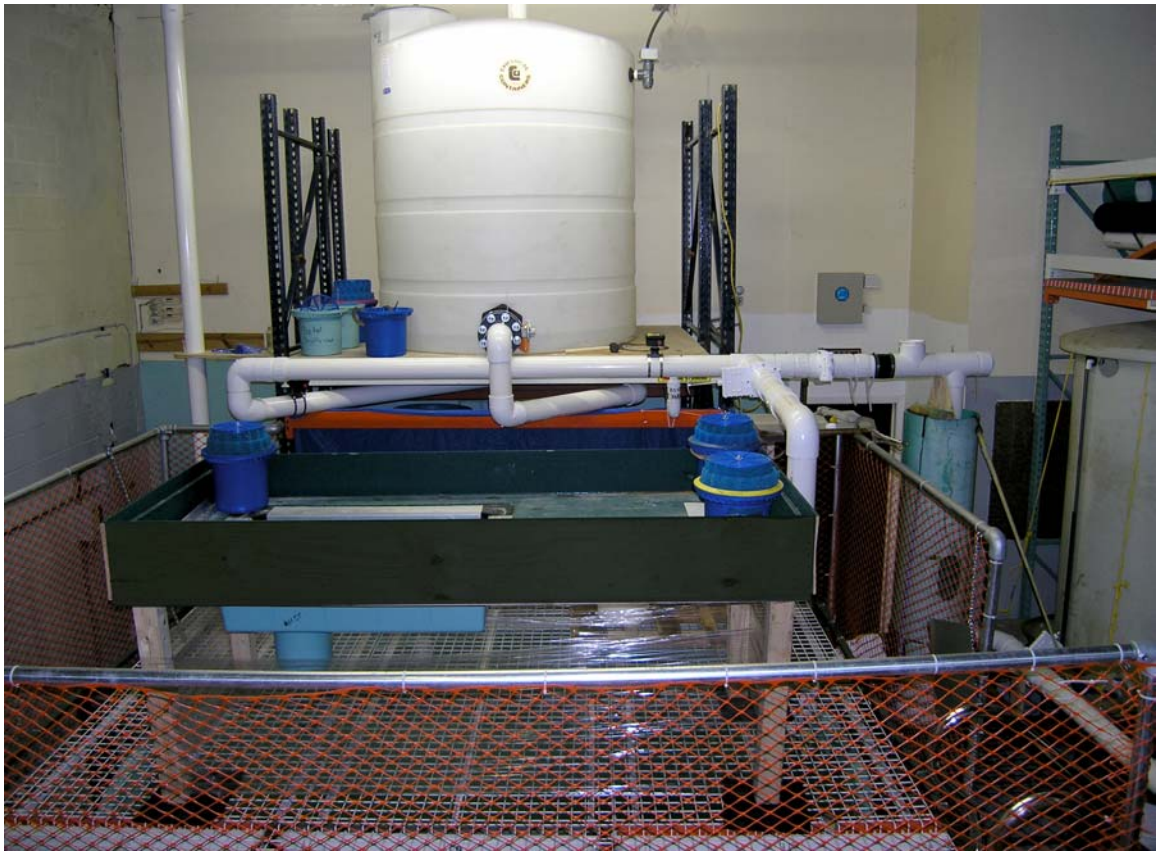
Table 3-2. Analytical Concentrations of Synthetic Wastewater Mix

Parameter	Concentration (mg/L)
TPH	42
TOC	13
Oil & Grease	52
Benzene	0.002
Ethylbenzene	<0.001
Toluene	0.003
Total Xylenes	0.002
MTBE	<0.001
Total Phenols	0.003
Total Suspended Solids	300
Metals (Al, Cd, Cr, Cu, Fe, Pb, Zn)	2
Surfactants (MBAS)	12
COD	280
PO_4-P	1
TKN	3
NH_3-N	0.2

