Stormceptor®

FIELD MONITORING

Field Evaluation of a Stormceptor® Model STC 1200

Westwood, Massachusetts

Prepared by:
Stormceptor Group of Companies

June, 2004

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1.0 General

Massachusetts firm, Environmental Sampling and Technology (EST) completed the field monitoring of a Stormceptor Model STC 1200 between June, 1997 and November, 1997. EST, located in Needham, Massachusetts, is a specialist organization experienced in the monitoring and sampling of stormwater runoff. Alpha Analytical Laboratories Inc., located in Westboro, Massachusetts, was engaged to complete the analytical laboratory work on samples obtained upstream and downstream of the Stormceptor unit. A total of five events were monitored during this period. A summary of the results are shown in Table 1-1. Laboratory reports of the analysis are provided Appendix A.

Table 1-1. Summary of performance data for a Stormceptor model STC 1200

Pollutant	Sample Description	Overall Removal Efficiency
Total Suspended Solids	First Flush	96%
	Overall	92%
	Simulated(1)	92%
Particle Size Distribution	Distribution less than 60 um	27%
Total Petroleum Hydrocarbons	First Flush	93%
	Overall	81%
Barium (Ba)	First Flush	73%
	Overall	55%
Lead (Pb)	First Flush	92%
	Overall	83%
Cadmium (Cd)	First Flush	29%
Chromium (Cr)	First Flush	67%

(1) Expected removal efficiency based on estimates of TSS removal by the Stormceptor Sizing Program Version 4.0.0, using a continuous rainfall/runoff pollutant export simulation.

(2) The overall removal efficiencies are based on a reduction of mass load. First flush efficiency is based on reduction of average concentration during first flush conditions rather than reduction in mass load.

(3) Data for heavy metals are based on limited events, since the majority of the concentrations were less than detection limits. The relatively high removal efficiencies indicated by the data for heavy metals is unlikely to be achieved over the long term, based on data from other sites and given the partitioning between dissolved and particulate fraction.

1.1 Site Description

The Stormceptor model STC 1200 accepts runoff from a 0.74 acre (0.3 ha) paved hardstand area associated with the unloading and loading of articulated vehicles from the Romanow Container Distribution Centre at 346 University Avenue, Westwood, Massachusetts. A photograph of the site is shown in Figure 1-1.

Figure 1-1. Westwood, Massachusetts Site.

1.2 Stormceptor Model STC 1200

Key physical characteristics of the Stormceptor Model STC 1200 are shown in Table 1-1.

Table 1-2. Stormceptor model STC 1200 physical characteristics

Water Quality Flow Before By-Pass	0.64 cfs (18 l/s)
Orifice Plate Diameter	6 inches (150 mm)
Sediment Storage Capacity	
Hydrocarbon Storage Capacity	
Diameter of Lower Chamber	72” (1800 mm)
Depth of Lower Chamber (pipe invert to top of slab)	71” (1775 mm)

2.0 Monitoring Methodology

Monitoring of the Stormceptor was completed with the installation of ISCO 3700 automatic samplers immediately upstream and downstream of the device. Each sampler was programmed to collect a “first flush” sample upon initiation of flow entering the Stormceptor and a composite sample consisting of 36 - 250 mL aliquot samples collected at five minute intervals over a three hour period. Flow was measured using an ISCO 3230 bubble flow module positioned upstream of the Stormceptor unit. An interface

between the flow meter and the automatic samplers was used to initiate the sampling program. A rain gauge was also mounted on a nearby pole which recorded rainfall data in 1/100 inch (0.25 mm) increments.

The primary focus of the sampling program was to determine the performance of the Stormceptor product to remove and retain Total Suspended Solids, Total Petroleum Hydrocarbons and Heavy Metals across a range of hydrologic conditions. A sediment sample was also obtained from the base of the Stormceptor unit following the monitoring program in order to analyze the particle size gradation of captured material. The contaminants measured included:

- Total Suspended Solids (TSS)
- Total Petroleum Hydrocarbons (TPH)
- Arsenic (As)
- Barium (Ba)
- Cadmium (Cd)
- Chromium (Cr)
- Selenium (Se)
- Lead (Pb)
- Mercury (Hg)
- Silver (Ag)

3.0 Monitoring Results

All removal efficiencies are calculated using the aggregate pollutant loading reduction method (WDOE, 1999) as shown in the equation below.

$$\mathrm{Re}\,movalEfficiency(\%) = \frac{(\sum_{n}^{1} In_n \times V_n) - (\sum_{n}^{1} Eff_n \times V_n)}{(\sum_{n}^{1} Eff_n \times V_n)} \times 100$$

where,
In = Composite Influent concentration measured for event n
Eff = Composite Effluent concentration measured for event n
V = Total storm volume for event n
n = Event number

3.1 Rainfall

A total of five events were monitored for the study. A summary of the hydrologic parameters measured are listed in Table 3-1.

