

Objective 1: Field demonstrate in New England the effectiveness of AbTech Smart Sponge Plus in a catch basin insert application in reducing bacteria contamination in stormwater. To remove 75% of hydrocarbons and bacteria from discharge sites of select high impact stormwater systems before they have a chance to enter Long Island Sound.

**The 275 AbTech Filters have been in the ground for two years. Two rounds of filter maintenance and cleanings were performed to determine the volume of trash, leaves, and other debris removed from the filters. The first cleaning yielded 14,816 pounds and the second cleaning yielded 15,860 pounds. These represent the equivalent of 54-56 pound of trash and debris per drain per cleaning session and a grand total of 30,676 pounds, or over 15 tons, of trash and debris removed from the filters that would have otherwise entered the Long Island Sound. See Appendix 1 for more details.**

**An analysis of the water quality was also performed with the results showing filter removal efficiency of bacteria (e.Coli) averaging approximately 75% and removal up to 95.9%. Oil and grease removal was 70.5%.**

**Further sampling of filter runoff by the city was very challenging due to the timing of the rainfall, which usually occurred after hours when the lab was closed. This made it difficult to meet the stringent testing protocols. In an attempt to validate the performance, alternative methods were pursued to document contaminant removal for hydrocarbons and solid contaminants. This alternative method consisted of quantifying the amount of contaminants trapped in the Smart Sponge media through sophisticated analytical techniques. (See Appendix 2.) The deconstruction or melting of the Smart Sponge media documented (for the tested filters) approximately 50 pounds per filter (including solvents, oils, and cosmetic product components as well as chemical plasticizers)(AbTech, 2007). With an average removal of 49.2 pounds of pollution per filter. The grand total of contaminates including hydrocarbons and heavy metals removed, extrapolated on the 275 filters, is an estimated 13,530 pounds (AbTech, 2007).**

**Soundkeeper has been extremely happy with how the filters have held up and continued to reduce hydrocarbons and bacteria. There have been no flooding or ice problems throughout the entire course of this project.**

Objective 2: To raise the awareness of Norwalk residents as well as the general public, about 500,000 people, about non-point source pollution, public health and Long Island Sound water quality.

**This objective was successfully met by presenting, speaking, and writing to the public in numerous ways.**

**It started with a press conference that was held to kick off The Filter Project. Soon after, brochures were created which detailed storm water runoff. These brochures were handed out at schools and brought home to families throughout the project term.**

**Frequently, demonstrations were made to show the Smart Sponge Plus technology. There were exhibits at Christmas fairs, Earth Day celebrations, public meetings, workshops, local businesses, and government offices.**

Articles explaining the project and research were frequently published in local Norwalk and Stamford media. Terry Backer was invited to radio shows which discussed pollution in the Long Island Sound and public health.

A physical model called *Enviroscape* was made and used to educate the public and municipal officials. *Enviroscape* demonstrates the harm of storm water runoff by physically adding substitutes for different types of pollution and then letting water run through the varied landscapes to show how pollution infiltrates our water quality differently, depending on land cover and land use.

Through teaching others why storm water runoff is such a threat to the environment, how these filters are a big step in learning more, and abating the problem, thousands of people were reached

Please see Appendix 3 to review a detailed list of how we met this objective.

Objective 3: To inspire a new generation of environmental stewards by engaging 25 elementary, middle school and high school classes in The Filter Project.

This objective was met by educating school groups in Norwalk and the surrounding towns. A non-point source curriculum was developed. Part of the curriculum uses *Enviroscape* as a landscape simulation, and then adding Smart Sponge Plus and motor oil to show the effectiveness of the filters. Dioramas were also used with the lower grades.

The Maritime Aquarium at Norwalk brought the students outside and showed the filter installations into the storm drains, for the kids to understand how they were placed in the drains. There was a display near the catch basin to inform others of this project. No pre/post tests were administered at the request of the schools.

Professional development workshops were created and then presented. The workshops taught teachers how to use the new curriculum for four 4<sup>th</sup> grade classes at Silvermine Elementry School in Norwalk.

A video was developed documenting the use of Smart Sponge and the technology that was used to collect oil and kill bacteria on site.

Throughout the first year and a half of this project, the Norwalk River Watershed Initiative and the Maritime Aquarium at Norwalk taught school aged children about stormwater runoff and pollution problems in the Long Island Sound. Students of all ages were taught, ranging from 4<sup>th</sup> grade through college level biology. Please see Appendix 4 to read more specifics about where and when education took place.