Appendix B

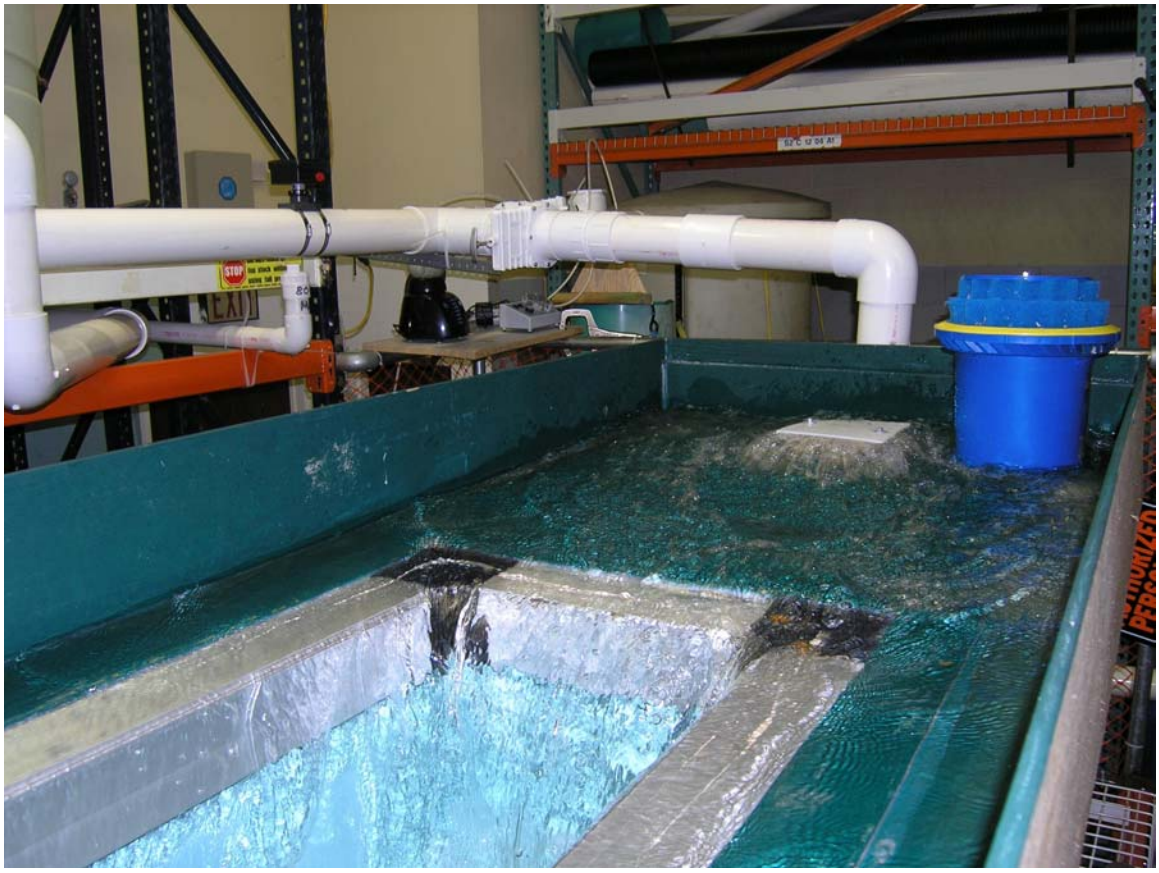
Fabco Re-circulating Hydraulic Test Rig – Image 1

Bohemia, NY



Fabco Re-circulating Hydraulic Test Rig – Image 2

Bohemia NY



Appendix C

Sampling Protocols / Analytical Parameters

Oils and Greases

Laboratory Test report: StormBasin effectiveness on hydrocarbons: oils & Greases

Various tests have been conducted with the Fabco StormBasin unit in order to determine the ability of the filter cartridge system to remove pollutants. Many of the in house tests are run using the experimental test apparatus shown in Figure # 1. The test fixture is designed around a vertically oriented pipe which can be fitted with a single Fabco filtering cartridge (fig 2) in a down flow configuration. System piping permits the injection of simulated pollutants into a continuous flow of water supplied by a large clean water tank. The fixture provides access for before and after sampling and the diversion of test effluent to separate tanks to allow for: flow stabilization, storage, and treatment of the wastewater prior to disposal. The design also insures that the entire pollutant load is directed down through the cartridge.

In this experiment the system was operated at two different continuous flow rates: 80gpm and 100 gpm. These rates were measured through the use of dual, in-line flow meters, which had been calibrated using accepted catch-and-weigh techniques.