Table 3-1. Hydrologic Summary of Monitored Events

Rainfall Event	Date	Total Depth	Storm Duration	Total Volume	Peak Flow
1	Jul 25, 1997	0.18 in (4.6 mm)	11 hrs	379 gal. (1.43 m3)	0.009 cfs (0.26 L/s)
2	Aug 5, 1997	0.18 in (4.6 mm)	7 hrs	122 gal. (0.46 m3)	0.004 cfs (0.11 L/s)
3	Aug 21, 1997	0.25 in (6.4 mm)	24 hrs	304 gal. (1.15 m3)	0.005 cfs (0.15 L/s)
4	Sep 29, 1997	N/A	N/A	672 gal. (2.54 m3)	0.007 cfs (0.20 L/s)
5	Oct 25, 1997	0.75 in (19.0 mm)	16 hrs	2569 gal. (9.72 L/s)	0.016 cfs (0.46 L/s)

3.2 Total Suspended Solids

Total suspended solids concentrations and mass load were determined across the five monitored events upstream and downstream of the Stormceptor unit. The final event sampled on the October 25, 1997 provided a composite sample concentration below the detention limit of 5 mg/l upstream and downstream of the unit and has not been included in calculating the total removal efficiency.

Samples to capture the first flush of suspended solids were also collected for the first three events, although the mass load during the first flush conditions were unable to be computed since a volumetric determination of what constituted a first flush was not completed. The monitoring data during the first flush is shown in Table 3-2.

Table 3-2. Monitoring data for TSS during First Flush Conditions

Runoff Event	Upstream Concentration (mg/L)	Downstream Concentration (mg/L)	Removal Efficiency (%)
July 25, 1997	110	6.2	94.4
August 5, 1997	320	5.0	98.4
August 21, 1997	26	5.6	78.5
Average TSS	**152**	**5.6**	**96.3%**

The average total suspended solids concentration during the first flush conditions was 152 mg/l upstream of the Stormceptor unit and 5.6 mg/l downstream, indicating retention of over 96% of suspended solids during the initial runoff period. These average concentrations represent a simple arithmetic mean of the individual event data, since a mass load could not be computed. Therefore the average first flush concentrations are not necessarily an absolute true measure of the overall first flush conditions, since there is no consideration or inherent weighting given to the variation in mass load between the three events. This aside, the data does provide a reasonable overall assessment of product performance under first flush conditions. The efficiency during individual events is not impacted by this same

deficiency. The concentrations upstream and downstream of the Stormceptor presented in tabular form above are shown in Figure 2 below.

Total suspended solids concentrations across the individual runoff events is shown in Table 3-3 below and presented graphically in Figure 3. The event mean concentration upstream and downstream of the Stormceptor for the entire monitoring program was 74 mg/l and 5.6 mg/l. The total mass load measured upstream of the Stormceptor was 415 grams and downstream was 31.3 grams, providing an overall removal efficiency across the monitoring period of 92%. It is noted once again that the overall event mean concentrations have utilized the mass loads rather than a simple arithmetic mean of the concentration levels (as was the case for the first flush condition), and therefore are considered to be an accurate description.

Table 3-3. Monitoring data for TSS by individual runoff events

Runoff Event	TSS mg/l		Mass Load mg		Removal Efficiency
	Upstream	Downstream	Upstream	Downstream	
Jul 25, 1997	8	5.8	11.4	8.3	27.5%
Aug 5, 1997	400	5.3	184.8	2.4	98.7%
Aug 21, 1997	86	6.8	99.1	7.8	92.1%
Sep 29, 1997	47	5.0	119.6	12.7	89.4%
TSS EMC/Total	**74**	**5.6**	**415**	**31.3**	**92.5%**

The performance of the Stormceptor exhibited by this monitoring program would generally be considered high in comparison to most design specifications. In general, the Stormceptor System is specified within the North American market to achieve a minimum total suspended solids removal efficiency of 80%. Utilizing the recorded particle size distribution documented below, and 52 years of continuous historical rainfall records for Boston, Massachusetts (Boston Logan Airport), the Stormceptor Sizing Program estimates a removal efficiency of 92% total suspended solids and the treatment of 90% of the total annual volume of runoff. The estimate made by the software is therefore consistent with the data collected during the monitoring program. If the particle size distribution from the site was finer and consistent with the standard fine distribution used for sizing the Stormceptor System, the removal efficiency predicted by the program is 87%.

