Appendix I

2008, 2009, 2010, and 2015
Treatability Testing Results

Appendix I1

2008-2009 Treatability Testing

TREATABILITY REPORT

ACID BROOK DELTA GEOTEXTILE EVALUATION AND BENCH SCALE STUDY

Prepared For:

ARCADIS

6723 Towpath Road
Syracuse, New York 13214

Prepared By:

Waste Stream Technology, Inc.
302 Grote Street
Buffalo, New York 14207

January 2009

1.0 Scope of Work

Samples for treatability were obtained from Acid Brook Delta, in Pompton Lakes, NJ. Waste Stream Technology, Inc (WST) conducted bench scale testing on sediment and peat mixtures to evaluate its ability to be dewatered through use of geotextile tubes and to determine if polymer could enhance sediment dewatering.

2.0 Initial Characterization

Sediment, peat, and water from various locations of the Acid Brook Delta (ABD) site were sampled between November 3, 2008 and November 5, 2008. A total of 30 five-gallon buckets of sediment and 10 five-gallon buckets of peat, along with 60 five-gallon buckets of water were shipped to WST under chain-of-custody. Chain-of-custody documents are in Appendix A. Upon receipt, all samples were logged in, weighed, and stored at 4^{o}C.

Two 50-gallon composite samples were created from the solids. The Primary Sediment Composite was made up of 80% sediment and 20% peat. The Primary Peat Composite was made up of 50% sediment and 50% peat. A 50-gallon site water composite was also generated. Each of the various areas was proportionally added to the composite. For example, 40 gallons of sediment were needed for the Primary Sediment composite. Sediment samples were collected from ten different locations within the ABD site. Therefore, 4 gallons from each location were used to generate the composite sample.

Each mixture was homogenized and sampled for metals analyses, including mercury, and Total Organic Carbon (TOC). Percent solids and moisture content were

performed on the solid samples. The solids samples were also sent to GZA for geotechnical analyses including specific gravity, grain size analysis, and Atterberg limits. Geotechnical results are found in Appendix H. The site water composite was analyzed for Total Suspended Solids (TSS), Dissolved Oxygen, turbidity, and pH. These analytic results are in Appendix B. The analytic methods, utilized in the initial characterization and treatability testing of the samples, are provided in Appendix C.

3.0 Elutriate Testing

Elutriate tests are often performed to evaluate the possible containments that may be released into the water column during dredge operations. The Effluent Elutriate Test (EET) and Dredge Elutriate Test (DRET) were performed on the samples obtained from the ABD site. A summary of the EET and DRET tests are found in Appendix D. The associate analytic results are found in Appendix B.

Effluent Elutriate Tests were performed on the Primary Sediment and Primary Peat composites. Each composite sample was diluted with site water to an initial solids concentration of 150g/L. The samples were homogenized before being aerated for one hour. After an hour of aeration the samples were allowed to settle for 24 hours. The sediment line was measured at 1, 2, 4, 8, and 24 hours. . The supernatant was removed after 24 hours of settling and was sampled for TSS, turbidity, TOC, pH, and metals analyses. The supernatant was very turbid and high in solids. See Table 1 for supernatant volume, turbidity, and TSS. The solids were also sampled for specific gravity, water content, percent solids, metals and TOC.

Dredge Elutriate Tests were also performed on the Primary Sediment and Primary Peat composites. Each composite sample was diluted with site water to an initial solids

concentration of 10g/L. The samples were homogenized and then aerated for one hour. After an hour of settling, the sediment line was recorded and the supernatant was sampled for TSS, turbidity, pH, TOC, and metals analyses. See Table 1 for supernatant volume, turbidity, and TSS.

Table 1:
Supernatant Summary from Elutriate Tests

Sample ID	Supernatant Volume (mL)	Supernatant Turbidity (NTU)	Supernatant TSS (ppm)
Primary Peat EET	1900	>4000	2280
Primary Peat DRET	2000	1278	740
Primary Sediment EET	1600	1119	640
Primary Sediment DRET	1000	1382	840

4.0 Polymer Screening

Polymers are often used to enhance the dewatering of sediments. Polymer selection is largely a method of trial and error. Several polymers were screened to evaluate their potential effectiveness on the samples from the Acid Brook Delta site. The Primary Sediment Composite and Primary Peat Composite were diluted, with site water, to a 5-10% solids by weigh slurry before polymer screening was performed. Polymers were also screened on the Primary Sediment Composite as is, which was 25-30% solids by weight.

Polymers were judged using several criteria such as floc quality and water clarity. If a polymer at a certain dose showed favorable results a Rapid Dewatering Test (RDT). The RDT consists of mixing 100mL of sample with a selected polymer and dose. Once the sample is mixed it is poured into a Buchner funnel containing a piece of geotextile fabric. The test is used to evaluate the drainage potential of a sample, usually by measuring the amount and quality of the filtrate at a specified time. The remaining solids

are also analyzed for percent solids. Polymer screening results for each sample are provided in Appendix E. RDT results are provided in Appendix F.

The low solids Primary Sediment and Primary Peat samples tested similarly during polymer screening. In general a cationic or a combination of a solution polymer and an anionic polymer produced a good floc that settled well, could withstand RDT tests and generated clear filtrate. Anionic polymers alone produced a good floc that settled well with a lot of filtrate. However, the filtrate was cloudy and high in solids. Solution polymers produced a floc that settled well, leaving clear filtrate. However, the floc was very fine and did not withstand RDT testing, as many solids passed through the geotextile filter. A solution polymer such as Hychem CP 626 or CP 757 in combination with an anionic polymer such as Hychem AE 843 or Nalclear 1689 created a floc that settled well, could withstand RDT tests and left clear filtrate.

Lower charged cationic polymers, also produced desirable floc and filtrate on its own. Higher charged cationic polymers may have been too strong for the test material. The floc and filtrate was not as good with high charged cationic polymers as it was with low and it was easy to over treat the samples with a high charged polymer.

5.0 Geotextile Testing

Geotube Dewatering Test (GDT) bags are used to evaluate the dewatering potential of geotextile bags. GDT bags were placed on a stand and a standpipe was placed inside the opening of the bag. Buckets were used to pour the slurry through the standpipe and into the bag. Time officially began when the last slurry bucket was poured into the bag. The test was considered complete at 24 hours. The filtrate volume was measured at the end of each test. The filtrate was sampled for TSS, turbidity, pH, TOC,

and metals analyses. These results are provided in Appendix B. Samples for percent solids and moisture content were taken from the center of the bag and the four corners. These results are provided in Appendix G. The remaining solids were also analyzed for TOC, metals, and specific gravity.

It was planned that each GDT test would use 15 gallons of slurry material. However, the first test was conducted with the high solids Primary Sediment and the bag was full after 10 gallons of sample were used. To maintain consistency for comparative purposes all further tests were performed using 10 gallons of slurry. Test ran on the untreated samples resulted in low solids and turbid filtrate. The solids remaining from the untreated Primary Peat and Primary Sediment at low solids were "soupy" when sampled.

Tests ran on the samples treated with cationic polymers showed a slight improvement. The percent solids were somewhat higher and the filtrate was slightly clearer. A combination of a solution polymer and an anionic polymer with the pretreatment step yielded the best test results. Initially, some solids passed through the geotextile bags as the bags were being filled. Filtrate would generally become clearer as the test continued. The filtrate is released at a faster rate during the beginning of the test and tapers off over time. About $^{1}/_{3}$ to ½ of the total filtrate was released during the first hour of the test.

5.0 Results and Discussion

The treatment regime for the GDT's was based on polymer screening and RDT's. Cup testing is done in order to observe what polymers are potentially effective for the GDT. Treatments that demonstrate a good quality floc and clear, colorless filtrate, then

undergo the RDT. The RDT does not fully simulate the GDT. There is no pressure exerted on the sample during the RDT, while there is pressure during the GDT. Pressure can force more water from the slurry, leaving less moisture in the solids. However, pressure can also force more solids through the geotextile fabric. If the floc is not strong and passes through the fabric during the RDT, it will not be able to with stand GDT testing.

After the GDT test, remaining sediment from the samples treated with a combination of Nalmet 1689, a solution polymer such as CP 626 or CP 757, and Nalclear 7763 had higher percent solids than those from the untreated and the samples treated with the cationic polymer. Five sections from each bag were evaluated for percent solids and moisture content. The averages of these are provided in Table 2.

Table 2:
Average Percent Solids/Moisture Content from Geotube Dewatering Tests

Sample ID	Test #	Average Percent Solids	Average Moisture Content
Low Solids Primary Peat	3	28.94	266.06
	5	26.87	272.54
	8	31.57	218.56
Low Solids Primary Sediment	2	24.26	315.25
	4	28.19	259.59
	7	31.57	218.56
High Solids Primary Sediment	1	34.92	186.50
	6	34.21	192.33
	9	36.39	174.16

The low solids Primary Sediment and Primary Peat samples tested similarly in regards to polymer screening, RDT and GDT tests. There is a noticeable improvement in the percent solids and moisture content from the GDT test where the samples were

treated with the combination of solution and anionic polymer as opposed to the untreated samples.

While there was some improvement in the low solids samples, there is very little difference in the treatment and testing of the high solids Primary Sediment. The high solids Primary Sediment samples did not readily release water, even with the addition of polymer. Besides, the high solids Primary Sediment not dewatering well, this sample was difficult to work with in regards to the GDT. The material did not flow easily through the standpipe while filling the GDT bags. The material is thick and not very fluid and did clog the pipe several times throughout testing. There was no difficulty passing the low solids samples through the standpipe.

Although there was little difference in percent solids from the GDT of the high solids Primary Sediment, there was some improvement in the filtrate. In general, the filtrate of the samples treated with the cationic and the solution and anionic combination were lower in turbidity and TSS than the filtrate of the untreated samples. The filtrate of the treated samples was also lower in metals and TOC. Those samples treated with the solution and anionic combination showed the most improvement in filtrate quality.

APPENDIX A

Chain-of-Custody Documents

Acid Brook Delta Treatability Study

Pompton Lakes, New Jersey

January 2009

ARCADIS

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CHAIN OF CUSTODY

Waste Stream Technology
302 Grote Street
302 Grote Street
716.876.5290

Account #: B6042322
SDG#

Client Information	Facility Information
ARCADIS	
Name: CHADD GENERAL	Project Name: DUPONT ACID BROOK DELTA
Acct No. / Quote #:	Location: 2000 CANNONBARC ROAD
Project Manager: HEATHER VANDERWALKER	State: NY Zip: Project/PO #: DUMPTON LAKES, NJ
Send Report to: Phone #: 315-671-9382	Report Submittal Contact: FAX #:

	Field ID / Point of Collection	Collection: Date	Time	Sampled By	Matrix	# of bottles	Preservation: HCl	NaOH	HNO_3	H_2SO_4	None	Analytical Information	For Lab Use
9	537-241 - WATER	11-3-08	1555	CR6		6					✓		
1	SW-12 - WATER	11-4-08	1000	CR6		6					✓		
	~~537-269 - WATER~~	11-4-08	0900	CR6	CR6 MS	6					✓		
3	537-273 - WATER	11-4-08	0945	CR6		6					✓		
4	537-339 - WATER	11-4-08	0930	CR6		6					✓		
5	SW-20 - WATER	11-4-08	0845	CR6		6					✓		
6	SW-13 - WATER	11-4-08	0815	CR6		6					✓		
7	SW-21 - WATER	11-4-08	0945	CR6		6					✓		
		MA				INF	Bottle Count by Parameter						

Turnaround Information

- ☐ 21 Day Standard — Approved By:
- ☐ 14 Day
- ☐ 7 Days *EMERGENCY*
- ☐ Other

RUSH TAT is for FAX data unless previously approved.

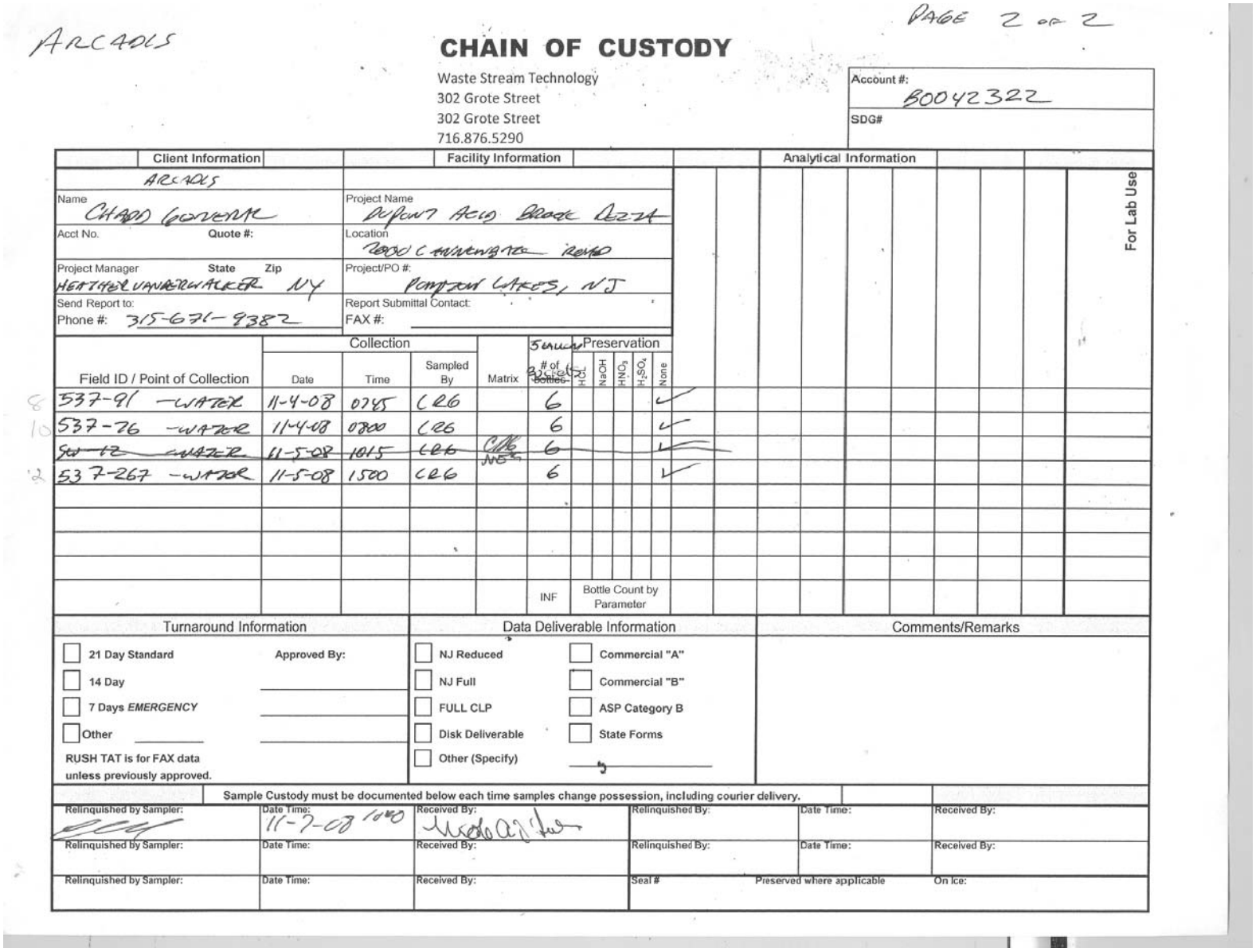
Data Deliverable Information

- ☐ NJ Reduced
- ☐ NJ Full
- ☐ FULL CLP
- ☐ Disk Deliverable
- ☐ Other (Specify)
- ☐ Commercial "A"
- ☐ Commercial "B"
- ☐ ASP Category B
- ☐ State Forms

Comments/Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
CHADD GENERAL	11-7-08 1040				
~~Relinquished by Sampler:~~	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
Relinquished by Sampler:	Date Time:	Received By:	Seal #	Preserved where applicable	On Ice:



ARCADIS

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CHAIN OF CUSTODY

Waste Stream Technology
302 Grote Street
302 Grote Street
716.876.5290

Account #: B0042322
SDG#

Client Information

ARCADIS
Name: CHADD GOVENAR
Acct No. Quote #:
Project Manager: HEATHER VANDERWALKER State: NY Zip:
Send Report to:
Phone #: 315-671-9382

Facility Information

Project Name: DUPONT ACID BROOK DELTA
Location: 2000 CANNONBALL ROAD
Project/PO #: POMPTON LAKES, NJ
Report Submittal Contact:
FAX #:

Analytical Information

For Lab Use

Field ID / Point of Collection	Collection: Date	Time	Sampled By	Matrix	# of Bottles	Preservation: HCl	NaOH	HNO_3	H_2SO_4	None
537-91 -WATER	11-4-08	0745	CRG		6					✓
537-76 -WATER	11-4-08	0800	CRG		6					✓
~~SW-12 -WATER~~	~~11-5-08~~	~~1015~~	~~CRG~~	~~GW~~ NS	6					✓
537-267 -WATER	11-5-08	1500	CRG		6					✓
					INF	Bottle Count by Parameter				

Turnaround Information

- ☐ 21 Day Standard — Approved By:
- ☐ 14 Day
- ☐ 7 Days *EMERGENCY*
- ☐ Other
- RUSH TAT is for FAX data unless previously approved.