In order to simulate pollutant loading in storm water runoff, a concentrated mixture of typical automotive fluids was made according to the proportions used in the Verification Testing Protocols prepared by NSF International for its' test under the direction of the US EPA. The components of the test mix are shown in Table # 1. For the purposes of these tests, it was decided not to include soils in our liquid matrix. This omission should give a truer measure

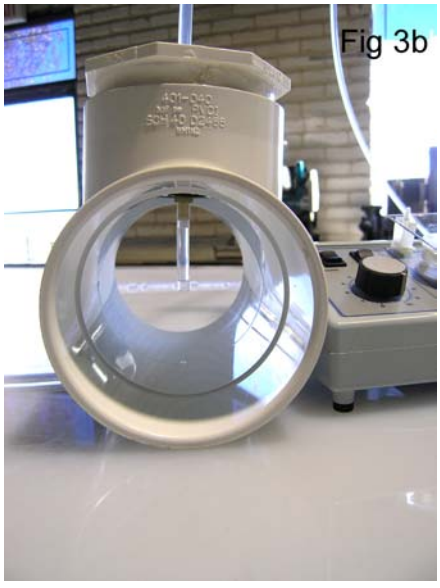
of the filters ability to remove free and emulsified oils and grease without the interference of suspended solids. This a more conservative approach as sediments readily bond with oils and grease which then get trapped in the filter by mechanical means. Varying the TSS concentration and particle size distribution could affect oils & grease removal rates by some unknown percentage.

Table #1

Synthetic Storm water matrix	
Component	% by volume
Gasoline	0.3
#2 Diesel	12.9
10W-30 motor oil	64.6
Brake Fluid	3.2
Antifreeze (glycol based)	9.5
Windshield Washer Fluid	9.5

The contaminants used included those normally present in maintenance areas, parking lots, gasoline stations and truck stops. The concentrated pollutant mix was pre-diluted with water in order to facilitate better mixing and dispersion into a flowing water stream. The pre-injection material was maintained in a reservoir where it was constantly agitated to prevent separation.

During the experiment a clean flow of water was allowed to pass through the StormBasin filter until stabilization at the required rate. The emulsified liquid was then precisely metered into the clean water in the pipe through the use of a calibrated peristaltic pump (figs 3a & 3b). This technique which is similar to that adapted by the NSF for the EPA provides a precise injection of the pollutant liquid matrix over a given period of time. The rate at which the pollutant matrix was injected in our experiment was chosen in order to generate a synthetic runoff mixture having an O&G concentration of approximately 200 mg/L



Manual Grab samples were taken of both the influent (fig 4) and the effluent (fig 5) materials in EPA approved 1 liter glass bottles for Oil and Grease and 40 ml vials for Gasoline components (BTEX).

All samples were appropriately collected, preserved and promptly transported as directed by the selected analytical laboratory EcoTest Laboratories, Inc.

Tests results reported from the laboratory included before and after results for gasoline components (BTEX) separately from the analysis for oils and grease.

The analytical results for Gasoline Hydrocarbons (semivolatiles) were somewhat inconclusive in that the levels found during analysis are quite low and, in some cases, approximated the minimum detection limits of the equipment. Additionally, there was free product (insoluble hydrocarbons) observable floating in the sample containers after collection. Testing of these collected samples did not include any part of the free product and therefore yielded results for only the soluble fraction of hydrocarbons dissolved in the water. In this case the water sample analyzed was not representative of the total sample therefore the results for these gas components was not presented in this report.

O&G removal efficiency:

Oil and Grease data generated from the experiment indicated that the filter cartridge provides greater than 90% removal of these materials at 80 and 100 gpm.

Technical support, sample containers and analysis provided by:
EcoTest Laboratories, Inc
377 Sheffield Ave
North Babylon, NY 11703
EPA Lab code NY 00038; NY lab ID 10320

Test 1: 254319.02
Syn Storm water containing oils and grease (automotive fluids)
Flow rate 80 gpm

Analytical Parameters	Units	Before sample	After Sample *	% Change	Lab reporting limit	EPA method
Oil and Grease	mg/L	64	< 5	92.2	6	413.1

Test 2: 254363.01
Syn Storm water containing oils and grease (automotive fluids)
Flow rate 100 gpm

Analytical Parameters	Units	Before sample	After Sample	% Change	Lab reporting limit	EPA method
Oil and Grease	mg/L	55	< 5	90.9	6	413.1