3.3 Particle Size Distribution

During the monitoring program, a sample of sediment was collected from the accumulated material from the lower chamber of the Stormceptor unit to obtain a grain size analysis. The results of the analysis are shown in Table 3-1 below and indicate that approximately 27% of the collected material has a particle size less than 60 µm (silt and clay particles).

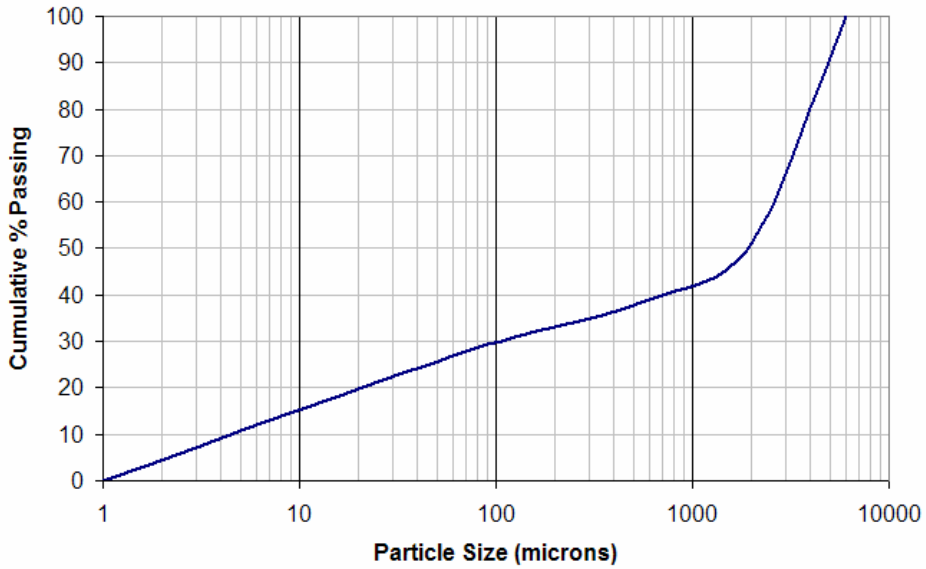

Figure 3-1. Plot of particle size distribution in Stormceptor lower chamber

The suspended solids collected are relatively coarse in comparison to other Stormceptor monitoring with approximately 50% of the material being classified as fine gravel. This relatively coarse grading has undoubtedly influenced the relatively high capture and retention efficiencies noted above for TSS and is most likely a result of the local geomorphology of the region. The material is also relatively coarse in comparison to the body of research regarding particle size distributions typically found in suspended solids exported from urbanized catchments in North America. Table 3-4 summarizes the particle size distribution found in the Stormceptor unit.

Table 3-4. Particle size distribution of sediment in lower chamber of the unit.

Sediment Material	Grain Size Description	Particle Size Range (um)	Percent of Total Sample
Gravel	Fine	2000 – 6000	49%
Sand	Coarse	600 – 2000	12%
	Medium	200 – 600	6%
	Fine	60 – 200	6%
Silt or Clay		<60	27%

3.4 Total Petroleum Hydrocarbons (TPH)

The concentration of TPH was determined upstream and downstream of the Stormceptor during the initial runoff period (first flush) for the first three events, and composite concentrations determined across the whole runoff period for five individual events. In three of the five events, the composite concentration was below the detection limit of 1 mg/l upstream and downstream of the Stormceptor unit. The concentration during the first flush was more elevated upstream of the Stormceptor but was generally at or below detection limits downstream.

Monitoring data during the initial runoff period are listed in Table 3-5. The arithmetic mean first flush concentration was 25.1 mg/l upstream and 1.7 mg/l downstream of the Stormceptor unit indicating overall

capture of 93% of the first flush hydrocarbon load. The first flush concentration was relatively elevated in comparison to the generally low concentrations for the overall runoff events.

Table 3-5. Summary of first flush TPH removal

Runoff Event	Upstream Concentration mg/l	Downstream Concentration mg/l	Removal Efficiency
Jul 25, 1997	5.2	<1	80.8%
Aug 5, 1997	32	<1	96.9%
Aug 21, 1997	38	3.2	91.6%
Average TPH	**25.1**	**1.7**	**93.2%**

Hydrocarbon event mean concentrations are shown in Table 3-6. The average overall concentration of total petroleum hydrocarbons exported from the site upstream of the Stormceptor was 6.8 mg/l. The average concentration downstream of the Stormceptor unit was 1.3 mg/l. Based on the total mass of hydrocarbons upstream and downstream of the Stormceptor, the product captured a total of 81% of the hydrocarbon load exported from the site.