Objective 4: To secure the commitment of two Fairfield County municipalities to launch similar filter projects.

This aim was met by completing the following proposals and meetings:

1. Project coordination meetings involving the city of Norwalk, The Maritime Aquarium at Norwalk, Norwalk River Watershed Initiative, Soundkeeper, Longo and Longo, and AbTech. Meetings took place:
  - a. 9/30/05

- b. 10/12/05
- c. 11/17/05
- d. 1/2006
- e. 2/2006

Note that there was also significant additional communication through e-mail and phone.

2. In November 2007, Soundkeeper met with town of Fairfield officials to discuss funding opportunities for their own filter project on some pollution “hot spots” in their town. Funders were suggested and suggestions for the final proposal were later made.
3. In December 2007 a list of foundations environmental was generated for town officials in West Hartford who are required to correct runoff problems from a city public works site. A list of forty foundations was reviewed and 15 were suggested for the city to contact.
4. In the interest of attracting and making additional municipalities aware of technology to address storm water contamination, Soundkeeper is creating the Stormwater Advocate Program. This will be a full-time position that will be dedicated to influencing towns and municipalities to take a more aggressive stance on treating urban stormwater with filter technology. The funding proposal describes the position as “...a technical education and outreach program for municipal agencies and non governmental organizations.” The program will address the containment and remediation of polluted storm water from our streets and paved areas. The focus will be education on the impacts to human health and wildlife, and will emphasize new technologies for urban areas of high pollutant loading, and community prevention planning.”

Appendix 1: During March 2006 Longo and Longo completed the first cleaning of the 275 Ultra Urban Filters that were installed in November 2005. This first cleaning of the filters yielded 14,816 pounds of trash, leaves, sand, and other materials averaging approximately 54 pounds per Ultra Urban Filter. Ten locations were selected, with removed materials sorted and weighed. The results are below.

Materials Removed

Location	Trash and Debris (lbs)	Leaves and Organics (lbs)	Sand and Silt (lbs)	Total Weight (lbs)
S1	7.75	41.5	67	116.25
S2	1.5	1.75	22.5	25.75
S3	1.5	16.25	5.5	23.25
S4	10	8	2.75	20.75
S5	7.5	7.25	33.25	48
S6	0.25	14.25	14	28.5
S7	1.5	7.25	42	50.75
S8	0.75	28.5	1.25	30.5
S9	2	20	17.75	39.75
S10	2	0	50.5	52.5
<b>TOTALS</b>	<b>34.75</b>	<b>144.75</b>	<b>256.5</b>	<b>436</b>

Location	E.coli before	E.coli after	E.coli % removed	Oil and Grease before	Oil and Grease after	Oil and Grease (% removal)
1	980.4	110.6	88.7	<5	<5	undetermined
2	275.5	59.1	78.5	<5	<5	undetermined
3	325.5	214.3	34.2	20	<5	70.5
4	24.3	<1	undetermined	<5	<5	undetermined

Appendix 2: This literature was taken from AbTech's Project Report for the City of Norwalk, written in August 2007.

As a part of the stormwater management project, a monitoring program was developed by the City of Norwalk, CT in partnership with Long Island Soundkeeper, Inc., the U.S. EPA, the Maritime Aquarium at Norwalk, the Norwalk River Watershed Initiative, and AbTech Industries. The purposes of the monitoring program were as follows:

1. Collect, quantify, and classify the trash, debris and sediment retained by the filter and assess overall filter conditions.
2. Conduct initial and follow-up baseline water quality sampling/testing and document program results.

In addition to the original scope of work outlined in the monitoring program above, AbTech took progressive steps to ensure that a more thorough and comprehensive analysis was conducted. While coarse contaminants, such as trash & debris, are easily collected and measured, all other contaminants (i.e., fine sediment, oil & grease, suspended heavy metals, etc.) can be more difficult to quantify based only on random sampling events. AbTech took a more advanced approach to quantify and identify the contaminants removed and trapped inside the UUFs. This innovative process required the use of complex analytical techniques to deconstruct the Smart Sponge polymer and selectively extract all the entrapped contaminants collected inside the filters over the duration of the project. This in-depth mapping and finger printing of contaminants (a first of its kind in stormwater treatment) is analogous to a "Black Box" reading of the UUF, offering an advanced method of testing that produces more reliable results than mere random sampling with reference to various pollutants present. Random sampling and comparisons of influent and effluent can be misleading due to the nonhomogenous concentrations in the storm water runoff. Analyzing all contaminants entrapped in the filter over a period time provides a better indicator of the filters' true performance. Accordingly, the extrapolation of data generated from this quantification of contaminants in the UUF is potentially more consistent and factual than data obtained by other methods.