Data Deliverable Information

- ☐ NJ Reduced
- ☐ NJ Full
- ☐ FULL CLP
- ☐ Disk Deliverable
- ☐ Other (Specify)
- ☐ Commercial "A"
- ☐ Commercial "B"
- ☐ ASP Category B
- ☐ State Forms

Comments/Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
	11-7-08 1040				
Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
Relinquished by Sampler:	Date Time:	Received By:	Seal # Preserved where applicable		On Ice:

Serial Number 59092

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SEVERN TRENT **STL**

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.stl-inc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
DuPont - Acid Brook Delta	B0042322.0001.00006	NJ
STL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Heather VanDewalker	CLIENT PHONE: 315.446.2570	CLIENT FAX
CLIENT NAME: DuPont - Pompton Lake Works	CLIENT E-MAIL: Heather.VanDewalker@us.arcadis-us.com	
CLIENT ADDRESS: 2000 Cannonball Road, Pompton Lakes, NJ		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 2 OF 2

STANDARD REPORT DELIVERY ○
DATE DUE
EXPEDITED REPORT DELIVERY (SURCHARGE) ○
DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	MATRIX TYPE: AQUEOUS (WATER)	SOLID OR SEMISOLID SEDIMENT	AIR PEAT	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	REQUIRED ANALYSIS: TREATABILITY STUDY	NUMBER OF CONTAINERS SUBMITTED	REMARKS
11/5/08	1400	537-237			3	3		X		Sediment - Red Bucket
11/5/08	1300	537-339			3	1		X		Peat - Gray Bucket
11/5/08	1600	SW-20			3	1		X		
11/5/08	0930	SW-13			3			X		
11/5/08	1045	SW-21			3			X		
11/4/08	1500	537-91			3	1		X		
11/4/08	1200	537-241			3	1		X		
11/5/08	0800	537-76			3			X		
11/5/08	0830	537-91				1		X		
11/5/08	1015	SW-12			3	1		X		
11/5/08	1500	537-267			3	1		X		

PRESERVATIVE

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
EMPTY CONTAINERS				11.6.08	1500		11/10/08	13:50			
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME			
EMPTY CONTAINERS			Roger Elliott - Arcadis	11.7.08	09:30		11/10/08	1350			

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT YES ○ NO ○	CUSTODY SEAL NO.	STL SAVANNAH LOG NO.	LABORATORY REMARKS

STL8240-680 (12/02)

APPENDIX B

Analytic Results

Acid Brook Delta Treatability Study
Pompton Lakes, New Jersey
January 2009

Arcadis- Acid Brook Delta

rec'd 11/7/08 & 11/10/08

			Low Solids Primary Peat		
Samle ID	**Primary Peat Initial**	**Primary Peat EET Solids**	**GDT 3-Solids**	**GDT 5-Solids**	**GDT 8-Solids**
WST Sample ID	8L02009-02	8L05011-06	8L11015-06	8L11015-10	8L19007-04
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Barium	81.2	83.0	48	57.6	59.7
Copper	229	388	145	206	177
Mercury	77.4	59.7	39.1	61.2	59.3
Lead	125	233	75.5	105	103
Selenium	17.1	<7.00	<1.40	2.69	4.24
Zinc	111	199	78.7	92.9	91.8
TOC	5.46%	3.50%	3.46%	4.24%	3.51%

			Low Solids Primary Sediment			High Solids Primary Sediment		
Samle ID	**Primary Sediment Initial**	**Primary Sediment EET Solids**	**GDT 2-Solids**	**GDT 4-Solids**	**GDT 7-Solids**	**GDT 1-Solids**	**GDT 6-Solids**	**GDT 9-Solids**
WST Sample ID	8L02009-01	8L05011-02	8L11015-04	8L11015-08	8L19007-06	8L11015-02	8L11015-12	8L19007-02
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Barium	101	327	69.1	65.1	77.1	90.8	79.7	94.2
Copper	499	375	428	296	353	472	450	444
Mercury	168	204	98.5	82.1	111	129	124	127
Lead	289	40.8	216	154	197	249	236	250
Selenium	23.6	39.2	3.99	1.48	9.08	3.58	1.74	9.02
Zinc	235	727	180	139	159	215	195	204
TOC	5.84%	3.50%	3.92%	4.07%	4.59%	3.90%	4.42%	4.03%

Samle ID	Site Water Composite Initial	Primary Sediment EET Supernatant	Primary Sediment DRET Supernatant	Primary Sediment DRET through Silt Screen	Primary Peat EET Supernatant	Primary Peat DRET Supernatant	Primary Peat DRET through Silt Screen
WST Sample ID	8L02009-03	8L05011-01	8L05011-03	8L05011-04	8L05011-05	8L05011-07	8L05011-08
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Barium	0.026	0.254	0.217	0.13	0.140	0.088	0.139
Barium (Filtered)	0.017	0.08	0.025	--	0.029	0.019	--
Copper	0.033	1.00	0.839	0.0249	0.524	0.245	0.186
Copper (Filtered)	<0.009	0.266	<0.009	--	<0.009	<0.009	--
Lead	0.017	0.851	0.573	0.398	0.341	0.154	0.299
Lead (Filtered)	<0.015	0.256	<0.015	--	<0.015	<0.015	--
Selenium	<0.019	<0.095	<0.019	<0.019	<0.019	<0.019	<0.019
Selenium (Filtered)	<0.019	<0.019	<0.019	--	<0.019	<0.019	--
Zinc	0.029	0.325	0.342	0.198	0.170	0.112	0.18
Zinc (Filtered)	<0.013	0.097	<0.013	--	<0.013	<0.013	--
TOC	4.1	10.8	6.0	--	12.4	6.0	--
TOC (Filtered)	--	8.1	4.2	--	5.8	4.5	--
TSS	54	640	840	--	2280	740	--
Dissolved Oxygen	9.93 mg O_2/L	--	--	--	--	--	--
CEBAM Sample ID	WST-0801-01	WST-0802-01	WST-0802-02	WST-0802-03	WST-0802-04	WST-0802-05	WST-0802-06
	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Low Level Mercury	6286.0	226720.3	138730.0	136246.6	363362.0	134243.0	125071.5
Low Level Mercury (Filtered)	15.0	183.1	705.8	--	3322.7	2070.7	--
Methyl Mercury	1.2	2.95	2.13	2.93	2.62	0.86	1.49
Methyl Mercury (Filtered)	0.3	0.33	0.07	--	0.11	0.03	--

	Low Solids Primary Peat			Low Solids Primary Sediment			High Solids Primary Sediment		
Samle ID	**GDT 3-Filtrate**	**GDT 5-Filtrate**	**GDT 8-Filtrate**	**GDT 2-Filtrate**	**GDT 4-Filtrate**	**GDT 7-Filtrate**	**GDT 1-Filtrate**	**GDT 6-Filtrate**	**GDT 9-Filtrate**
WST Sample ID	8L11015-05	8L11015-09	8L19007-03	8L11015-03	8L11015-07	8L19007-01	8L11015-01	8L11015-11	8L19007-05
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Barium	1.07	0.133	0.036	0.167	0.034	0.036	0.085	0.083	0.111
Copper	0.335	0.238	0.024	0.465	0.027	0.011	0.176	0.177	<0.009
Lead	0.949	0.249	0.017	0.651	0.028	<0.015	0.172	0.217	<0.015
Selenium	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
Zinc	1.24	0.204	<0.013	0.256	0.030	<0.013	0.134	0.096	<0.013
TOC	11.8	9.6	6.1	9.2	10.2	5.7	17.7	19.6	9.8
TSS	10200	350	18.0	1020	25.0	10.0	440	810	10.0
CEBAM Sample ID	WST-0802-09	WST-0802-11	WST-0803-2	WST-0802-8	WST-0802-10	WST-0803-1	WST-0802-07	WST-0802-12	WST-0803-3
	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Low Level Mercury	1513105.3	66712.3	4843.9	214613.9	12464.8	2209.7	79806.4	168474.0	960.9
Methyl Mercury	3.11	1.91	1.02	3.15	1.44	0.52	2.13	1.88	0.62

APPENDIX C

Analytic and Geotechnical Methods

Acid Brook Delta Treatability Study

Pompton Lakes, New Jersey

January 2009

Summary of Analytic Methods

Analysis	Matrix	Method
Water Content	Solid	ASTM D2216
Specific Gravity	Solid	ASTM D854
Atterberg Limits	Solid	ASTM D4318
Grain-size distribution	Solid	ASTM D422
Grain-size distribution with hydrometer	Solid	ASTM D1140
pH	Solid	EPA 9045C
TOC	Solid	EPA 9060
Mercury	Solid	SW-846 7471A
Metals: Ba, Se, Zn, Pb, Cu	Solid and Aqueous	SW-846 6010B
TSS	Aqueous	ASTM D3977-97
Turbidity	Aqueous	USEPA 180.1
TOC	Aqueous	EPA 415.1/415.2
pH	Aqueous	SM 4500-H B
Dissolved Oxygen	Aqueous	Probe Measurement
Low-level Mercury	Aqueous	USEPA 1631
Methyl Mercury	Aqueous	USEPA 1630

APPENDIX D

Elutriate Tests Summary

Acid Brook Delta Treatability Study

Pompton Lakes, New Jersey

January 2009

Dredge Elutriate Tests

Sediment I.D.: **Primary Sediment**

Sediment Volume/Weight: 164.32 g
Resulting Concentration (10g/L): 10 g solids/L
Test Volume: 4 L

Aeration Time : 60 min
Settling Time : 60 min

Visual Observations:
After 1 hour of settling, the sediment line was at the 3000mL mark, leaving **1000mL** of supernatant. The resulting supernatant was very cloudy. A portion of the supernatant was filtered through a 0.425mm screen before being sampled for metals analyses. There was no residual material retained on this screen.

Supernatant Turbidity: 1382 NTU
Supernatant pH: 6.78

Sediment I.D.: **Primary Peat**

Sediment Volume/Weight: 112.72 g
Resulting Concentration (10g/L): 10 g solids/L
Test Volume: 4 L

Aeration Time (60 min): 60 min
Settling Time (60 min): 60 min

Visual Observations:
After 1 hour of settling, the sediment line was at the 2000mL mark, leaving **2000mL** of supernatant. The resulting supernatant was very cloudy. A portion of the supernatant was filtered through a 0.425mm screen before being sampled for metals analyses. There was no residual material retained on this screen.

Supernatant Turbidity: 1278 NTU
Supernatant pH: 6.91

Effluent Elutriate Tests

Sediment I.D.: **Primary Sediment**

Sediment Volume/Weight: 2570.69 g

Resulting Concentration (150g/L): 150 g solids/L
Test Volume: 4 L

Aeration Time: 60 min
Settling Time : 24 hr

Time (hours)	Sediment Line (mL)	Supernatant Volume (mL)
0	4000	0
1	3500	500
2	3300	700
4	3050	950
8	2775	1225
24	2400	1600

Visual Observations:
After 24 hours of settling, the supernatant is dark and cloudy.

Supernatant Turbidity: 1119 NTU
Supernatant pH: 6.79

Sludge % Solids: 17.94
Sludge pH: 6.80
Sludge Specific Gravity (SM 2710F): 1.13g/mL

Sediment I.D.: **Primary Peat**

Sediment Volume/Weight: 1690.62 g

Resulting Concentration (150g/L): 150 g solids/L
Test Volume: 4 L

Aeration Time: 60 min
Settling Time : 24 hr

Time (hours)	Sediment Line (mL)	Supernatant Volume (mL)
0	4000	0
1	3050	950
2	2800	1200
4	2575	1425
8	2400	1600
24	2100	1900

Visual Observations:
After 24 hours of settling, the supernatant is dark and cloudy.

Supernatant Turbidity: >4000 NTU
Supernatant pH: 6.61

Sludge % Solids: 21.69
Sludge pH: 6.78
Sludge Specific Gravity (SM 2710F): 1.13g/mL

APPENDIX E

Polymer Screening Summary

Acid Brook Delta Treatability Study

Pompton Lakes, New Jersey

January 2009

Polymer Screening

Sample ID	Additive	Dosage (ppm)	Comments
Primary Sediment (High Solids)	CE 814	up to 700	Sample is noticeably thicker, but no free water is released.
	CE 824	500	Sample is noticeably thicker. Releases some free water after half hour of settling.
	CE 864	up to 500	Sample is noticeable thicker, but no free water is released.
	AE 843	up to 700	Sample is noticeably thicker, but no free water is released.
	AE 873	up to 700	Sample is thicker. No free water is released. Becomes slightly slimy, possibly over treated
	CP 626	50*	No noticeable difference.
		300*	Good floc, releases very little free water.
	CP 757	600*	Noticeable floc. Releases free water after settling.
		up to 1000	Sample is noticeablythicker, very little free water is released.
	CP 757 +AE 843	200 + 250	Samples is noticeablyhicker, but no free water is released.
		300 + 300	Samples is noticeably thicker, but no free water is released.
		500 + 250	Samples is noticeably thicker, but no free water is released.
	Nalclear 7763	150	Chunky floc, no free water.
		400	Sample becomes one large blob that holds water.
	CP 757 + Nalclear 7763	1000 + 300*	Sample gets thicker and chunkier. There is very little free water after 30 minutes of settling.
		300 + 150*	Chunky floc, no free water at first. There is free water after half hour of settling.
	Nalco Core Shell	up to 600	No noticeable difference.

* 5ppm of Nalmet 1689 was added to sample prior to polymer screening.

Dose used for GDT test.

Sample ID	Additive	Dosage (ppm)	Comments
Primary Sediment (Low Solids)	CE 803	50	Slightly noticeable floc.
		200	Floc more noticeable, some clear free water.
		300	Good floc, settles quick. Free, clear water with some floating particles.
		400	Chunky floc, but easily broken up. Lots of free, clear water.
	CE 814	200	Slight floc, settles well leaving some clear, free water.
		300	Floc improves, but is loose. Water is more clear.
		500	Floc starts to get chunky, but easily broken up.
	CE 824	300	Noticeable floc, very little free water.
		400-500	Good floc, some clear, free water.
		700	Floc is never tight or strong. Clear water.
	AE 843	50	Noticeable floc, very little free water.
		100	Floc improves and more free water is released. Water is cloudy.
		400-500	Good floc with cloudy, free water.
	NE 823	300	Good floc. Free water with many suspended particles.
		600	Good floc. Water quality does not improve, still has many suspended particles.
	CP 758	500	Noticeable floc, but no noticeable settling or free water.
	CP 758 + AE 843	200 + 150	Okay floc that settles slightly leaving some free, clear water.
	CP 626	20*	Good floc that settles well leaving clear, free water.
		150	Good floc. Settles slightly leaving some clear water.
	CP 626 + AE 843	150 + 100	Floc settles better and faster than with CP 626 alone. More clear water is released.
	CP 626 + Nalclear 7763	20 + 10*	Good floc, settles quick, leaving clear free water. Floc and water quality better than 20ppm of 626 alone.
		40 + 30*	Good floc, settles well. Clear water with some floating particles.
		50 + 10*	Good floc, settles well. Lots of clear free water.
	CP 757	150	Good floc. Very little free water.
	CP 757 + AE 843	150 + 100	Floc settles better and faster than with CP 757 alone. More clear water is released.
	Nalco Core Shell	up to 600	No noticeable difference.