Table 3-6. TPH for individual runoff events.

Runoff Event	TSS mg/l		Mass Load mg		Removal Efficiency
	Upstream	Downstream	Upstream	Downstream	
Aug 5, 1997	4.8	<1	2217.6	462.0	79.2%
Aug 21, 1997	7.6	1.4	8755.2	1612.8	81.6%
TPH EMC/Total Mass Load	**6.8**	**1.29**	**10972.8**	**2074.8**	**81.1%**

3.5 Heavy Metals

The concentration of Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (hg), Selenium (Se) and Silver (Ag), was determined upstream and downstream of the Stormceptor for the five runoff events. As with other constituents, concentrations for Barium were also determined during the first flush for the first three events. The concentration of Arsenic, Mercury, Selenium and Silver were all below detection limits for the entire monitoring program. The concentration of cadmium and Chromium were also below detection, although an elevated first flush concentration was present for Event 2 of the 5 August 1997, which allowed data for this individual event to be obtained. Event 2 also provided the only measurable quantity of Lead (during both first flush and for the overall event). The concentration of Cadmium, Chromium and Lead during the first flush conditions of Event 2 sampled on August 5, 1997 are shown in

Table 3-7. The concentration of lead across the entire runoff event on August 5, 1997 is shown in Table 3-8. The elevated heavy metal concentrations during event 2 coincide with this event also providing by far the greatest total suspended solids concentration during both the initial first flush runoff and for the whole runoff event.

Table 3-7. Cadmium, Chromium and Lead Removal Efficiency During First Flush, Event 2

Metal	Upstream Concentration mg/l	Downstream Concentration mg/l	Removal Efficiency
Cadmium (Cd)	0.007	<0.005	29%
Chromium (Cr)	0.03	<0.01	67%
Lead (Pb)	0.12	<0.01	92%

Table 3-8. Removal Efficiency for entire Event 2

Metal	Upstream Concentration mg/l	Downstream Concentration mg/l	Removal Efficiency
Lead (Pb)	0.06	0.01	83%

Barium was the only heavy metal that was consistently exported from the catchment in considerable concentrations for four of the five events. As with other contaminants the concentration upstream and downstream for the fifth event was below detection limits. Table 3-9 shows the concentration of Barium upstream and downstream of the Stormceptor during first flush conditions, with the individual removal efficiency varying from 33% to 85%. The arithmetic average first flush concentration upstream of the Stormceptor System was 63 µg/l. The downstream concentration was 17 µg/l indicating an overall removal efficiency during first flush conditions of 73%.

Over the entire monitoring period, a total mass of 165 mg of barium was exported form the catchment. The monitoring results for each overall individual event are shown in Table 3-10.

Table 3-9. Concentration and Removal Efficiency for Barium During First Flush Conditions

Metal	Upstream Concentration mg/l	Downstream Concentration mg/l	Removal Efficiency
Jul 25, 1997	0.03	0.02	33.3%
Aug 5, 1997	0.14	0.02	85.7%
Aug 21, 1997	0.02	<0.01	50.0%
Average [Ba]	**0.063**	**0.017**	**73.0%**

Table 3-10. Monitoring data for Barium for Individual Runoff Events

Runoff Event	TSS mg/l		Mass Load mg		Removal Efficiency
	Upstream	Downstream	Upstream	Downstream	
Jul 25, 1997	0.03	0.02	42.9	28.6	33%
Aug 5, 1997	0.08	0.02	37.0	9.2	75%
Aug 21, 1997	0.03	<0.01	34.6	11.5	67%
Sep 29, 1997	0.02	<0.01	50.9	25.5	50%
Ba EMC/Total Mass Load	**0.030**	**0.013**	**165.3**	**74.8**	**55%**

The mass load downstream of the Stormceptor was 75 mg, indicating retention of 55% of the Barium load across the four runoff events. The event mean concentration from the catchment was 30 µg/l. The event mean concentration downstream of the Stormceptor was 13 µg/l. Individual removal efficiencies varied from 33% to 75%.

Like other heavy metal elements, Event 2, which occurred on August 5, 1997, provided by far the greatest concentration in Barium, both during the first flush and for the overall event. There appears to be a strong correlation between all heavy metal components and the concentration of total suspended solids as noted previously. Event 2, also provided the highest removal efficiency for suspended solids, and this too is reflected in the highest removal efficiencies achieved across all heavy metals, including Barium. It is noted that the composite concentration of total suspended solids for Event 2 (400 mg/l) is some five times higher than the next highest concentration, for Event 3 (August 21, 1997) 86 mg/l, the actual mass load, while still being greater than other events, is not as pronounced as the concentration. It therefore appears that the most significant influence on heavy metal concentrations it eh concentration of total suspended solids rather than the total mass load.