As agreed in the monitoring program, AbTech's distributor, Longo & Longo performed filter maintenance events with the City of Norwalk after the date of initial installation. According to procedure, the gross contaminants (trash, debris and sediment) were manually removed from the UUFs, bagged, and labeled with identifying information for each respective catch basin. Upon completion of the field collection, removed materials were shipped offsite for classification and quantification. Following analysis, collected materials were disposed of in accordance with all applicable regulations and protocols. The following cleanings of contaminants (sediment, trash, debris, organic material and vegetation) were performed:

- March 2006
- January 2007
- September 2007

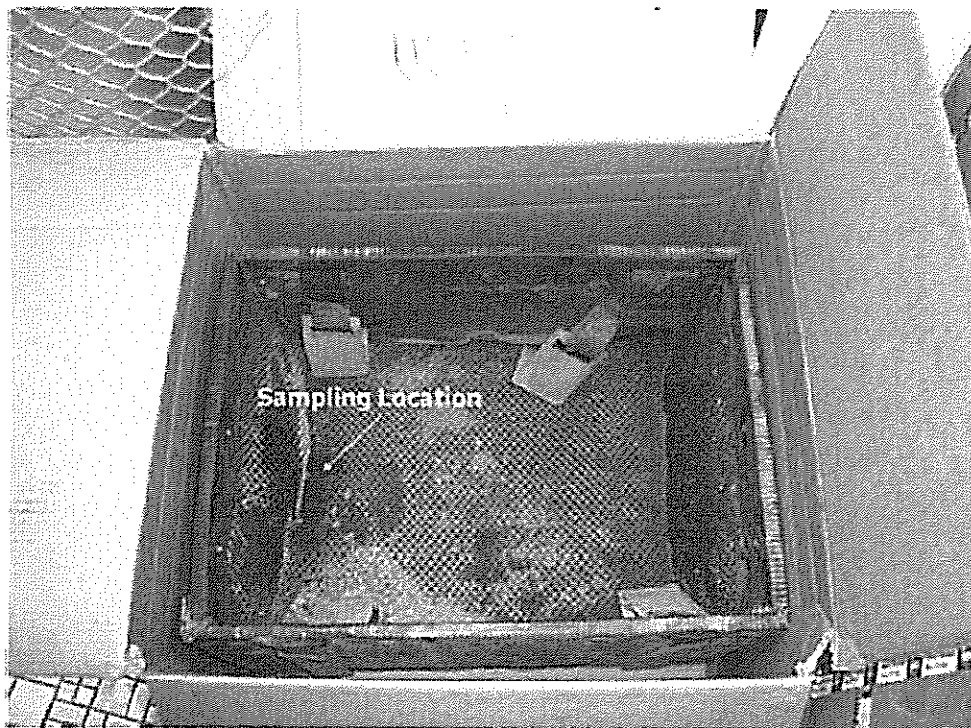
The first cleaning yielded 14,816 pounds, the second cleaning yielded 15,860 pounds and the third cleaning yielded 7,300 pounds.

**“Black Box” Smart Sponge® Characterization:**

Due to the unique ability of the Smart Sponge® to capture and retain hydrocarbons and other contaminants within its highly porous structure, one of the best measures of its performance is an in-depth look at the spent material to analyze the composition and quantity of the various contaminants retained. AbTech engaged a highly qualified, analytical laboratory, Analyze, Inc. to conduct this complex analysis and characterize various samples of used Smart Sponge generated in this Project. Through extrapolation of these results, an estimation was made of the total contaminants retained in the entire drain network. Four (4) Smart Sponge® filters were extracted from catch basins in different areas, dried, and shipped to Analyze, Inc. for sample preparation and analysis. Analyze, Inc. is a custom chemical technology lab which provides total materials characterization services. The composite sample was subjected to various analytical tests and results were compared to base tests performed on virgin Smart Sponge material. The difference between the two samples constitute the contaminants collected by the field deployed Smart Sponge.

The below photo shows the used Ultra Urban Filter and where, on this particular filter, they chose to take the sample out of the filter.