* 5ppm of Nalmet 1689 was added to sample prior to polymer screening.

Dose used for GDT test.

Sample ID	Additive	Dosage (ppm)	Comments
Primary Peat (Low Solids)	CE 803	50	Noticeable floc.
		200	Good floc with clear, free water released.
		350	Good floc that settles fast. Lots of free, clear water.
	CE 814	200	Noticeable floc. Some free water, but water is not clear.
		300	Good floc, is tighter and thicker. More free water is release and is clear.
	CE 824	300	Floc slightly noticeable, some cloudy, free water.
		400	Thicker floc, more clear water
		450	Tighter floc. Lots of clear, free water.
		500-700	Good floc but not as tight. Clear water.
	CE 864	100	Noticeable floc, that starts to settle. Water is cloudy.
		150	Floc is thicker and settles well. More water is released and is clear.
		200	Floc is loose and does not settle well. Possibly over treated.
	AE 843	50	Good floc that settles well. Water is cloudy.
		500	No improvement in water quality.
	CP 758	50	Slightly noticeable floc.
		100	Floc becomes more noticeable, very little free water.
		up to 1000	No significant improvement in floc or water quality.
	CP 758 + 843	100 + 100	Floc settles well with some free water.
	CP 757	100	Good floc. Thin layer of free water.
	CP 757 + AE 843	100 + 75	Good floc that settles faster and leaves more clear, free water than with CP 757 alone.
		150 + 100	Good floc, settles well. Water looks slightly cloudy…possibly over treated?
	CP 626	150	Good floc that settles slightly. Some clear, free water.
	CP 626 + AE 843	150 + 50	Better than with CP 626 alone. Floc is good and settles quick. There is more clear, free water.
		150 + 100	Some improvement in floc quality compared to previous dose.
	Nalclear 7763	25*	Noticeable floc. Cloudy, free water.
		75*	Good floc. Water is slightly cloudy.
		150*	Floc is becoming looser. Water is still cloudy.
		500*	Floc is still soft and loose. Possibly over treated. Water is slightly less cloudy.
	CP 626 + Nalclear 7763	50 + 10*	Good floc, settles well. Lots of clear free water.
	Nalco Core Shell	up to 600	No noticeable difference.

* 5ppm of Nalmet 1689 was added to sample prior to polymer screening.

Dose used for GDT test.

APPENDIX F

Rapid Dewatering Tests Summary

Acid Brook Delta Treatability Study
Pompton Lakes, New Jersey
January 2009

Sample ID	Test #	Additive	Cake % Solids	Filtrate Volume (mL)	Filtrate TSS (ppm)	
Low Solids Primary Peat	1	350ppm CE 803	15.26	66	76	
	2	300ppm CE 814	14.04	63	37	
	3	450ppm CE 824	15.16	50	14	
	4	550ppm CE 844	14.6	60	73	
	5	75ppm CP 758 + 150ppm AE 843	13.38	54	57	
	6	100ppm CP 758 + 100ppm AE 843	15.53	72	32	
	7	5ppm Nalmet 1689 + 75ppm Nalclear 7763	15.93	--	--	<-- Visibly: Cloudy
	8	10ppm Nalmet 1689 + 60ppm Nalclear 7763	15.65	--	--	<-- Visibly: Cloudy
	9	5ppm Nalmet 1689 + 50ppm CP 626 + 10ppm Nalclear 7763	12.58	49	35	
Low Solids Primary Sediment	1	300ppm CE 803	16.86	49	31	
	2	450ppm CE 824	13.76	67	34	
	3	550ppm CE 844	13.61	80	38	
	4	100ppm CP 758 + 100ppm AE 843	14.91	57	30	
	5	150ppm CP 758 + 150ppm AE 843	15.16	51	29	
	6	150ppm CP 626 + 100ppm AE 843	16.02	57	39	
	7	5ppm Nalmet 1689 + 50ppm CP 626 + 10ppm Nalclear 7763	17.20	53	34	
Hi Solids Primary Sediment	1	500ppm 626 + 300ppm 873	27.04	--	--	
	2	500ppm CE 824	46.56	8	NA*	<-- visibly: cloudy
	3	500ppm CE 834	26.95	--	--	
	4	400ppm AE 873	27.38	--	--	
	5	500ppm CP 758 + 300ppm AE 843	26.14	--	--	
	6	600ppm 757	27.52	8	NA*	<--visibly: slightly cloudy
	7	5ppm Nalmet 1689 + 400ppm Nalclear 7763	29.07	7	NA*	<-- visibly: cloudy
	8	5ppm Nalmet 1689 + 150ppm Nalclear 7763	30.25	0	NA*	<-- visibly: cloudy
	9	5ppm Nalmet 1689 + 1000ppm CP 757 + 300ppm Nalclear 7763	29.48	8	NA*	<-- visibly: clear
	10	5ppm Nalmet 1689 + 300ppm CP 757 + 150ppm Nalclear 7763	38.33	7	NA*	<-- visibly: cloudy

NA*- Not enough filtrate to run TSS analysis.

APPENDIX G

Geotube Dewatering Tests Summary

Acid Brook Delta Treatability Study
Pompton Lakes, New Jersey
January 2009

Sample ID: Low Solids Primary Peat

		GDT Filtrate		
Test ID	**Treatment**	**Volume (gallons)**	**Turbidity (NTU)**	**pH**
GDT 3	Untreated	7.3	>4000	7.14
GDT 5	350 ppm CE 803	6.8	122	7.12
GDT 8	5ppm Nalment 1689, 50ppm CP626 and 10ppm Nalclear 7763	7.5	19.3	7.17

	GDT 3		GDT 5		GDT 8	
Location	**% Solids**	**Moisture Content**	**% Solids**	**Moisture Content**	**% Solids**	**Moisture Content**
Center	25.04	299.30	26.81	272.99	30.32	229.84
Corner 1	25.95	285.39	27.80	259.69	30.71	225.58
Corner 2	23.99	316.90	26.71	274.33	30.11	232.08
Corner 3	24.56	307.09	25.26	295.90	30.16	231.55
Corner 4	45.16	121.64	27.79	259.80	36.53	173.73
Average	**28.94**	**266.06**	**26.87**	**272.54**	**31.57**	**218.56**

10 gallons of sludge @ 9.24% solids were used for each GDT test.

Sample ID: Low Solids Primary Sediment

		GDT Filtrate		
Test ID	**Treatment**	**Volume (gallons)**	**Turbidity (NTU)**	**pH**
GDT 2	Untreated	6.9	1515	7.38
GDT 4	300 ppm CE 803	6.6	12.2	6.52
GDT 7	5ppm Nalment 1689, 50ppm CP626 and 10ppm Nalclear 7763	8.2	8.96	7.37

	GDT 2		GDT 4		GDT 7	
Location	**% Solids**	**Moisture Content**	**% Solids**	**Moisture Content**	**% Solids**	**Moisture Content**
Center	21.70	360.90	26.71	274.41	30.32	229.84
Corner 1	22.54	343.69	26.25	280.95	30.71	225.58
Corner 2	23.78	320.61	27.18	267.98	30.11	232.08
Corner 3	26.61	275.80	25.61	290.45	30.16	231.55
Corner 4	26.65	275.26	35.19	184.15	36.53	173.73
Average	**24.26**	**315.25**	**28.19**	**259.59**	**31.57**	**218.56**

10 gallons of sludge @ 9.71% solids were used for each GDT test.

Sample ID: High Solids Primary Sediment

		GDT Filtrate		
Test ID	**Treatment**	**Volume (gallons)**	**Turbidity (NTU)**	**pH**
GDT 1	Untreated	1.8	174	7.38
GDT 6	500 ppm CE 824	2.4	12.2	7.06
GDT 9	5ppm Nalment 1689, 300ppm CP 757 and 150ppm Nalclear 7763	2.7	15.9	7.60

	GDT 1		GDT 6		GDT 9	
Location	**% Solids**	**Moisture Content**	**% Solids**	**Moisture Content**	**% Solids**	**Moisture Content**
Center	34.70	188.20	33.86	195.37	36.35	175.10
Corner 1	35.66	180.40	34.33	191.29	36.13	173.20
Corner 2	35.86	178.86	34.71	188.06	35.68	180.29
Corner 3	34.40	190.71	34.67	188.41	36.24	175.91
Corner 4	33.98	194.33	33.50	198.51	37.55	166.29
Average	**34.92**	**186.50**	**34.21**	**192.33**	**36.39**	**174.16**

10 gallons of sludge @28.34% solids were used for each GDT test.

APPENDIX H

Geotechnical Data

Acid Brook Delta Treatability Study
Pompton Lakes, New Jersey
January 2009

LABORATORY TESTING DATA SHEET

Project Name Waste Stream Technology
Project No. 19281.00
Project Manager M. Polsky

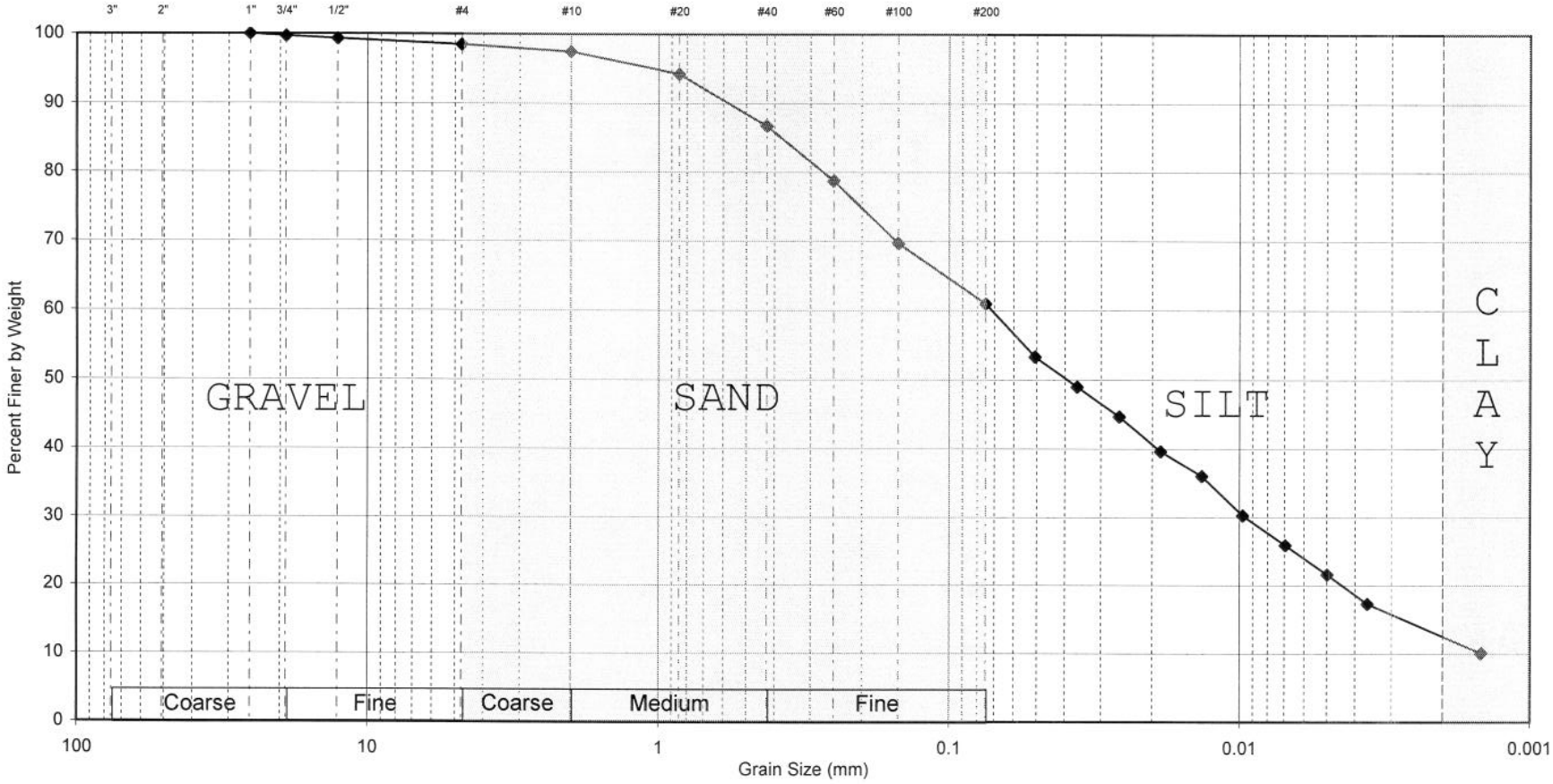
Location Arcadis Acid Brook Delta
Assigned By N. O'Sullivan
Report Date 12/11/2008

Reviewed By
Date Reviewed 12/12/08

Sample	Sample Date	Lab No.	Identification Tests							Strength Tests						
			Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	Gs	Dry unit wt. pcf	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	Laboratory Log and Soil Description
Primary Peat	12/3/08	13		92	63	61	13	2.25								Dark Brown Fine Grained PEAT
Primary Sediment	12/3/08	14		100	68	68	15	2.41								Dark Brown Fine Grained PEAT

GZA GeoEnvironmental, Inc.

U.S. STANDARD SIEVE AND HYDROMETER



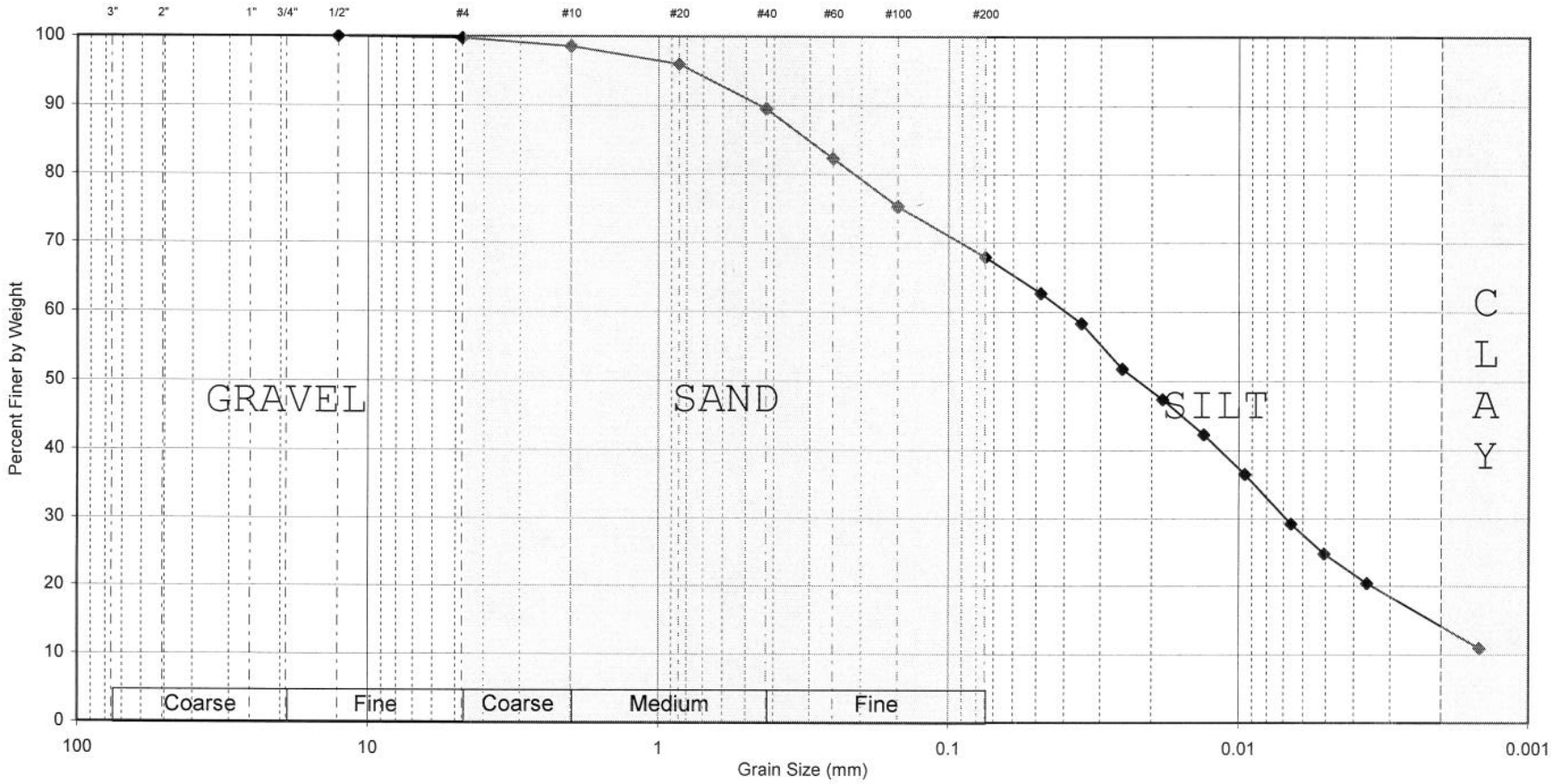
Gravel	Sand	Fines
1.5%	37.5%	61.0%

Lab #	Sample Date	Material	Depth (ft)	Description	Gs	LL	PL	PI
13	12/3/08	Primary Peat		Dark Brown Fine Grained PEAT	2.25	92	63	29