APPENDIX 1

LABORATORY ANALYTICAL REPORTS
POLLUTANT ANALYSIS

EST
ENVIRONMENTAL SAMPLING TECHNOLOGY

■ 368 Hillside Avenue ■ Needham ■ MA 02194 ■ (617) 455-0003 ■ Fax (617) 455-8336

FAX MEMO

To: Rhett Grant
CSR New England Pipe

FAX: (508) 597-8661

From: Kathleen Dugan
Environmental Sampling Technology

Number of pages including this cover page: 7

Dear Rhett.

Attached please find the stormwater sampling reports for the samples collected on 8/05/97 and 8/21/97. Hard copies will follow in the mail, as well as the raw data from Alpha Analytical Laboratories. Also attached is a revision from the first sampling event that occurred on 7/25/97, since we added additional information to the sampling report. Please call me if you have any questions or concerns. I hope you had a nice holiday weekend!

EST ENVIRONMENTAL SAMPLING TECHNOLOGY
368 Hillside Avenue ■ Needham ■ MA 02194 ■ (617) 455-0003 ■ Fax (617) 455-8336

STORMWATER SAMPLING REPORT

Client: CSR New England Pipe
PO Box 481
Townsend, MA 01469
Attention: Mr. Rhett Grant

Report Date: August 20, 1997

Site Location:	Romanow Container, Westwood, MA
Sample Date:	July 25, 1997
Field Technicians:	John Carlin, John Corrigan

Stormwater Sampling Summary:

On July 25, 1997, EST field technicians John Carlin and John Corrigan collected "First Flush" grab samples and composite samples from a *stormceptor* located at Romanow Container in Westwood, Massachusetts.

Samples are collected using two (2) ISCO Model 3700 wastewater samplers. The autosamplers are stationed at the site prior to the rain event. All sampling equipment is calibrated according to manufacturers specifications and decontaminated according to Standard Operating Procedures (SOP) prior to installation on site. Each sampler is programmed to collect a "First Flush" grab sample upon initiation of flow entering the stormceptor. Flow is measured using an ISCO 3230 (Bubbler Type) flow meter used in conjunction with a temporary weir inserted into the 12" diameter influent line. A flowmeter to sampler interface cable is used to begin the stormwater program. The stormwater program consists of two (2) events: A "First Flush" grab sample and a composite sample consisting of thirty six (36) two hundred (200) mL aliquot samples collected at five (5) minute intervals for a three (3) hour period. A rain gauge mounted on a nearby utility pole is used to measure and record rainfall in 0.01 foot incriments.

Field technicians are dispached following each rain event. Samples are preserved in accordance with 40 CFR Part 136 and delivered to Alpha Analytical Laboratories with the associated chain of custody documentation.

Sampling Location(s): Influent and Effluent of Stormceptor located in parking area adjacent to shipping and receiving.

Weather/Rainfall Information:

Date(s) of Rain Event:	7/25/97
Previous rainfall greater than 0.1 inches:	7/15/97, 0.11 inches
Rain Initiation:	7/24/97, ~11:00 PM
Total Precipitation (Event):[1]	0.34 inches
Total Precipitation (Day):	0.35 inches
Storm Duration:	11 hours
Ambient Temperature:	63° F - 68° F

[1] Total precipitation from start of rainfall to end of composite sampling cycle.

Flow Data:

Flow Initiation:	7/25/97 05:42
Maximum Flow:	4.2 gpm
Average Flow:	2.1 gpm
Total Flow Volume (3 hours):	379 gallons

Sample Collection Data:

Condition of Monitoring Equipment:	Good, Cycles Complete, Battery 11.8V/11.0V	
Condition of Samples:	Good, Bottles +/- 3/4 Capacity	
Preservation of Samples (per 40 CFR Part 136):	TSS-	Cool, 4° C
	Total Metals-	Cool. 4° C, adjust to pH <2 S.U. with HNO_3
	TPH (IR)-	Cool, 4° C, adjust to pH <2 S.U. with HCl

Stormceptor Sample Results (in mg/L):

Parameter	Method	Influent First Flush Grab 5:42 AM	Effluent First Flush Grab 5:45 AM	Influent Composite 5:42 - 8:42 AM	Effluent Composite 5:45 - 8:45 AM
TSS	160.2	110	6.2	8	5.8
TPH	418.1	5.2	< 1.0	< 1.0	< 1.0
Arsenic	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Barium	200.7	0.03	0.02	0.03	0.02
Cadmium	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Chromium	200.7	< 0.01	< 0.01	< 0.01	< 0.01
Lead	200.7	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	245.2	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Silver	200.7	< 0.01	< 0.01	< 0.01	< 0.01

Sample Documentation:

Chain of Custody completed by John Carlin.
Samples delivered to laboratory by John Carlin on 7/28/97.