**Photo 1 – UUF Norwalk #1 Sample Location**



## Norwalk, CT – Filter Project

### Runoff Contaminants Characterization

- 275 Filters (UUF) were installed in a wide area, mixed in use (commercial & industrial).
- The filters have been in the ground for about one year with maintenance (cleaning of trash and debris) and inspection performed regularly.
- Four filters were extracted from their sites by City of Norwalk, cleaned, dried and weighted (by Weights and Measures Department).
- The filters were shipped to Analyze Inc., a lab specialized in high tech materials characterization.
- Samples of used Smart Sponge were extracted from the filters trying to optimize a representative composite sample.
- The composite sample was subjected to various analytical tests and results compared to virgin Smart Sponge to detect contaminants not present in the virgin Smart Sponge (see attached report).
- The following techniques were used:
  1. TGA – to quantify the percentage of various contaminants via progressive temperature increase. As indicated in Attachment A, TGA is able to separate the initial sample in four categories.
    - A. Volatiles (H<sub>2</sub>O and light hydrocarbons)
    - B. Hydrocarbons
    - C. Aromatic products
    - D. Inorganic (residual, ashes)

\*Based on the specific sample, with an average weight of the used UUF at 72.2 lbs. (a 214% increase vs. average initial weight), the total quantity of contaminants amount to 49.2 lbs. of which,

    1. 14 lbs. of inorganic sediment (see EDS section); 28.5% of total contaminants.
    2. 2.46 lbs. of volatiles (light hydrocarbons, H<sub>2</sub>O); 5% of total contaminants.
    3. 32.74 lbs. of organic contaminants, mostly hydrocarbons, equivalent to (see Attachment B): about 66.5% of total contaminants.
  2. EDS – to identify the presence of specific metals (including heavy metals) in the ashes. Metals identified, not present in virgin material, included Cu (copper) Ti (titanium), Fe (iron), Zn (zinc). Additional tests would be required to quantify each single metal.
  3. CG-MS – allows identification of specific hydrocarbons separated (extracted) from the used Smart Sponge. Hydrocarbons found in the sample included hydrocarbon solvent, oil, methyl stearate, methyl palmitate, diethylhexyl phthalate, some derived from traffic pollution, others from cosmetics, etc. Individual quantitative analysis would require additional work.

Appendix 3: Detailed response to how we met Objective 2. Objective 2 is defined as raising awareness about non-point source pollution, public health, and the water quality of the Long Island Sound.

1. A press conference held that included a filter installation demonstration on October 25, 2005. Background information on stormwater runoff was handed out. Stamford and Norwalk CT newspapers were represented and each wrote an article about the filters.
2. A family friendly brochure detailing non-point source pollution was created for school students to take home to their parents.
3. Non-point source pollution demonstration and Smart Sponge technology presentation for Board of Trustees of The Maritime Aquarium.
4. Hosted Norwalk River Watershed Initiative exhibit on non-point source pollution and The Filter Project between Christmas and New Years at the Maritime Aquarium at Norwalk.
5. Completed a public demonstration of The Filter Project curriculum for a storm water runoff workshop for municipal officials during January. It was cosponsored with Save The Sound, Inc. and The Maritime Aquarium.
6. Made short presentations to the Mayor's Neighborhood Preservation Committee on Wednesday, February 1, 2006.
7. Wrote an article about The Filter Project for the Greater Norwalk Chamber of Commerce which appeared in its January 2006 newsletter.
8. Planned and participated in activities for the April 22<sup>nd</sup> Earth Day celebration at the Aquarium. Program highlighted clean water and The Filter Project on Thursday, February 2, 2006.
9. Maritime Aquarium hosted Norwalk River Watershed Initiative exhibit on non-point source pollution.
10. Demonstrated Enviroscape and filter technology to municipal officials at Stormwater Management Informational Session, Friday, January 27<sup>th</sup> 2006, at The Maritime Aquarium. Cosponsored with Save The Sound, Inc and The Maritime Aquarium. Approximately 100 people participated.
11. Community educator from The Maritime Aquarium, made presentations to
  - Harbor Shores Association (Wednesday, March 8)
  - SoNo Alliance (Tuesday, March 14); and 3)
  - April -- at Norwalk Community College on Thursday, April 24, 2006
  - Earth Festival, Earthplace, Saturday, April 29.
  - Two sets of posterboard displays were made with The Filter Project information, one of which has been used for Maritime Aquarium demonstrations and the other which is being displayed near the DPW office at Norwalk's City Hall.
12. Norwalk River Watershed Initiative and Maritime Aquarium staff made day-long demonstrations of non-point pollution and the Filter Project. These demonstrations took place at the Maritime Aquarium. The total of 10,524 people were exposed to the project (based on the Aquarium's daily attendance records).
  - March 18-2542
  - March 19-2620
  - April 1-1554