Waste Stream Technologies
Arcadis Acid Brook Delta
GZA File # 19281

Tested by: PEC Date: 12/10/08
Reviewed by: MBP Date: 12/11/08

U.S. STANDARD SIEVE AND HYDROMETER



Gravel	Sand	Fines
0.2%	31.8%	68.0%

Lab #	Sample Date	Material	Depth (ft)	Description	Gs	LL	PL	PI
14	12/3/08	Primary Sediment		Dark Brown Fine Grained PEAT	2.41	100	68	32

Waste Stream Technologies
Arcadis Acid Brook Delta
GZA File # 19281

Tested by: PEC Date: 12/10/08
Reviewed by: MBP Date: 12/11/08

LABORATORY TESTING DATA SHEET

Project Name Waste Stream Technology
Project No. 19281.00
Project Manager M. Polsky

Location Arcadis Acid Brook Delta
Assigned By N. O'Sullivan
Report Date 1/6/2009

Reviewed By [signature]
Date Reviewed 1/7/09

Sample	Sample Date	Lab No.	Identification Tests							Strength Tests						Laboratory Log and Soil Description
			Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	Gs	Dry unit wt. pcf	Perme-ability cm/sec	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	
Primary Sediment EET Solids	12/5/08	1						2.40								
Primary Peat EET Solids	12/5/08	2						2.42								
GDT 1 Solids	12/9/08	3						2.47								
GDT 2 Solids	12/9/08	4						2.52								
GDT 3 Solids	12/9/08	5						2.56								
GDT 4 Solids	12/10/08	6						2.37								
GDT 5 Solids	12/10/08	7						2.57								
GDT 6 Solids	12/11/08	8						2.20								
GDT 7 Solids	12/18/08	9						2.48								
GDT 8 Solids	12/18/08	10						2.26								
GDT 9 Solids	12/19/08	11						2.50								

Water Treatment Treatability Testing – Waste Stream Technology Revised Scope of Work
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

Based on the results obtained from the Geotube Dewatering Tests (GDT), the water treatment testing will be revised (from that included in the November 2008 scope of work) to include additional filtration and analysis of each of the GDT filtrates (i.e., GDT 1-Filtrate through GDT 9-Filtrate). Details on the filtering and sampling are provided below. Note that, at this point, no additional testing will be conducted on the Dredging Elutriate Test (DRET) and Effluent Elutriate Test (EET) supernatant, although these should still be retained for potential future analysis.

Results from this treatability study and other testing performed by DuPont has indicated that the mercury is likely attached to the solids; therefore, it is anticipated that if the solids are removed from the filtrate, mercury levels will decrease. As such, additional filtration will be performed followed by analytical testing on each resulting filtrate to determine the effectiveness of various filter sizes and techniques. In order to obtain adequate filtrate volume to run the testing included herein, additional GDT tests may be required especially for the high solids primarily sediment GDT filtrates (1, 6, and 9). As needed, the sediment, peat, and site water will be remixed to form the necessary composite and GDT testing will be repeated using the same procedure and polymers followed during the initial testing in December 2008.

The attached figure provides a flow diagram of the steps to be conducted for each GDT filtrate (GDT 1-Filtrate through GDT 9-Filtrate). The bullets presented below summarize this process. This process will be repeated for all 9 GDT filtrates.

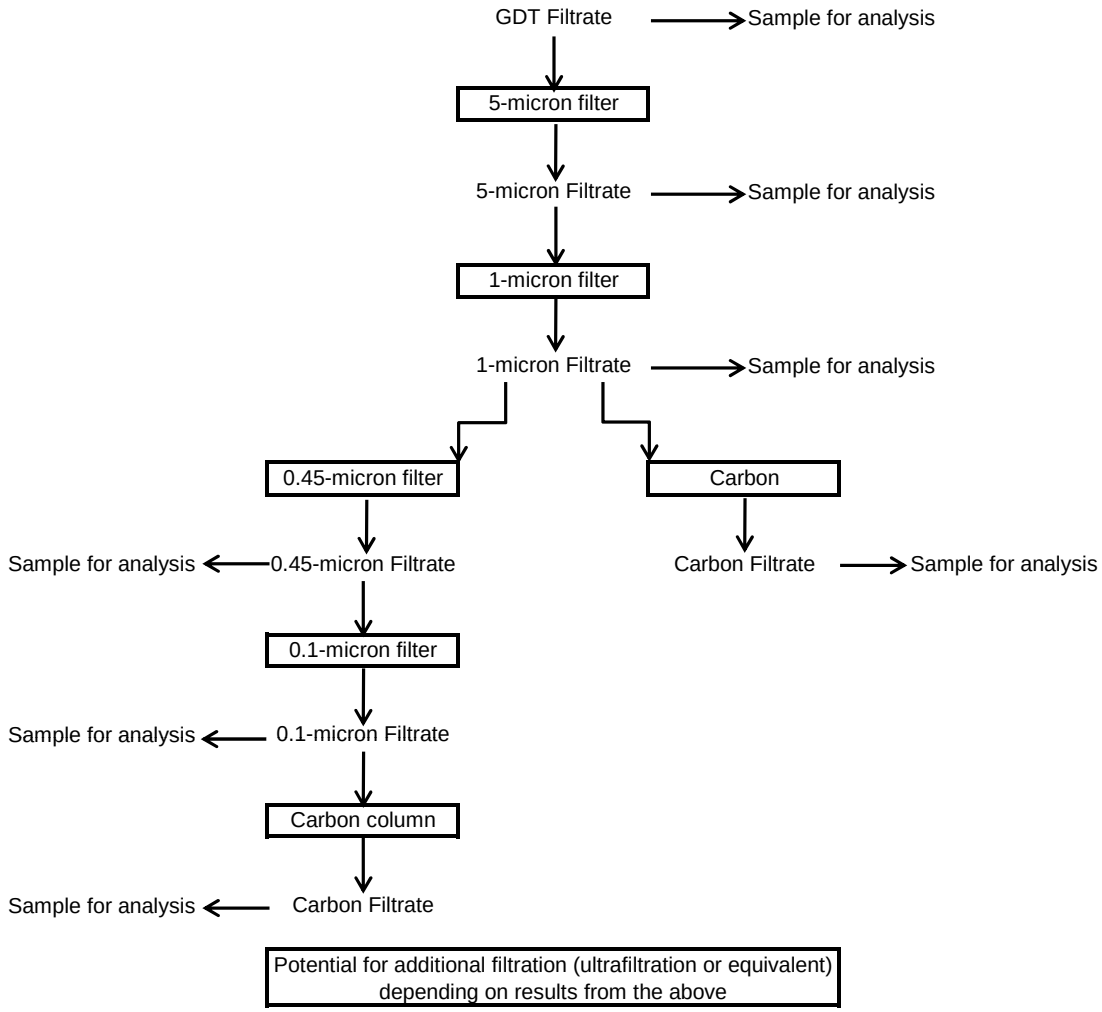
1. Sample the initial GDT filtrate and submit for analysis.
2. Run the filtrate from Step 1 through a 5-micron screen to simulate a clarifier/finishing Geotube step. Sample the filtrate and submit for analysis.
3. Run the filtrate from Step 2 through a 1-micron filter to simulate a sand filter. Sample the filtrate and submit for analysis.
4. Divide the filtrate from Step 3 into two portions.
    a. Run ½ of the filtrate through the carbon column. Sample the filtrate and submit for analysis. This filtrate will not be used again based on this scope of work; however, the filtrate should be retained for potential future analysis.
    b. Run ½ of the filtrate through a 0.45-micron filter. Sample the filtrate and submit for analysis.
5. Run the filtrate from Step 4b through a 0.1-micron filter and sample the filtrate and submit for analysis.
6. Run the filtrate from Step 5 through the carbon column. Sample the filtrate and submit for analysis.

A maximum of 63 samples (9 GDT filtrates and 7 different filtrations/testing) will be analyzed for each of the following:

- Total suspended solids (TSS; USEPA Method 160.2, with modifications consistent with ASTM D3977-97, Test Method B – filtration);
- Lead (USEPA 6010B; unfiltered); and
- Low-level mercury (USEPA Method 1631) and methyl mercury (USEPA Method 1630).

The analytical results will be evaluated to assess the success the different filtrations had in reducing mercury concentrations. If mercury results are not lower than the water quality criteria, additional testing using ultrafiltration (or an equivalent method) may be performed. This scope does not include ultratfiltration testing, and if this is determined necessary, an additional scope of work will be developed.

Water Treatment Treatability Testing – Waste Stream Technology Revised Scope of Work - Flow Chart
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey



Additional information:

Number of test cycles = 9
Maximum number of samples per test cycle = 7
Analyses to be conducted on each sample and required sample volume:

TSS	100	mL
Lead	500	mL
Low-level mercury	250	mL
Methyl mercury	250	mL
Total sample volume	1,100	mL

Maximum required sample volume per test cycle = 9,900 mL
2.6 gal
Maximum Number of Samples = 63

Current GDT filtrate volume remaining:

Low solids primarily peat:
- GDT 3-Filtrate = 7.3 gallons
- GDT 5-Filtrate = 6.8 gallons
- GDT 8-Filtrate = 7.5 gallons

Low solids primarily sediment:
- GDT 2-Filtrate = 6.9 gallons
- GDT 4-Filtrate = 6.6 gallons
- GDT 7-Filtrate = 8.2 gallons

High solids primarily sediment:
- GDT 1-Filtrate = 1.8 gallons
- GDT 6-Filtrate = 2.4 gallons
- GDT 9-Filtrate = 2.7 gallons

Current site water, sediment, and peat remaining:
- Site water = ~230 gallons
- Sediment = ~85 gallons
- Peat = ~30 gallons

Additional Water Treatment Testing – Geotube Filtrate Test Results
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

Based on the results from the Geotube Dewatering Tests (GDT) conducted in January 2009, the water treatment treatability testing was expanded to include additional filtration and analysis of each of the GDT filtrates (i.e., GDT 1-Filtrate through GDT 9-Filtrate). The additional testing was performed by WST in July 2009 in accordance with ARCADIS' November 30, 2008 scope. The bullets below summarize the testing process and corresponding results and conclusions.

1. GDT Filtrates Used for Testing

- Filtrates from all nine GDTs performed in January 2009 were used as part of the additional filtration testing; the filtrates along with the polymer treatment (where applicable) are listed below.
    - High Solids Primarily Sediment (80% sediment:20% peat; 28.3% initial solids to simulate mechanical dredging):
        - GDT 1 – No polymer
        - GDT 6 – 500 ppm Hyperfloc CE824
        - GDT 9 – 5 ppm Nalmet 1689; 300 ppm Hyperfloc CP757 & 150 ppm Nalclear 7763
        - Note that these GDTs were re-run to obtain adequate filtrate volume for this testing
    - Low Solids Primarily Sediment (80% sediment:20% peat; 9.7% initial solids to simulate hydraulic dredging):
        - GDT 2 – No polymer
        - GDT 4 – 300 ppm Hyperfloc CE803
        - GDT 7 – 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763
    - Low Solids Primarily Peat (50% sediment:50% peat; 9.2% initial solids to simulate hydraulic dredging):
        - GDT 3 – No polymer
        - GDT 5 – 350 ppm Hyperfloc CE803
        - GDT 8 – 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763
- Initial filtrate results from the January 2009 treatability testing are presented in WST's Treatability Report, and are also provided on Table 1.
- All filtrate samples were re-analyzed prior to the initiation of the additional filtrate testing. The July 2009 results are shown in Table 1.

2. Filtration Testing Procedures

- GDT samples were sequentially passed across four filter media (approx. opening sizes of 5-um, 1-um, 0.45-um, and 0.1-um); the 1-um and 0.1-um filtrates were also passed across an activated carbon media.
- All intermediate and final filtrates were tested for:

- Total suspended solids (TSS; USEPA Method 160.2, with modifications consistent with ASTM D3977-97, Test Method B – filtration)
- Lead (Pb; USEPA 6010B; unfiltered)
- Low-level mercury (HG; USEPA Method 1631) and methyl mercury (Me-Hg; USEPA Method 1630)
- TSS analysis was not performed on filtrate samples that passed through the 0.45 micron and 0.1 micron filters as results would be non-detect (ND) since the TSS filter has a larger pore size.

3. Results – TSS Correlations

- January 2009 GDT filtrate results and initial July 2009 GDT filtrate results are provided on Table 1
  - Ratios of July/January results are at bottom of Table 1
    - TSS, Pb and Hg mostly compared within 1 order of magnitude
  - Me-Hg was mostly higher in the July 2009 filtrate versus the January 2009 filtrate
    - As indicated above, GDT 1, 6, and 9 were freshly prepared and were not as elevated in Me-Hg
  - July 2009 samples should represent more challenging conditions for treating Me-Hg

- All the sample results were pooled and plotted vs TSS (Tables 2A and 2B)
  - Table 2A quantified NDs as one-half the detection limit (DL)
  - Table 2B removed NDs from the analysis

  - A strong correlation is evident between TSS vs Pb, Hg, and Me-Hg
    - TSS vs Pb with R^2 of 0.84 to 0.93
    - TSS vs Hg with R^2 of 0.86 to 0.83
    - TSS vs Me-Hg with R^2 of 0.89 to 0.85

  - Plots can be used to estimate the TSS which must be achieved to correspond to lead and mercury water quality criteria
    - Achieving Hg WQC criterion of 50 ng/L will require removal of TSS to reach levels of 1-4 mg/L (these were determined by extrapolation and are below the TSS detection level of 4 mg/L)
    - Achieving Pb WQC criterion of 0.005 mg/L will require removal of TSS to reach levels of 2-7 mg/L

  - Note that a plot of Me-Hg vs Hg is also provided (again with NDs as one-half the DL and with NDs removed)
    - Me-Hg vs Hg had R^2 of 0.96 (both cases)

4. Results – Removal Rates

- Removal rates across each filter media are presented on Table 3; removal rates are calculated separately across each filter and cumulative across all preceding filters
  - All GDT filtrates achieved Hg < WQC criterion of 50 ng/L after the 0.1-um filter and 0.1-um filter plus carbon
  - Four of the GDT filtrates achieved Hg < WQC criterion of 50 ng/L after the 0.45-um filter
  - Most of the GDT filtrates achieved Pb below the DL of 0.015 mg/L after the 0.45-um filter; DL is above the WQC criterion of 0.005 mg/L

- Table 4 presents a summary of the separate and cumulative removals using the average results from all of the nine GDT filtrates
    - Each of the filter media contributed significantly to the overall cumulative removals of TSS, Pb, Hg, and Me-Hg
    - The carbon columns also contributed to Pb and Hg removals, but to a lesser extent than the filters
    - In general, the tests suggest that filtration across 0.1-um media should be able to achieve Pb and Hg WQCs without using activated carbon

Table 1 - January 2009 and July 2009 Initial GDT Filtrate Results
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