Samples delivered to:	Alpha Analytical Laboratories, Inc. 8 Walkup Drive Westboro, MA 01581
DEP ID:	#084
Sample ID:	L9705849

EST ENVIRONMENTAL SAMPLING TECHNOLOGY
368 Hillside Avenue ■ Needham ■ MA 02194 ■ (617) 455-0003 ■ Fax (617) 455-8336

STORMWATER SAMPLING REPORT

Client: **CSR New England Pipe**
PO Box 481
Townsend, MA 01469
Attention: **Mr. Rhett Grant**

Report Date: August 29, 1997

Site Location:	**Romanow Container, Westwood, MA**
Sample Date:	**August 5, 1997**
Field Technicians:	**John Carlin, John D'Andrea**

Stormwater Sampling Summary:

On August 5, 1997, EST field technician John Carlin and John D'Andrea collected "First Flush" grab samples and composite samples from a *stormceptor* located at Romanow Container in Westwood, Massachusetts.

Samples are collected using two (2) ISCO Model 3700 wastewater samplers. The autosamplers are stationed at the site prior to the rain event. All sampling equipment is calibrated according to manufacturers specifications and decontaminated according to Standard Operating Procedures (SOP) prior to installation on site. Each sampler is programmed to collect a "First Flush" grab sample upon initiation of flow entering the stormceptor. Flow is measured using an ISCO 3230 (Bubbler Type) flow meter used in conjunction with a temporary weir inserted into the 12" diameter influent line. A flowmeter to sampler interface cable is used to begin the stormwater program. The stormwater program consists of two (2) events: A "First Flush" grab sample and a composite sample consisting of thirty six (36) two hundred (200) mL aliquot samples collected at five (5) minute intervals for a three (3) hour period. A rain gauge mounted on a nearby utility pole is used to measure and record rainfall in 0.01 foot incriments.

Field technicians are dispached following each rain event. Samples are preserved in accordance with 40 CFR Part 136 and delivered to Alpha Analytical Laboratories with the associated chain of custody documentation.

Sampling Location(s): Influent and Effluent of Stormceptor located in parking area adjacent to shipping and receiving.

Weather/Rainfall Information:

Date(s) of Rain Event:	8/05/97
Previous rainfall greater than 0.1 inches:	8/03/97, 0.44 inches
Rain Initiation:	8/04/97, ~9:00 PM
Total Precipitation (Event):[1]	0.18 inches
Total Precipitation (Day):	0.12 inches
Storm Duration:	7 hours
Ambient Temperature:	67^0 F

[1] Total precipitation from start of rainfall to end of composite sampling cycle.

EST
ENVIRONMENTAL SAMPLING TECHNOLOGY

Flow Data:

Flow Initiation:	8/05/97, 1:37 AM
Maximum Flow:	1.8 gpm
Average Flow:	0.7 gpm
Total Flow Volume (3 hours):	122 gallons

Sample Collection Data:

Condition of Monitoring Equipment:	Good, Cycles Complete, Battery 12.3V/11.8V	
Condition of Samples:	Good, Bottles +/- 3/4 Capacity	
Preservation of Samples (per 40 CFR Part 136):	TSS-	Cool, 4^0 C
	Total Metals-	Cool, 4^0 C, adjust to pH <2 S.U. with HNO_3
	TPH (IR)-	Cool, 4^0 C, adjust to pH <2 S.U. with HCl

Stormceptor Sample Results (in mg/L):

Parameter	Method	Influent First Flush Grab 1:37 AM	Effluent First Flush Grab 1:42 AM	Influent Composite 1:37 - 4:37 AM	Effluent Composite 1:42 - 4:42 AM
TSS	160.2	320	< 5.0	400	5.3
TPH	418.1	32	< 1.0	4.8	< 1.0
Arsenic	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Barium	200.7	0.14	0.02	0.08	0.02
Cadmium	200.7	0.007	< 0.005	< 0.005	< 0.005
Chromium	200.7	0.03	< 0.01	0.01	< 0.01
Lead	200.7	0.12	< 0.01	0.06	< 0.01
Mercury	245.2	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Silver	200.7	< 0.01	< 0.01	< 0.01	< 0.01

Sample Documentation:

Chain of Custody completed by John Carlin.
Samples delivered to laboratory by John Carlin on 8/06/97.