- April 2-1055
  - April 22 -2753 (part of Earth Day celebration)
13. Senator Joe Lieberman was the guest of honor at a press conference held near the river at the Maritime Aquarium in Norwalk. The Senator took part in a demonstration of the filter technology, spoke about the importance of the project as an exemplary use of technology to solve environmental challenges and also praised the collaborative efforts that made the project happen. There was much resulting press coverage and public awareness generated from this event. This took place June, 2006.
  14. At a meeting of the chief elected officials of the seven towns in the Norwalk River Watershed, Ms. Jessica Kaplan of the Norwalk River Watershed Initiative presented results and a demonstration of the filter technology. The meeting was attended by 28 elected officials, members of Norwalk River Watershed Initiative Advisory Committee and the media. This took place in June 6, 2006.
  15. On June 8, 2006, Mike Yeosick, and Sal Longo of Longo & Longo set up a Filter Project booth at the *Connecticut Transportation Institute's Technology Transfer Center* in Storrs, CT. 250 municipal officials and engineers stopped by the booth to see the demonstrations of the filter material in action.
  16. On August 3, 2006, a presentation was made to 35 municipal officials on non-point pollution and The Filter Project. A creative tabletop demonstration was made using a simulated watershed and a series of filters to treat the polluted water. This was done at Norwalk Town Hall.
  17. Soundkeeper hosted another filter project demonstration and awareness meeting at the Maritime Aquarium in Norwalk. This was attended by the Mayor of Bridgeport; Bill Finch, and State Representative of Norwalk; Bob Duff.

Appendix 4: A detailed response to how we met Objective 3. Objective 3 is defined as educating students on environmental problems and The Filter Project.

1. Developed the non-point source curriculum which uses an Enviroscope landscape simulation and the Smart Sponge combined with motor oil bench test. The curriculum fulfills CT Science Framework Standard for the 6<sup>th</sup> grade: *6.4 Water moving across and through earth materials carries with it the products of human activities.*
2. Conducted a professional development workshop, using the curriculum, with Norwalk Public Schools 6<sup>th</sup> grade teachers. Taught four 4<sup>th</sup> grade classes at Silvermine Elementary School. No pre/post tests were administered at the request of the school because the student population was primarily Spanish-speaking and the English version was not appropriate.
3. Reserved ten classes for Roton Middle School 6<sup>th</sup> grade for May and June.
4. Developed video documenting Smart Sponge installation for student instruction.
5. Six additional classes for West Rocks Middle School 6<sup>th</sup> grade were conducted in December 15<sup>th</sup> 2005. 125 students attended.
6. Publicized The Filter Project in *Maritimes*, the membership newsletter of The Maritime Aquarium. Distributed to 10,000 member families on the 16<sup>th</sup> December, 2006.
7. Created a short presentation for Silvermine Elementary School, and gave a talk on the subject of non-point source pollution on Monday, February 6, 2006.
8. Held a public demonstration of The Filter Project curriculum for a storm water runoff workshop for municipal officials during January. Cosponsored with Save The Sound, Inc. and The Maritime Aquarium at Norwalk.
9. Presentation to biology class at Norwalk Community College (April, 2006).
10. Educators from the Maritime Aquarium conducted in-class programs From March 1<sup>st</sup> to May 31<sup>st</sup> that incorporated the Filter Project info at the following schools
  - Nathan Hale Middle School, 167 students at the 6<sup>th</sup> grade level
  - Westrocks Middle School, 228 students at the 6<sup>th</sup> grade level
  - Roton Middle School in Norwalk, 96 students at the 6<sup>th</sup> grade level
  - Silvermine School, 86 students at the 4<sup>th</sup> grade level
11. By the end of the school year in June 2006, 732 students in 29 classes had a special in-class program which covered The Filter Project.
12. On June 1<sup>st</sup> 2006, a presentation on non-point source pollution and The Filter Project was held for 90 students at Roton Middle School in Norwalk.
13. On July 12<sup>th</sup> a presentation was made for 25 sixth grade summer school students at Thurgood Marshall Middle School in Bridgeport.

References:

AbTech Industries, City of Norwalk Filter Project Report, 2007