January 2009 GDT Filtrate Results

GDT	TSS	Pb	Hg	Me-Hg
	mg/L	mg/L	ng/L	ng/L
1	440	0.172	79806.4	2.13
6	810	0.217	168474	1.88
9	10	<0.015	960.9	0.62
2	1020	0.651	214613.9	3.15
4	25	0.028	12464.8	1.44
7	10	<0.015	2209.7	0.52
3	10200	0.949	1513105.3	3.11
5	350	0.249	66712.3	1.91
8	18	0.017	4843.9	1.02

July 2009 GDT Filtrate Results (Prior to Filtration)

GDT	TSS	Pb	Hg	Me-Hg
	mg/L	mg/L	ng/L	ng/L
1	328	0.139	16972.4	13.96
6	40	0.031	2132.1	2.96
9	184	0.078	9377.6	14.9
2	8580	4.32	524323.8	1156.63
4	400	0.164	23450.7	23.4
7	1660	0.592	169505.7	131.63
3	1860	4.32	105110.5	210.73
5	1160	0.823	43671.8	71.34
8	272	0.108	10952.8	15.04

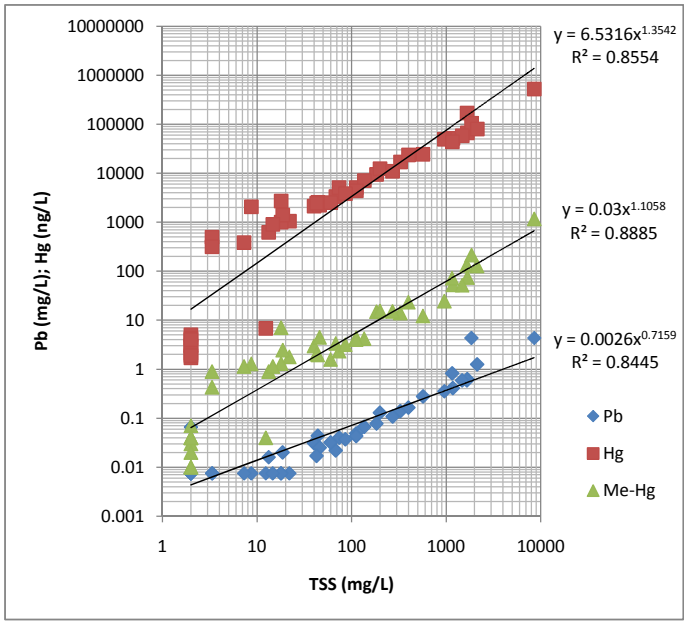
Ratio of July 2009/January 2009 Results

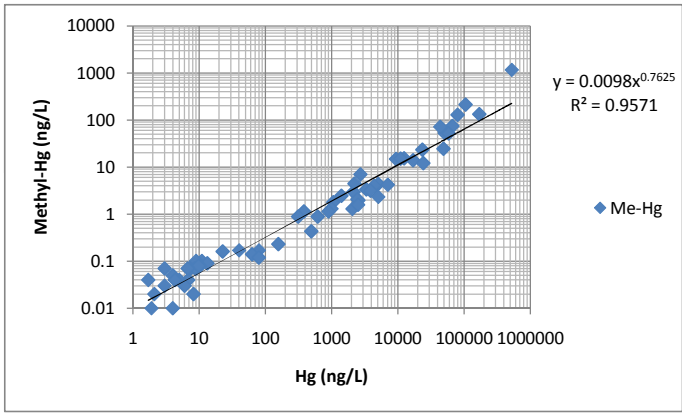
GDT	TSS	Pb	Hg	Me-Hg
1	0.75	0.81	0.21	6.55
6	0.05	0.14	0.01	1.57
9	18.40	>5.2	9.76	24.03
2	8.41	6.64	2.44	367.18
4	16.00	5.86	1.88	16.25
7	166.00	>39.46	76.71	253.13
3	0.18	4.55	0.07	67.76
5	3.31	3.31	0.65	37.35
8	15.11	6.35	2.26	14.75

Notes:
Ratio <0.1 or >10 (outside 1 order of magnitude)
GDT composition and polymer:
High solids primarily sediment (80% sed:20% peat; 28.3% initial solids to simulate mechanical dredging):
GDT 1 - No polymer
GDT 6 - 500 ppm Hyperfloc CE824
GDT 9 - 5 ppm Nalmet 1689; 300 ppm Hyperfloc CP757 & 150 ppm Nalclear 7763
Note that the above GDTs were re-run to obtain adequate filtrate volume for this testing
Low solids primarily sediment (80% sed:20% peat; 9.7% initial solids to simulate hydraulic dredging):
GDT 2 - No polymer
GDT 4 - 300 ppm Hyperfloc CE803
GDT 7 - 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763
Low solids primarily peat (50% sed:50% peat; 9.2% initial solids to simulate hydraulic dredging):
GDT 3 - No polymer
GDT 5 - 350 ppm Hyperfloc CE803
GDT 8 - 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763

Table 2A - Correlation of July 2009 GDT Filtrates - Results and Plots (ND = DL/2)
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

	Filter	TSS mg/L	Pb mg/L	Low Level Hg ng/L	Me-Hg ng/L
High Solids Primarily Sediment					
GDT 1	Initial	328	0.139	16972.4	13.96
	< 5um	112	0.049	5058.7	4.37
	<1um	44	0.044	2542.5	1.96
	<1um Post Carbon	8.7	0.0075	2057.7	1.29
	<0.45um		0.0075	79.8	0.17
	<0.1um		0.0075	9	0.07
	<0.1um Post Carbon	12.4	0.0075	6.8	0.04
GDT 6	Initial	40	0.031	2132.1	2.96
	< 5um	22	0.0075	1055.1	1.79
	<1um	18	0.0075	995.1	1.3
	<1um Post Carbon	13.3	0.016	617.7	0.89
	<0.45um		0.0075	62.6	0.14
	<0.1um		0.0075	11	0.1
	<0.1um Post Carbon	2	0.066	3	0.07
GDT 9	Initial	184	0.078	9377.6	14.9
	< 5um	46	0.025	2211.3	4.43
	<1um	18.7	0.02	1404.1	2.46
	<1um Post Carbon	7.3	0.0075	380.8	1.14
	<0.45um		0.0075	40.1	0.17
	<0.1um		0.0075	7.4	0.07
	<0.1um Post Carbon	2	0.0075	1.7	0.04
Low Solids Primarily Sediment					
GDT 2	Initial	8580	4.32	524324	1156.63
	< 5um	1680	0.626	66384.5	74.28
	<1um	1180	0.41	51151.1	52.61
	<1um Post Carbon	570	0.278	24242.4	12.11
	<0.45um		0.0075	156.8	0.23
	<0.1um		0.0075	9	0.1
	<0.1um Post Carbon	2	0.0075	5	0.04
GDT 4	Initial	400	0.164	23450.7	23.4
	< 5um	68	0.022	3336.1	3.33
	<1um	42.7	0.017	2448.8	2.05
	<1um Post Carbon	3.35	0.0075	490.7	0.43
	<0.45um		0.0075	13.3	0.09
	<0.1um		0.0075	8.2	0.02
	<0.1um Post Carbon	2	0.0075	3	0.03
GDT 7	Initial	1660	0.592	169506	131.63
	< 5um	18	0.0075	2716.4	6.98
	<1um	14.7	0.0075	900.9	1.14
	<1um Post Carbon	3.35	0.0075	313.5	0.89
	<0.45um		0.0075	6	0.03
	<0.1um		0.0075	4	0.05
	<0.1um Post Carbon	2	0.0075	2.1	0.02
Low Solids Primarily Peat					
GDT 3	Initial	1860	4.32	105111	210.73
	< 5um	2130	1.25	79579.5	127.97
	<1um	1480	0.591	58254.6	51.48
	<1um Post Carbon	960	0.352	48888.8	24.51
	<0.45um		0.0075	79.3	0.12
	<0.1um		0.0075	8.7	0.07
	<0.1um Post Carbon	2	0.0075	1.9	0.01
GDT 5	Initial	1160	0.823	43671.8	71.34
	< 5um	200	0.129	12356	15.27
	<1um	136	0.067	7046.1	4.2
	<1um Post Carbon	74	0.04	5068.9	2.32
	<0.45um		0.0075	22.5	0.16
	<0.1um		0.0075	10.3	0.08
	<0.1um Post Carbon	2	0.0075	4.3	0.04
GDT 8	Initial	272	0.108	10952.8	15.04
	< 5um	112	0.043	4380.3	4.01
	<1um	86	0.037	3840.2	3.15
	<1um Post Carbon	60	0.032	2489.1	1.58
	<0.45um		0.0075	9.8	0.08
	<0.1um		0.0075	6.7	0.07
	<0.1um Post Carbon	2	0.0075	4	0.01





Notes:

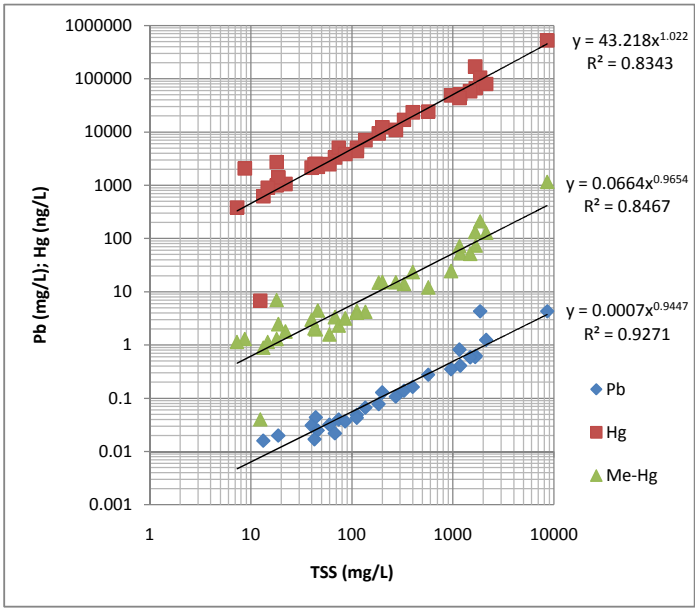
High Solids Primarily Sediment (80% sed : 20% peat; 28.3% initial solids):
GDT 1 - No polymer
GDT 6 - 500 ppm Hyperfloc CE824
GDT 9 - 5 ppm Nalmet 1689; 300 ppm Hyperfloc CP757 & 150 ppm Nalclear 7763

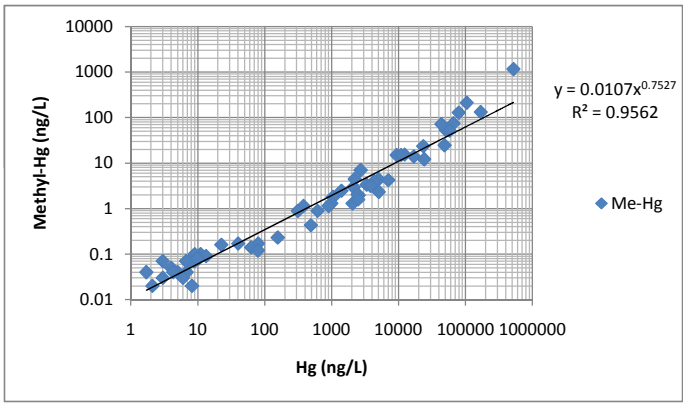
Low Solids Primarily Sediment (80% sed : 20% peat; 9.7% initial solids):
GDT 2 - No polymer
GDT 4 - 300 ppm Hyperfloc CE803
GDT 7 - 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763

Low Solids Primarily Peat (50% sed : 50% peat; 9.2% initial solids):
GDT 3 - No polymer
GDT 5 - 350 ppm Hyperfloc CE803
GDT 8 - 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763

Table 2B - Correlation of July 2009 GDT Filtrates - Results and Plots (NDs Removed)
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

	Filter	TSS mg/L	Pb mg/L	Low Level Hg ng/L	Me-Hg ng/L
High Solids Primarily Sediment					
GDT 1	Initial	328	0.139	16972.4	13.96
	< 5um	112	0.049	5058.7	4.37
	<1um	44	0.044	2542.5	1.96
	<1um Post Carbon	8.7		2057.7	1.29
	<0.45um			79.8	0.17
	<0.1um			9	0.07
	<0.1um Post Carbon	12.4		6.8	0.04
GDT 6	Initial	40	0.031	2132.1	2.96
	< 5um	22		1055.1	1.79
	<1um	18		995.1	1.3
	<1um Post Carbon	13.3	0.016	617.7	0.89
	<0.45um			62.6	0.14
	<0.1um			11	0.1
	<0.1um Post Carbon		0.066	3	0.07
GDT 9	Initial	184	0.078	9377.6	14.9
	< 5um	46	0.025	2211.3	4.43
	<1um	18.7	0.02	1404.1	2.46
	<1um Post Carbon	7.3		380.8	1.14
	<0.45um			40.1	0.17
	<0.1um			7.4	0.07
	<0.1um Post Carbon			1.7	0.04
Low Solids Primarily Sediment					
GDT 2	Initial	8580	4.32	524324	1156.63
	< 5um	1680	0.626	66384.5	74.28
	<1um	1180	0.41	51151.1	52.61
	<1um Post Carbon	570	0.278	24242.4	12.11
	<0.45um			156.8	0.23
	<0.1um			9	0.1
	<0.1um Post Carbon			5	0.04
GDT 4	Initial	400	0.164	23450.7	23.4
	< 5um	68	0.022	3336.1	3.33
	<1um	42.7	0.017	2448.8	2.05
	<1um Post Carbon			490.7	0.43
	<0.45um			13.3	0.09
	<0.1um			8.2	0.02
	<0.1um Post Carbon			3	0.03
GDT 7	Initial	1660	0.592	169506	131.63
	< 5um	18		2716.4	6.98
	<1um	14.7		900.9	1.14
	<1um Post Carbon			313.5	0.89
	<0.45um			6	0.03
	<0.1um			4	0.05
	<0.1um Post Carbon			2.1	0.02
Low Solids Primarily Peat					
GDT 3	Initial	1860	4.32	105111	210.73
	< 5um	2130	1.25	79579.5	127.97
	<1um	1480	0.591	58254.6	51.48
	<1um Post Carbon	960	0.352	48888.8	24.51
	<0.45um			79.3	0.12
	<0.1um			8.7	0.07
	<0.1um Post Carbon			1.9	
GDT 5	Initial	1160	0.823	43671.8	71.34
	< 5um	200	0.129	12356	15.27
	<1um	136	0.067	7046.1	4.2
	<1um Post Carbon	74	0.04	5068.9	2.32
	<0.45um			22.5	0.16
	<0.1um			10.3	0.08
	<0.1um Post Carbon			4.3	0.04
GDT 8	Initial	272	0.108	10952.8	15.04
	< 5um	112	0.043	4380.3	4.01
	<1um	86	0.037	3840.2	3.15
	<1um Post Carbon	60	0.032	2489.1	1.58
	<0.45um			9.8	0.08
	<0.1um			6.7	0.07
	<0.1um Post Carbon			4	





Notes:
High Solids Primarily Sediment (80% sed : 20% peat; 28.3% initial solids):
GDT 1 - No polymer
GDT 6 - 500 ppm Hyperfloc CE824
GDT 9 - 5 ppm Nalmet 1689; 300 ppm Hyperfloc CP757 & 150 ppm Nalclear 7763
Low Solids Primarily Sediment (80% sed : 20% peat; 9.7% initial solids):
GDT 2 - No polymer
GDT 4 - 300 ppm Hyperfloc CE803
GDT 7 - 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763
Low Solids Primarily Peat (50% sed : 50% peat; 9.2% initial solids):
GDT 3 - No polymer
GDT 5 - 350 ppm Hyperfloc CE803
GDT 8 - 5 ppm Nalmet 1689; 50 ppm Hyperfloc CP626; & 10 ppm Nalclear 7763

Table 3 - Removal Rates Across Each Filter (ND = DL/2)
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