Samples delivered to:	Alpha Analytical Laboratories. Inc. 8 Walkup Drive Westboro, MA 01581
DEP ID:	#084
Sample ID:	L9706083

EST
ENVIRONMENTAL SAMPLING TECHNOLOGY
368 Hillside Avenue ■ Needham ■ MA 02194 ■ (617) 455-0003 ■ Fax (617) 455-8336

STORMWATER SAMPLING REPORT

Client: **CSR New England Pipe**
PO Box 481
Townsend, MA 01469
Attention: **Mr. Rhett Grant**

Report Date: August 29, 1997

Site Location:	**Romanow Container, Westwood, MA**
Sample Date:	**August 21, 1997**
Field Technicians:	**John Carlin, John Corrigan**

Stormwater Sampling Summary:

On August 21, 1997, EST field technician John Carlin and John Corrigan collected "First Flush" grab samples and composite samples from a *stormceptor* located at Romanow Container in Westwood, Massachusetts.

Samples are collected using two (2) ISCO Model 3700 wastewater samplers. The autosamplers are stationed at the site prior to the rain event. All sampling equipment is calibrated according to manufacturers specifications and decontaminated according to Standard Operating Procedures (SOP) prior to installation on site. Each sampler is programmed to collect a "First Flush" grab sample upon initiation of flow entering the stormceptor. Flow is measured using an ISCO 3230 (Bubbler Type) flow meter used in conjunction with a temporary weir inserted into the 12" diameter influent line. A flowmeter to sampler interface cable is used to begin the stormwater program. The stormwater program consists of two (2) events: A "First Flush" grab sample and a composite sample consisting of thirty six (36) two hundred (200) mL aliquot samples collected at five (5) minute intervals for a three (3) hour period. A rain gauge mounted on a nearby utility pole is used to measure and record rainfall in 0.01 foot incriments.

Field technicians are dispached following each rain event. Samples are preserved in accordance with 40 CFR Part 136 and delivered to Alpha Analytical Laboratories with the associated chain of custody documentation.

Sampling Location(s): Influent and Effluent of Stormceptor located in parking area adjacent to shipping and receiving.

Weather/Rainfall Information:

Date(s) of Rain Event:	8/21/97
Previous rainfall greater than 0.1 inches:	8/18/97, 0.57 inches
Rain Initiation:	8/20/97, ~11:00 PM
Total Precipitation (Event):[1]	0.25 inches
Total Precipitation (Day):	0.60 inches
Storm Duration:	24 hours
Ambient Temperature:	62° - 67° F

[1] Total precipitation from start of rainfall to end of composite sampling cycle.

EST
ENVIRONMENTAL
SAMPLING
TECHNOLOGY

Flow Data:

Flow Initiation:	8/21/97, 4:26 AM
Maximum Flow:	2.3 gpm
Average Flow:	1.6 gpm
Total Flow Volume (3 hours):	304 gallons

Sample Collection Data:

Condition of Monitoring Equipment:	Good, Cycles Complete, Battery 12.5V/12.2V	
Condition of Samples:	Good, Bottles +/- 3/4 Capacity	
Preservation of Samples (per 40 CFR Part 136):	TSS-	Cool, 4^0 C
	Total Metals-	Cool, 4^0 C, adjust to pH <2 S.U. with HNO_3
	TPH (IR)-	Cool, 4^0 C, adjust to pH <2 S.U. with HCl

Stormceptor Sample Results (in mg/L):

Parameter	Method	Influent First Flush Grab 4:26 AM	Effluent First Flush Grab 4:26 AM	Influent Composite 4:26 - 7:26 AM	Effluent Composite 4:26 - 7:26 AM
TSS	160.2	26	5.6	86	6.8
TPH	418.1	38	3.2	7.6	1.4
Arsenic	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Barium	200.7	0.02	< 0.01	0.03	< 0.01
Cadmium	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Chromium	200.7	< 0.01	< 0.01	< 0.01	< 0.01
Lead	200.7	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	245.2	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium	200.7	< 0.005	< 0.005	< 0.005	< 0.005
Silver	200.7	< 0.01	< 0.01	< 0.01	< 0.01

Sample Documentation:

Chain of Custody completed by John Carlin.
Samples delivered to laboratory by Tom Doherty on 8/21/97.