	Sample ID	TSS mg/L	Pb mg/L	Hg ng/L	Me-Hg ng/L	Filt um	Removal Rate Across 1 Filter (%) TSS	Pb	Hg	Me-Hg	Cum. Removal Rate (All Filters; %) TSS	Pb	Hg	Me-Hg
High Solids Primarily Sediment														
GDT 1	Initial	328	0.139	16972.4	13.96									
	< 5um	112	0.049	5058.7	4.37	5	65.9%	64.7%	70.2%	68.7%	65.9%	64.7%	70.2%	68.7%
	<1um	44	0.044	2542.5	1.96	1	60.7%	10.2%	49.7%	55.1%	86.6%	68.3%	85.0%	86.0%
	<1um Post Carbon	8.7	0.0075	2057.7	1.29	1 + C	80.2%	83.0%	19.1%	34.2%	97.3%	94.6%	87.9%	90.8%
	<0.45um		0.0075	79.8	0.17	0.45		83.0%	96.9%	91.3%		94.6%	99.5%	98.8%
	<0.1um		0.0075	9	0.07	0.1		0.0%	88.7%	58.8%		94.6%	99.9%	99.5%
	<0.1um Post Carbon	12.4	0.0075	6.8	0.04	0.1 + C		0.0%	91.5%	76.5%	96.2%	94.6%	100.0%	99.7%
GDT 6	Initial	40	0.031	2132.1	2.96									
	< 5um	22	0.0075	1055.1	1.79	5	45.0%	75.8%	50.5%	39.5%	45.0%	75.8%	50.5%	39.5%
	<1um	18	0.0075	995.1	1.3	1	18.2%	0.0%	5.7%	27.4%	55.0%	75.8%	53.3%	56.1%
	<1um Post Carbon	13.3	0.016	617.7	0.89	1 + C	26.1%	-113.3%	37.9%	31.5%	66.8%	48.4%	71.0%	69.9%
	<0.45um		0.0075	62.6	0.14	0.45		0.0%	93.7%	89.2%		75.8%	97.1%	95.3%
	<0.1um		0.0075	11	0.1	0.1		0.0%	82.4%	28.6%		75.8%	99.5%	96.6%
	<0.1um Post Carbon	2	0.066	3	0.07	0.1 + C		-780.0%	95.2%	50.0%	95.0%	-112.9%	99.9%	97.6%
GDT 9	Initial	184	0.078	9377.6	14.9									
	< 5um	46	0.025	2211.3	4.43	5	75.0%	67.9%	76.4%	70.3%	75.0%	67.9%	76.4%	70.3%
	<1um	18.7	0.02	1404.1	2.46	1	59.3%	20.0%	36.5%	44.5%	89.8%	74.4%	85.0%	83.5%
	<1um Post Carbon	7.3	0.0075	380.8	1.14	1 + C	61.0%	62.5%	72.9%	53.7%	96.0%	90.4%	95.9%	92.3%
	<0.45um		0.0075	40.1	0.17	0.45		62.5%	97.1%	93.1%		90.4%	99.6%	98.9%
	<0.1um		0.0075	7.4	0.07	0.1		0.0%	81.5%	58.8%		90.4%	99.9%	99.5%
	<0.1um Post Carbon	2	0.0075	1.7	0.04	0.1 + C		0.0%	95.8%	76.5%	98.9%	90.4%	100.0%	99.7%
Low Solids Primarily Sediment														
GDT 2	Initial	8580	4.32	524324	1156.63									
	< 5um	1680	0.626	66384.5	74.28	5	80.4%	85.5%	87.3%	93.6%	80.4%	85.5%	87.3%	93.6%
	<1um	1180	0.41	51151.1	52.61	1	29.8%	34.5%	22.9%	29.2%	86.2%	90.5%	90.2%	95.5%
	<1um Post Carbon	570	0.278	24242.4	12.11	1 + C	51.7%	32.2%	52.6%	77.0%	93.4%	93.6%	95.4%	99.0%
	<0.45um		0.0075	156.8	0.23	0.45		98.2%	99.7%	99.6%		99.8%	100.0%	100.0%
	<0.1um		0.0075	9	0.1	0.1		0.0%	94.3%	56.5%		99.8%	100.0%	100.0%
	<0.1um Post Carbon	2	0.0075	5	0.04	0.1 + C		0.0%	96.8%	82.6%	100.0%	99.8%	100.0%	100.0%
GDT 4	Initial	400	0.164	23450.7	23.4									
	< 5um	68	0.022	3336.1	3.33	5	83.0%	86.6%	85.8%	85.8%	83.0%	86.6%	85.8%	85.8%
	<1um	42.7	0.017	2448.8	2.05	1	37.2%	22.7%	26.6%	38.4%	89.3%	89.6%	89.6%	91.2%
	<1um Post Carbon	3.35	0.0075	490.7	0.43	1 + C	92.2%	55.9%	80.0%	79.0%	99.2%	95.4%	97.9%	98.2%
	<0.45um		0.0075	13.3	0.09	0.45		55.9%	99.5%	95.6%		95.4%	99.9%	99.6%
	<0.1um		0.0075	8.2	0.02	0.1		0.0%	38.3%	77.8%		95.4%	100.0%	99.9%
	<0.1um Post Carbon	2	0.0075	3	0.03	0.1 + C		0.0%	77.4%	66.7%	99.5%	95.4%	100.0%	99.9%
GDT 7	Initial	1660	0.592	169506	131.63									
	< 5um	18	0.0075	2716.4	6.98	5	98.9%	98.7%	98.4%	94.7%	98.9%	98.7%	98.4%	94.7%
	<1um	14.7	0.0075	900.9	1.14	1	18.3%	0.0%	66.8%	83.7%	99.1%	98.7%	99.5%	99.1%
	<1um Post Carbon	3.35	0.0075	313.5	0.89	1 + C	77.2%	0.0%	65.2%	21.9%	99.8%	98.7%	99.8%	99.3%
	<0.45um		0.0075	6	0.03	0.45		0.0%	99.3%	97.4%		98.7%	100.0%	100.0%
	<0.1um		0.0075	4	0.05	0.1		0.0%	33.3%	-66.7%		98.7%	100.0%	100.0%
	<0.1um Post Carbon	2	0.0075	2.1	0.02	0.1 + C		0.0%	65.0%	33.3%	99.9%	98.7%	100.0%	100.0%
Low Solids Primarily Peat														
GDT 3	Initial	1860	4.32	105111	210.73									
	< 5um	2130	1.25	79579.5	127.97	5	-14.5%	71.1%	24.3%	39.3%	-14.5%	71.1%	24.3%	39.3%
	<1um	1480	0.591	58254.6	51.48	1	30.5%	52.7%	26.8%	59.8%	20.4%	86.3%	44.6%	75.6%
	<1um Post Carbon	960	0.352	48888.8	24.51	1 + C	35.1%	40.4%	16.1%	52.4%	48.4%	91.9%	53.5%	88.4%
	<0.45um		0.0075	79.3	0.12	0.45		98.7%	99.9%	99.8%		99.8%	99.9%	99.9%
	<0.1um		0.0075	8.7	0.07	0.1		0.0%	89.0%	41.7%		99.8%	100.0%	100.0%
	<0.1um Post Carbon	2	0.0075	1.9	0.01	0.1 + C		0.0%	97.6%	91.7%	99.9%	99.8%	100.0%	100.0%
GDT 5	Initial	1160	0.823	43671.8	71.34									
	< 5um	200	0.129	12356	15.27	5	82.8%	84.3%	71.7%	78.6%	82.8%	84.3%	71.7%	78.6%
	<1um	136	0.067	7046.1	4.2	1	32.0%	48.1%	43.0%	72.5%	88.3%	91.9%	83.9%	94.1%
	<1um Post Carbon	74	0.04	5068.9	2.32	1 + C	45.6%	40.3%	28.1%	44.8%	93.6%	95.1%	88.4%	96.7%
	<0.45um		0.0075	22.5	0.16	0.45		88.8%	99.7%	96.2%		99.1%	99.9%	99.8%
	<0.1um		0.0075	10.3	0.08	0.1		0.0%	54.2%	50.0%		99.1%	100.0%	99.9%
	<0.1um Post Carbon	2	0.0075	4.3	0.04	0.1 + C		0.0%	80.9%	75.0%	99.8%	99.1%	100.0%	99.9%
GDT 8	Initial	272	0.108	10952.8	15.04									
	< 5um	112	0.043	4380.3	4.01	5	58.8%	60.2%	60.0%	73.3%	58.8%	60.2%	60.0%	73.3%
	<1um	86	0.037	3840.2	3.15	1	23.2%	14.0%	12.3%	21.4%	68.4%	65.7%	64.9%	79.1%
	<1um Post Carbon	60	0.032	2489.1	1.58	1 + C	30.2%	13.5%	35.2%	49.8%	77.9%	70.4%	77.3%	89.5%
	<0.45um		0.0075	9.8	0.08	0.45		79.7%	99.7%	97.5%		93.1%	99.9%	99.5%
	<0.1um		0.0075	6.7	0.07	0.1		0.0%	31.6%	12.5%		93.1%	99.9%	99.5%
	<0.1um Post Carbon	2	0.0075	4	0.01	0.1 + C		0.0%	59.2%	87.5%	99.3%	93.1%	100.0%	99.9%

Note:
Filtrate samples with total Hg < WQC criterion of 50 ng/L and Pb < DL

Table 4 - Removal Rates Using Average Results from All Filtrates (GDT 1 to 9)
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

4A - Average of GDT 1 to 9

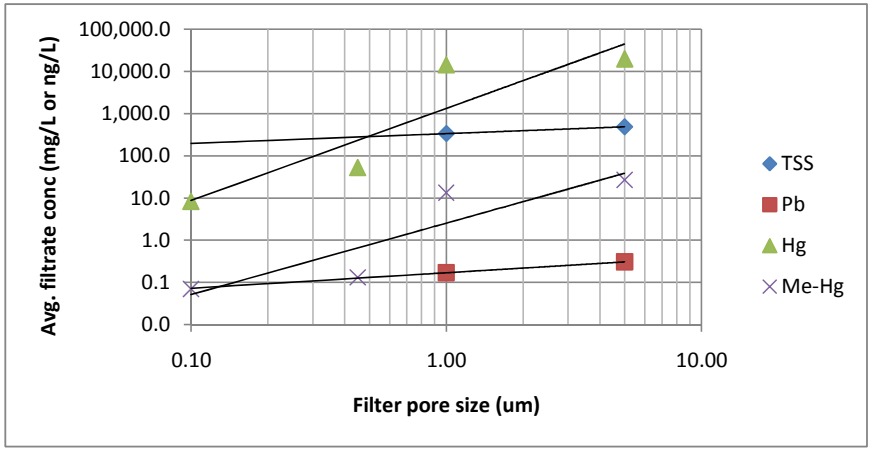
	mm	TSS	Pb	Hg	Me-Hg
		mg/L	mg/L	ng/L	ng/L
Initial	100	1,609.3	1.175	100,611	182.3
< 5um	5.00	487.6	0.306	19,675	26.9
<1um	1.00	335.6	0.169	14,287	13.4
<0.45um	0.45			52.2	0.132
<0.1um	0.1			8.3	0.070
<1um Post Carbon	1.00	241.9	0.144	9,394	5.0
<0.1um Post Carbon	0.1	12.4	0.066	3.5	0.040

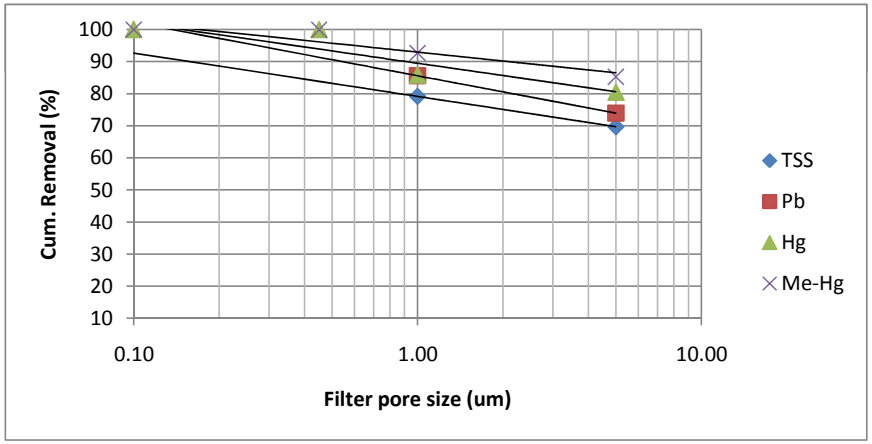
4B - Average Removal Rate Across 1 Filter

	mm	TSS	Pb	Hg	Me-Hg
		% Remov.	% Remov.	% Remov.	% Remov.
< 5um	5.00	69.7	73.9	80.4	85.2
<1um	1.00	31.2	44.7	27.4	50.4
<0.45um	0.45			99.6	99.0
<0.1um	0.1			84.2	47.1
<1um Post Carbon	1.00	27.9	15.2	34.2	62.5
<0.1um Post Carbon	0.1			57.2	42.9

4C - Cumulative Remov. Rate across all filters

	mm	TSS	Pb	Hg	Me-Hg
		Cum.	Cum.	Cum.	Cum.
		% Remov.	% Remov.	% Remov.	% Remov.
< 5um	5.00	69.70	73.93	80.44	85.22
<1um	1.00	79.15	85.58	85.80	92.66
<0.45um	0.45			99.95	99.93
<0.1um	0.1			99.99	99.96
<1um Post Carbon	1.00	84.97	87.78	90.66	97.25
<0.1um Post Carbon	0.1	99.23	94.38	100.00	99.98





Assessing Resuspension Impacts to the Water Column – Scope of Work
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

Treatability testing was conducted previously by Waste Stream Technologies (WST) on sediment/peat materials and site water collected from Acid Brook Delta (ABD) in November 2008. Those tests evaluated the effectiveness of gravity drainage and geotube filtration and compared the use of various polymers for dewatering. The elutriation tests performed as part of those studies evaluated the levels of suspended and dissolved solids that may remain in waters after settling or dewatering. Specific results from the previous dredge elutriate test (DRET) showed a high amount of total suspended solids (TSS) (740 - 840 mg/L) and mercury (Hg) (134,000 - 139,000 ng/L) in the supernatant for both the primarily sediment (80% sediment and 20% peat) and primarily peat (50% sediment and 50% peat) simulations after a 1-hour settling time. After subsequent evaluation and discussion, it was determined that additional testing could promote further understanding of the proposed remedial techniques and reduce potential uncertainties during remedy design.

The purpose of this additional testing is to obtain information on the settling time of resuspended solids and the potential distribution of solids and contaminants to the water column both after dredging and as a result of subsequent cover placement. It is intended that these tests will provide insight as to the amount of time necessary for the water column to attain acceptable conditions prior to the removal of silt containment and/or placement of a cover. During application of cover material for sediments remaining in ABD it is anticipated that some fraction of sediment solids may resuspend when disturbed by the placement of cover materials. In addition, some fraction of cover material fines will be suspended in the water column as a result of placement. Some of the suspended solids and associated contaminants may then redeposit on top of the cover material, others could remain suspended in the water column for an extended period of time and may require treatment for removal from the water column.

These additional treatability tests will estimate potential sediment disturbance that may occur during various cover placement methods along with an assessment of settling time for resuspended dredge and cover materials. These data are necessary for evaluating the remedial approach and equipment selection during the remedial design. The objectives of the treatability testing are as follows:

- Determine the settling time requirements for redeposition of solids dispersed in the water column as a result of dredging;
- Provide data for use in the evaluation of water treatment requirements that may be required for the isolated water column after dredging;
- Compare potential methods of cover material placement with respect to the expected amount of sediment contaminant disturbance;
- Determine the amount of solids and metals contaminants that might be disturbed from dredged sediment surfaces when cover materials are applied;
- Determine the amount of cover material fine solids that become suspended in the water column when cover materials are applied; and
- Evaluate findings in comparison to results from the previous treatability studies.

To achieve these objectives, additional sediment and water treatability testing are proposed to include the following:

- Preparation of new mixtures of sediments and peat similar to those described as "primarily sediment" in the previous treatability tests by WST and testing of the site water composite sample (Subtask 1);
- Performance of extended DRET to evaluate settling time of resuspended materials (Subtask 2);
- Preparation of test columns to allow simulations of sediment disturbance during placement of cover materials (Subtask 3); and
- Simulations of placement of cover materials and sampling and testing of overlying water columns (Subtask 4).

The remainder of this scope of work provides additional details on Subtasks 1 and 2; the scope for Subtasks 3 and 4 will be provided under separate cover once results from the first two tasks are evaluated.