Samples delivered to:	Alpha Analytical Laboratories, Inc. 8 Walkup Drive Westboro, MA 01581
DEP ID:	#084
Sample ID:	L9706567

APPENDIX 2

LABORATORY ANALYTICAL REPORTS
PARTICLE SIZE ANALYSIS

EST ENVIRONMENTAL SAMPLING TECHNOLOGY
368 Hillside Avenue ■ Needham ■ MA 02194 ■ (617) 455-0003 ■ Fax (617) 455-8336

Date: 9/05/97

To: Rhett Grant

Company: CSR NE Pipe

FAX #:

From: Kathleen Dugan

Environmental Sampling Technology, Inc.

Total Number of Pages Including Cover Sheet: 6

Comments: Particle Size Info.

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA:M-MA-086 NH:200395-B/C CT:PH-0574 ME:MA086 RI:65

CERTIFICATE OF ANALYSIS

Client: Environmental Sampling Technologies
Address: 368 Hillside Avenue
Needham Heights, MA 02194
Attn: John Carlin
Project Number:
Site: CSR New England Pipe

Laboratory Job Number: L9706695
Invoice Number: 7841
Date Received: 26-AUG-97
Date Reported: 03-SEP-97
Delivery Method: Client

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
L9706695-01	STORMCEPTOR SEDIMENT	Wauregan, CT

Authorized by: James R. Roth

James R. Roth, PhD - Laboratory Manager

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA:M-MA-086 NH:200395-B/C CT:PH-0574 ME:MA086 RI:65

Laboratory Sample Number: L9706695-01
Sample Matrix: STORMCEPTOR SEDIMENT
SOIL

Date Collected: 26-AUG-97
Date Received : 26-AUG-97
Date Reported : 03-SEP-97

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 1 Amber Glass

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATES PREP	DATES ANALYSIS	ID
Solids, Total	59.	%	0.10	3	2540B		28-Aug	ST
Particle Size Analysis by Sieve (% Retained)								
Sieve, #10	49.	%		12	D422		02-Sep	ST
Sieve, #40	63.	%		12	D422		02-Sep	ST
Sieve, #200	73.	%		12	D422		02-Sep	ST

Comments: Complete list of References and Glossary of Terms found in Addendum 1

ALPHA ANALYTICAL LABORATORIES
QUALITY ASSURANCE BATCH DUPLICATE ANALYSIS

Laboratory Job Number: L9706695

Parameter	Value 1	Value 2	RPD	Units
Solids, Total	DUPLICATE for sample(s) 01			
	80.	80.	0	%

ALPHA ANALYTICAL LABORATORIES
ADDENDUM I

REFERENCES

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

GLOSSARY OF TERMS AND SYMBOLS

REF Reference number in which test method may be found.

METHOD Method number by which analysis was performed.

ID Initials of the analyst.

LIMITATION OF LIABILITIES

Alpha Analytical, Inc. performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical, Inc., shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical, Inc. be held liable for any incidental consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical, Inc.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding times and splitting of samples in the field.

EST INC.

Environmental Sampling Technology
368 Hillside Avenue
Needham Heights, MA 02194
(617) 455-0003 FAX (617) 455-8336

CHAIN OF CUSTODY RECORD

LABORATORY: ALPHA ANALYTICAL
(508) 898-9220

CLIENT: CSR NEW ENGLAND PIPE *
ADDRESS: 174 All Hallows Road
WAUREGAN, CT 06387
PHONE #: (508) 597-6910
P.O. #
CLIENT CONTACT: MR RHETT GRANT
DESCRIPTION: ROMANOW CONTAINER

CONTAINER TYPE
P — Plastic
G — Glass
V — VOA
B — Bacteria

SAMPLE TYPE
1. Wastewater
2. Groundwater
3. Drinking Water
4. Soil / Sediment
5. Surface Water
6. Other

SPECIAL INSTRUCTIONS
(6) RUSH ____ DAY TURNAROUND
ROUTINE

LOCATION (SAMPLE IDENTIFICATION)	SAMPLE TYPE	CONTAINER SIZE	CONTAINER TYPE	CONTAINER #	SAMPLING DATE	SAMPLING TIME	PRESERVATIVE	ANALYSES: GRAIN SIZE	COMMENTS
STORMCEPTOR SEDIMENT	4	16oz	G	1	8/26	0945	—	✓	

Sampler's Signature	Date	Time
John D'Andrea	8/26	1000

ADDITIONAL COMMENTS:
* REPORT AND INVOICE TO EST, INC

NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME
1	John D'Andrea		8/26/97	1525
2				
3				
4				

08/05/97 14:59 FAX 617 455 8336 EST INC. 008