Subtask 1 - Sediment Sample Preparation and Initial Testing

Representative sediment, peat, and water samples were collected by ARCADIS and delivered to WST in Buffalo, New York in November 2008 for treatability testing, which was completed by January 2009. Additionally ten gallons of primarily-sediment composite (P-Sed) was used for filtration testing described in ARCADIS' treatability scope of work dated March 11, 2009. It is estimated that WST has about 230 gallons of water, 85 gallons of sediment, and about 30 gallons of peat remaining. Of the formerly-prepared sediment and peat composites, there remains about 5 gallons of each.

P-Sed consists of mixing 80% sediment and 20% peat by volume. WST will prepare five liters of P-Sed by mixing four liters of sediment and one liter of peat. The composite samples will be used to perform the testing outlined under Subtask 2. Primarily-peat composite (P-Peat) was tested in the previous DRET test and results were similar to those for P-Sed. In addition, it is anticipated that dredged material will be more similar to P-Sed than P-Peat. Therefore, these extended DRET tests will use only P-Sed simulations.

Samples of P-Sed and P-Peat were previously submitted for analytical testing of physical properties and analytical chemistry during the November 2008 studies. The composite P-Sed sample will be analyzed by WST for:

- pH (probe measurement)
- TOC (EPA 9060)
- Water content (ASTM D2216)
- Metals: mercury, barium, selenium, zinc, lead, and copper (SW-846 Method 6010B/7471A)
- Visual observations

An untreated site water sample will be analyzed by WST for:

- TSS (USEPA 160.2)
- Turbidity (USEPA 180.1)
- TOC (EPA 415.1/415.2)
- Field pH (probe measurement)
- Field DO (probe measurement)

- Filtered and unfiltered metals: barium, selenium, zinc, lead, and copper (USEPA Method 6010B), and low-level mercury (USEPA Method 1631)
- Visual observations

Subtask 2 - Extended Dredge Elutriate Tests

Dredging Elutriate Tests (DRETs) will be performed in 4-liter cylinders using procedures described in USACE, 1995 (*Dredging Elutriate Test (DRET) Development; Contract Report D-95-1* by F.A. DiGiano, C.T. Miller and J. Yoon). WST will create an initial slurry with suspended solids at a concentration of 10 g/L to conduct the DRET; WST will send 1 gallon (approximately 4 liters) of this initial slurry to the DuPont Experimental Station for centrifuge testing discussed in detail later on (address: DuPont Experimental Station E304/B152D, Route 141 & Henry Clay, Wilmington, DE 19803 – Attention: J.G. Wood/A.S. Trasatti).

Samples for the DRET will be mixed mechanically for 1 hour (rather than aerated) at no greater than 90 revolutions per minute. Instead of a settling time of 1 hour, the test will be extended to collect additional data and settled supernatant samples at times of 12 hours, and 1, 2, 4, 8, 16 and/or 32 days (test may be stopped after 16 days based on initial results and other testing). A test volume of 4-liters will be required in order to have sufficient volume to perform the required analyses. The cylinder should be maintained in a temperature controlled environment and covered for the longer settling tests to mitigate water loss via evaporation.

DRET results provide an estimate of elutriation at an initial slurry suspended solids concentration of 10 g/L to estimate potential disturbance in the vicinity of dredging operations. Following settling over each of the prescribed timeframes, supernatant volume will be measured and samples will be removed for testing. Figure 1 summarizes the sampling/testing process. All supernatant samples (i.e., after settling times of times of 12 hours, and 1, 2, 4, 8, 16 and/or 32 days) will be monitored/tested at WST for:

- Visual observations
- Field pH (probe measurement)
- Field DO (probe measurement)
- Turbidity (as described above; USEPA 180.1)

Supernatants will also be sampled after settling times of 12 hours, and 2, 8, and 16 or 32 days along with one duplicate sample from one of the settling times (4 supernatant samples and one duplicate; total of 5 samples), for the following additional analysis at WST and CEBAM Analytical, Inc. (Seattle, Washington; CEBAM) (specific laboratory for testing indicated below in brackets):

- Unfiltered metals: barium, selenium, zinc lead, copper (USEPA Method 6010B) [WST], and total low-level mercury (USEPA 1631) [CEBAM]
- TSS analysis through a 0.45-um filter (USEPA 160.2) [WST]

Supernatant samples collected after settling times of 12 hours, and 2, 8, and 16 or 32 days will then be sequentially filtered by WST through filters of pore sizes of 1-um, 0.45 um, and 0.1 um. A portion of each filtrate will be retained for testing (as shown on Figure 1), while the remainder of filtrate will be processed through the next finer filter. The following analytical testing will be performed at WST and

CEBAM (specific laboratory for testing indicated below in brackets) on each filtered supernatant (i.e., 12 tests):

- Visual observations [WST]
- Unfiltered metals: barium, selenium, zinc, lead, and copper (USEPA Method 6010B) [WST], and low-level mercury (USEPA Method 1631) [CEBAM]

All remaining samples will be retained by WST for potential future analysis.

Concurrent with the DRET testing at WST, centrifugation will be conducted at the DuPont Experimental Station. The purpose of the centrifugation is to simulate a settled supernatant that could be achieved following a long settling period (i.e., represents the best that could be achieved through extended settling). The initial slurry provided by WST will be tested for the following (specific laboratory for testing indicated below in brackets):

- TSS (USEPA 160.2) [DuPont]
- Turbidity (USEPA 180.1) [DuPont]
- Particle size distribution by laser light scattering using a Malvern Mastersizer [DuPont]
- Unfiltered metals: barium, selenium, zinc, lead, and copper (USEPA Method 6010B) [WST], and low-level mercury (USEPA Method 1631) [CEBAM]

This slurry will then be centrifuged at approximately 6000xG in a Sorvall Super T21 fixed angle centrifuge (with temperature control) for up to 10 minutes at 21 degrees Celsius. A centrifuge spin test control will be conducted prior to centrifuging the slurry using water from a Barnstead EASYpure LF water purifier system (equivalent to Type I reagent grade water) or equivalent to demonstrate that the equipment is "clean" prior to testing with site water/P-Sed. The centrate and samples from spin test control will be analyzed at DuPont, WST, and CEBAM (specific laboratory for testing indicated below in brackets) for:

- Visual observations [DuPont]
- TSS (USEPA 160.2) [DuPont]
- Turbidity (USEPA 180.1) [DuPont]
- Particle size distribution by laser light scattering using a Malvern Mastersizer [DuPont]
- Unfiltered metals: barium, selenium, zinc, lead, and copper (USEPA Method 6010B) [WST], and low-level mercury (USEPA Method 1631) [CEBAM]

The samples to be tested at WST or CEBAM will be sent to WST by the DuPont Experimental Station (address: Waste Stream Technology, 302 Grote Street, Buffalo, NY 14207 – Attention: N. O'Sullivan). WST will handle shipment of samples to CEBAM. Based on these results and comparisons to expected effluent target concentrations, the 16- and/or 32-day settling tests and filtration may be modified and/or eliminated.

WST will conduct Subtask 1, and Subtask 2 will be performed by WST, CEBAM, and DuPont as indicated above. Coordination with CEBAM will be performed by WST. Once WST has completed testing, ARCADIS will transport the sediment/peat back to DuPont for disposal. Table 1 summarizes the analytical testing to be performed as part of this scope of work.

All sample handling and treatability testing will be conducted with proper contamination controls in place. DuPont required sample ID nomenclature will be followed [POM-E-537-"x"; where x is a unique identifier (with <10 additional characters) established by the laboratory]. Electronic data deliverable packages will also be prepared.

Table 1
Extended DRET - Summary of Analytical Tests
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

	P-Sed
Sediment	
pH (probe measurement)	1
TOC (EPA 9060)	1
Water content (ASTM D2216)	1
Metals: mercury, barium, selenium, zinc, lead, and copper (SW-846 Method 6010B/7471A)	1

	Site Water	Initial Slurry	DRET	Filtered	Centrifuge	Totals
Water						
TSS (USEPA 160.2)	1	1	5		2	9
Turbidity (USEPA 180.1)	1	1	7		2	11
TOC (EPA 415.1/415.2)	1					1
Field pH (probe measurement)	1		7			8
Field DO (probe measurement)	1		7			8
Metals: barium, selenium, zinc, lead, and copper (USEPA Method 6010B)	1	1	5	12	2	21
Metals (filtered): barium, selenium, zinc, lead, and copper (USEPA Method 6010B)	1					1
Low-level mercury (USEPA Method 1631)	1	1	5	12	2	21
Low-level mercury (filtered) (USEPA Method 1631)	1					1
Particle size distribution		1			2	3

Figure 1
Extended DRET - Testing Overview and Flow Chart
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

Settling Time		Initial Testing			Unfiltered Samples			1 um			Filtered Samples 0.45 um			0.10 um	
		Turbidity	pH		WST	CEBAM		WST	CEBAM		WST	CEBAM		WST	CEBAM
12 Hour	----->	X	X	----->	Metals and TSS	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg
1 Day	----->	X	X												
2 Days	----->	X	X	----->	Metals and TSS	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg
4 Days	----->	X	X												
8 Days	----->	X	X	----->	Metals and TSS	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg
16 Days	----->	X	X												
32 Days	----->	X	X	----->	Metals and TSS	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg	----->	Filtration and Metals	LL Hg

Notes:
1. DRET to be conducted on P-Sed (80% sediment and 20% peat mixture) at 10 g/L mechanically stirred at 90 RPM for 1 hour.
2. All pre-filtered/unfiltered samples should be taken from the same large master batch, continually well-shaken between aliquots.
3. Filtered samples should be split, with WST and CEBAM receiving identical samples.

Initial Testing Results
Additional DRET Studies
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

P-SED

Sample ID:	POM-E-537-InitialPS
WST Sample ID:	9K02014-01
Units:	mg/kg
Barium	1210
Copper	58.5
Mercury	108
Lead	90.2
Selenium	<7.00
Zinc	355
TOC	3.68%

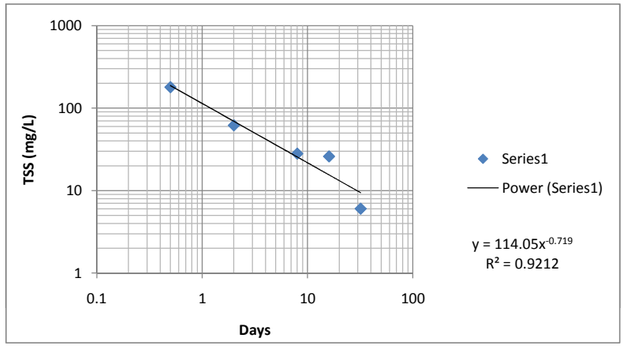
Site Water

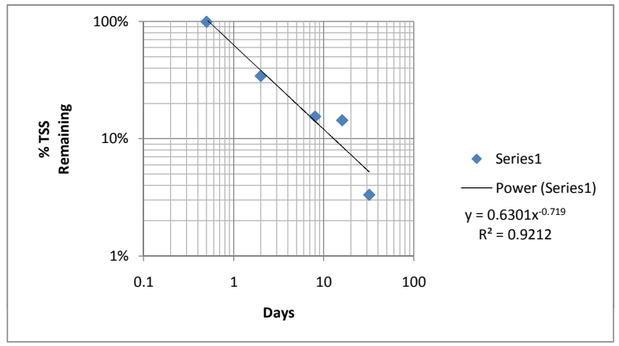
Sample ID:	POM-E-537-InitialSW	
WST Sample ID:	9K02014-02	
Units:	mg/L	
Barium	0.024	
Barium (Filtered)	0.052	
Copper	0.020	
Copper (Filtered)	<0.009	
Lead	<0.015	
Lead (Filtered)	<0.015	
Selenium	<0.019	
Selenium (Filtered)	<0.019	
Zinc	0.033	
Zinc (Filtered)	1.15	
TOC	3.5	
DO	10.2	
Turbidity	14.5	NTU
pH	7.05	
TSS	3.53	ppm

CEBAM Sample ID:	WST-0902-01
Units:	ng/L
Low Level Mercury	1369.7
Low Level Mercury (Filtered)	2.8

Extended DRET - Observations and Physical Results
Additional DRET Studies
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

Settling Time	DO (mg/L)	Turbidity (NTU)	pH	TSS (ppm)	Observations
Initial	10.2	14.5	7.05	3.53	Light brown, slightly cloudy water with some sediment.
12Hr	8.32	179	5.89	180	Sediment settles below 200mL mark and appears to be layered. Water is dark brown and cloudy.
1 Day	7.46	29.4	6.62	--	Sediment settles below 200mL mark and appears to be layered. Water is dark brown and cloudy.
2 Day	7.18	71.3	6.23	62	Sediment settles below 200mL mark and appears to be layered. Water is dark brown and cloudy, but becoming slightly more clear toward the top.
4 Day	7.23	26.2	6.37	--	Sediment settles below 200mL mark and appears to be layered. Water is dark brown and cloudy, but becoming slightly more clear toward the top.
8 Day	7.31	44.3	6.42	24	Sediment settles below 200mL mark and appears to be layered. Water is brown and cloudy, but becomes more clear toward the top.
8 Day Duplicate	7.51	41.1	6.53	32	
16 Day	8.56	31.9	6.61	26	Sediment settles below 200mL mark and appears to be layered. Water is cloudy, but lighter in color.
32 Day	9.21	17.9	6.68	6	Sediment settles below 200mL mark and appears to be layered. Water is fairly colorless and slightly cloudy.





Days	TSS	Predicted TSS
0.5	180	188
2	62	69
8	28	26
16	26	16
32	6	9

Days	181 TSS	% Remain	Predicted % Remain	181 Predicted TSS
0.5	180	99.45%	103.72%	188
2	62	34.25%	38.28%	69
8	28	15.47%	14.13%	26
16	26	14.36%	8.58%	16
32	6	3.31%	5.21%	9

Note:
1. Duplicate sample run during the 8 day settling time. The 8 day testing was performed in 2 cylinders, with the supernatant from each cylinder combined into a clean 5-gallon bucket prior to sampling and/or filtration.

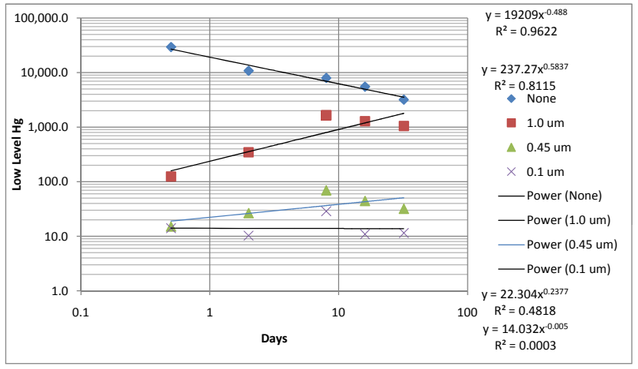
Extended DRET - Analytical Results
Additional DRET Studies
DuPont, Acid Brook Delta, Pompton Lakes, New Jersey

Settling Time:	Initial	12 hour				2 day				8 day								16 day				32 day				EB
Sample ID:	POM-E-537-InitialSW	POM-E-537-12Hr	POM-E-537-12Hr<1.0um	POM-E-537-12Hr<0.45um	POM-E-537-12Hr<0.1um	POM-E-537-2Day	POM-E-537-2Day<1.0um	POM-E-537-2Day<.45um	POM-E-537-2Day<.1um	POM-E-537-8Day	POM-E-537-8DayD	POM-E-537-8Day<1um	POM-E-537-8Day<1umD	POM-E-537-8Day<.45	POM-E-537-8Day<.45D	POM-E-537-8Day<.1	POM-E-537-8Day<.1D	POM-E-537-16Day	POM-E-537-16Day<1um	POM-E-537-16Day<.45	POM-E-537-16Day<.1	POM-E-537-32Day	POM-E-537-32Day<1um	POM-E-537-32Day<.45	POM-E-537-32Day<.1	POM-E-537-EB
Filtering:	None	None	1.0 um	0.45 um	0.1 um	None	1.0 um	0.45 um	0.1 um	None	None	1.0 um	1.0 um	0.45 um	0.45 um	0.1 um	0.1 um	None	1.0 um	0.45 um	0.1 um	None	1.0 um	0.45 um	0.1 um	None
WST Sample ID:	9K02014-02	9K04028-01	9K04028-02	9K04028-03	9K04028-04	9K06016-01	9K06016-02	9K06016-03	9K06016-04	9K10005-01	9K10005-02	9K10005-03	9K10005-04	9K10005-05	9K10005-06	9K10005-07	9K10005-08	9K10005-01	9K10005-02	9K10005-03	9K10005-04	9K10005-05	9K10005-06	9K10005-07	9K10005-08	--
Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
Barium	0.024	0.065	0.029	0.028	0.028	0.038	0.028	0.026	0.026	0.044	0.044	0.034	0.032	0.032	0.032	0.032	0.032	--	--	--	--	0.036	0.033	0.032	0.031	--
Barium (Filtered)	0.052	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	0.020	0.117	<0.009	<0.009	<0.009	0.044	0.021	0.013	0.013	0.065	0.064	0.023	0.22	0.015	0.015	0.015	0.015	--	--	--	--	0.038	0.025	0.019	0.018	--
Copper (Filtered)	<0.009	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	<0.015	0.113	<0.015	<0.015	<0.015	0.047	0.299	<0.015	<0.015	0.037	0.039	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	--	--	--	--	0.020	0.050	<0.015	<0.015	--
Lead (Filtered)	<0.015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	--	--	--	--	<0.019	<0.019	<0.019	<0.019	--
Selenium (Filtered)	<0.019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	0.033	0.056	<0.013	<0.013	<0.013	0.023	0.18	<0.013	<0.013	0.026	0.029	0.014	0.014	0.024	0.022	0.026	0.022	--	--	--	--	0.021	0.017	0.018	0.024	--
Zinc (Filtered)	1.15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOC	3.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CEBAM Sample ID:	WST-0902-01	WST-0902-02	WST-0902-03	WST-0902-04	WST-0902-05	WST-0902-06	WST-0902-07	WST-0902-08	WST-0902-09	WST-0902-11	WST-0902-12	WST-0902-13	WST-0902-14	WST-0902-15	WST-0902-16	WST-0902-17	WST-0902-18	WST-0903-01	WST-0903-02	WST-0900-03	WST-0903-04	WST-0903-05	WST-0903-06	WST-0903-07	WST-0903-08	WST-0903-09
Units:	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Low Level Mercury	1369.7	29536.5	124.8	15.1	14.1	10841.9	346.6	26.5	10.3	8218.1	7768.6	1624.4	1687.4	65.0	74.2	28.1	29.4	5526.7	1286.2	44.6	10.9	3193.6	1048.4	32.1	11.5	0.5
Low Level Mercury (Filtered)	2.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
1. Duplicate sample run during the 8 day settling time. The 8 day testing was performed in 2 cylinders, with the supernatant from each cylinder combined into a clean 5-gallon bucket prior to sampling and/or filtration. The duplicate sample is denoted with a "D" at the end of the Sample ID.
2. EB indicates equipment blank sample. Type 1 DI water ran through filtration vessel with 1um filter for Equipment Blank.

Low Level Mercury:

	Days	None ng/L	1.0 um ng/L	0.45 um ng/L	0.1 um ng/L
	0				
	0.5	29,536.5	124.8	15.1	14.1
	2	10,841.9	346.6	26.5	10.3
avg -->	8	7,993.4	1,655.9	69.6	28.8
	16	5,526.7	1,286.2	44.6	10.9
	32	3,193.6	1,048.4	32.1	11.5



Appendix I2

Spring 2010
Solidification/Stabilization
Testing

M E M O R A N D U M

November 18, 2010

To: Ed Seger; DuPont

From: Ted Schoenberg, Ph.D.; Parsons

Subject: Pompton Lakes Acid Brook Delta Sediment Solidification Study Results

EXECUTIVE SUMMARY

Parsons tested a number of solidification agents or combinations of agents on bottom lake sediment samples collected from Acid Brook Delta, Pompton Lakes, New Jersey. The primary objective of testing was to identify an optimum solidification process that passes acceptance criteria for acceptance at an approved landfill while allowing for safe and environmentally sound treatment, transport, and disposal. Testing was performed in accordance with the June10, 2010 work plan developed by Parsons, as modified in response to team discussions of interim test results. Testing was performed in the following phases:

- Sample Preparation and Initial Characterization
- Round 1 Solidification: Cup Testing on Composite Area Samples
- Round 2 Solidification: Larger-Scale Testing on Composite Area Samples
- Round 3 Solidification: Focused Testing on Subarea Samples

Sample Preparation and Initial Characterization

Parsons received three 3.5-gallon containers containing sediment core samples from each of 18 subareas, including four subareas each from Areas X, Y, Z, and P, along with one subarea each from Areas A and B. The three containers from each subarea were consolidated into a single discrete subarea sample (e.g., X-1). The following summarizes initial characterization results for the subarea samples, summarized by area:

Area Average ± Std Deviation	Moisture Content (%)	Organic Content (%)	Total Mercury (mg/kg)	Total Lead (mg/kg)	Percent Retained on No. 200 Sieve[(4)]
X	74 ± 4.5	10 ± 1.8	117 ± 108	573 ± 375	41 ± 20
Y	75 ± 3.2	11 ± 0.3	232 ± 120	641 ± 297	40 ± 9.0
Z	75 ± 2.9	11 ± 0.9	58 ± 45	260 ± 71	38 ± 22
P	73 ± 7.4	23 ± 8.7	172 ± 94	448 ± 278	73 ± 16
A	70	8%	9.77	207	6
B	76	12%	8.82	117	65

In the above table, moisture content is wet sediment basis; and organic content is dry sediment basis. Total mercury and lead concentrations were as high as 341 and 1060 µg/L, respectively.

Round 1: Cup Testing of Composited Area Samples

Composite samples for Areas X, Y, Z, and P were prepared by combining equal volumes from the consolidated subarea samples comprising each respective area. Cup testing involved application of different solidification agents to small (~ 100 g) specimens of these composited area sediment samples to (1) screen potentially effective agents; and (2) range-find appropriate doses. The following solidification agents were tested:

1. Ordinary (Type I) Portland cement
2. Ground corn cobs
3. Fly ash
4. Proprietary polymer products from (a) ZappaTec (McCleansville, NC) and (b) RTS Services (Ontario), Inc. (London, ON).

Portland cement, fly ash, and ground corn cobs were added over a range of 5 – 20% by weight. Polymer products were added over a range of approximately 0.5% - 2% by weight. Analyses included paint filter test and strength index.

Round 2: Expanded Testing on Composite Area Samples

Based on cup testing, the following agents were retained for full testing: Cement, ground corn cobs, ZappaTec Low End Polymer, and RTS-1 polymer. Cement was also paired with ZappaTec polymer, $FeCl_2$ + Na_2S (to form FeS), and alum. Round 2 testing was performed on 1,500 gram specimen sizes of composite samples from Areas X, Y, Z, and P. Analyses included paint filter test; soil pH; moisture content; unit weight; strength index; and TCLP – metals. The following summarizes the results obtained during this testing:

- Homogenized Area X, Y, and Z sediment had a soupy consistency, with the Y and Z samples being thinner in texture. Area P samples were considerably thicker. All samples were comprised predominantly of fines which precluded grain size analysis; furthermore, the organic content precluded accurate hydrometer analysis.
- All treatments resulted in TCLP concentrations of target metals that were below the respective EPA hazardous classification criteria for the metals.
- Cement applied at 20% (w/w) applied to Area X, Y, and Z composite samples resulted in high strength index (approximately 300 – 500 psf) and low TCLP mercury and lead concentrations; but exhibited pH approaching 11 and non-passage of PFT at the time of application. Similar results were obtained at 10% (w/w) dose applied to Area P sediment.

  - Adding alum resulted in immediate passage of PFT and provided some attenuation of pH, while retaining high strength index.
  - Adding $FeCl_2$ and Na_2S did not confer any significant advantage over cement alone.

- Ground corn cobs applied at 15-20% (w/w) resulted in immediate passage of PFT and low TCLP mercury concentrations, but resulted in low strength index (mostly < 100 psf) and unit weight. Ground corn cobs also resulted in sediment expansion accompanied by a putrid odor, possibly due to an adverse biochemical reaction which would potentially pose health and safety concerns for workers, site personnel, and the local community.
- Polymer products applied at 1-2% (w/w) resulted in immediate passage of PFT and circum-neutral pH, but had low strength index (< 50 psf for Area X, Y, and Z; < 100 psf for Area P), relatively high (although still acceptable) TCLP lead concentrations, and high moisture content. Furthermore, the long-term integrity of solidified sediment was questionable (i.e., water released over time).
- Cement combined with polymer applied at 10%/0.5% (w/w) to Area X, Y, and Z composite samples benefitted from excellent TCLP lead concentrations, but retained several disadvantages that characterized each agent separately. Conversely, applied at 5%/0.5% (w/w) to Area P, this combination of agents provided for decent strength index (approaching 150 psf) and relatively low TCLP mercury and lead concentrations, with lower moisture content and better consistency than Area P sediment treated with cement alone.

Photographs from Round 2 Testing (taken at time of application of solidification agent(s) may be found in Attachments 1 through 4.

Round 3: Individual Subarea Samples

Cement and ZappaTec Low End polymer were tested on the discrete subarea samples that exhibited the highest total mercury / total lead concentrations from each Area. Cement was tested at 10% and 20% (samples X-1, Y-2, and Z-1), and 5% and 10% (P-1). ZappaTec was tested at 1.0% (all four samples). Analyses included paint filter test; soil pH; moisture content; unit weight; strength index; and TCLP – metals. The following generalities are made based on Round 3 tests:

ZappaTec Polymer: ZappaTec treated samples demonstrated the same advantages and disadvantages as seen during Round 2 testing, including immediate solidification; near-neutral pH; low strength index; and acceptable TCLP results, although the TCLP mercury and lead concentrations for each subarea sample were generally an order of magnitude higher with TCLP lead concentration exceeding 2 mg/L versus the EPA standard of 5 mg/L.

Cement: Lower Dose:

- 10% cement treatments for X-1, Y-2, and Z-1 all failed PFT at time zero but passed after one day. Strength indices were generally an order of magnitude less than when applied at 20%, and pH approached or exceeded 11. Moisture contents were lower than polymer applications but higher than the 20% cement treatments. TCLP was not measured.
- 5% cement treatment for P-1 passed PFT at time zero. Although pH exceeded 10, it was a full pH unit below the 10% cement treatments of X-1, Y-2, and Z-1. The strength index was approximately 40% of that achieved at 10% dose for P-1. Moisture content was between those for polymer and the 10% cement dose for P-1.

Cement: Higher Dose:

- 20% (X-1, Y-2, Z-1): The 20% cement treatments for X-1, Y-2, and Z-1 also failed PFT at time zero but passed after one day, and pH approached 11.5. Strength indices at three days ranged from 340 – 560 psf, approximately an order of magnitude higher than the 10% cement treatments for the same subarea samples. Moisture contents were the lowest of the treatments tested. TCLP mercury concentrations were all < 0.000069 mg/L, with TCLP lead concentrations approximately one-tenth to one-half the polymer treatments.
- 10% (P-1): The 10% cement treatment for P-1 passed PFT at time zero but exhibited an elevated pH above 1. The strength index approached 300 psf. Moisture content was the lowest of the three treatments for P-1. TCLP mercury and lead concentrations approximately one-third those from the polymer-treated P-1 sample.

Cement Set-Up Time

Cement applications of 10% and 20%, as well as 10% plus 2% alum, were applied to the subarea samples tested in Round 3. PFT and strength index were measured at time of application (0 hours) and at approximately 2 to 3 hour and 6 to 7 hour time points. The following was observed during this testing:

- Cement Only
  - Sample X-1 did not pass PFT at time of application; X-1 passed PFT within 7 hours but with no measurable strength.
  - Y-2 and Z-1 did not pass PFT within the timeframe of the test.
  - P-1 immediately passed PFT, with a measurable strength index of 50 – 100 psf within the test timeframe.
- Cement with Alum

- Sample X-1 passed the PFT at time of application, and led to a measurable strength index of almost 50 psf within the timeframe of the test.
- Sample Y-2 sample passed PFT within 2.2 hours, but there was no measurable strength within the test timeframe.
- The Z-1 sample did not pass the PFT within the timeframe of the test.
- Alum applied to the Area P sample led to more rapid attainment of strength.

CONCLUSIONS

Based on the three rounds of testing plus the cement set-up test, the most favorable results for Area X, Y, and Z sediment were obtained using cement combined with alum. Additional testing would allow for optimization of the cement and alum doses that may allow for reduced cement doses, a particularly important consideration due to the added transport costs for the weight of cement added to the sediment. The most favorable results for Area P were obtained using cement combined with ZappaTec Low End polymer. The combination of these two agents provided for very effective treatment as measured by both physical attributes as well as TCLP metals concentrations.

1.0 INTRODUCTION

This report presents the results of Acid Brook Delta sediment solidification testing performed at the Parsons Treatability Laboratory, Syracuse. All testing was performed in accordance with the June 10, 2010 work plan developed by Parsons to plan, organize, develop, and execute the solidification test procedures, supplemented with client-approved modifications in response to interim test results. Procedures, results, and recommendations presented in this report encompass the following treatability phases:

- Sample Preparation and Initial Characterization
- Round 1 Solidification: Cup Testing on Composite Area Samples
- Round 2 Solidification: Larger-Scale Testing on Composite Area Samples
- Round 3 Solidification: Focused Testing on Subarea Samples

2.0 OBJECTIVES

The primary objective of testing was to identify an optimum solidification process that passes acceptance criteria for acceptance at an approved landfill while allowing for safe and environmentally sound treatment, transport, and disposal. Test evaluation criteria included the following:

1. Results in sufficiently solidified material that passes the Paint Filter Test (SW-846 Method 9095B);
2. Achieves toxicity characteristic leaching procedure (TCLP) concentrations of target metals that are below EPA hazardous classification standards;
3. Is practicable in execution at the full scale; and
4. Eliminates or minimizes impacts on workers, other site personnel, and the community.

Solidification processes are intended to address problems associated with the generation, treatment, and transportation which potentially include the following:

- Leakage of contaminated water from transport trucks.
- Odors associated with solidification processes.
- Leaching of heavy metals after transport and disposal.
- Effects of buried sediment at the landfill location (e.g., structural integrity).
- Time constraints associated with the solidification process.

Parsons, in consultation with DuPont, developed a phased approach to evaluate potential solutions to sediment solidification that would be applied to excavated sediment at the source. Several solidification agents or combinations of agent were identified and tested. This report presents the results of each phase of testing using these agents. All results were documented in laboratory notebooks. Measurements, analytical data, observations, and calculations were entered into Excel spreadsheets and summarized in tables embedded within this report. Conclusions based on quantifiable results and qualitative observations are presented.

3.0 OVERVIEW OF RESEARCH METHODS

All sediment solidification testing was performed in the Parsons Treatability Laboratory, Syracuse, on samples collected and delivered by others. All testing was performed in a laboratory hood under negative pressure to prevent migration of vapors potentially containing mercury or other noxious components.

3.1 Summary of Sediment Sample Locations

The following summarizes the locations within Acid Brook Delta from which sediment samples were received by Parsons for testing:

Area	Discrete Subarea Samples	Number of Subareas per Area
X	X-1 through X-4	4
Y	Y-1 through Y-4	4
Z	Z-1 through Z-4	4
P	P-1 through P-4	4
A	One Area A Sample	1
B	One Area B Sample	1
Total Number of Discrete Samples:		**18**

3.2 Sample Preparation and Characterization

Sample preparation and characterization consisted of the following steps:

1. Consolidation of sediment core samples from each subarea into discrete subarea samples;
2. Initial characterization of discrete subarea samples;
3. Preparation of composite samples from each primary area (X, Y, Z, and P) from their respective discrete subarea samples;

3.1.1 Preparation of Discrete Subarea Samples

Three 3.5-gallon bulk containers containing sediment core samples were received from each subarea. The entire contents of the three bulk containers from each subarea were combined in a large flat plastic tub by hand into a single consolidated sample, which was then redistributed to the bulk containers. A clean plastic tub was used to prepare each consolidated subarea sample.

3.1.2 Initial Characterization of Discrete Subarea Samples

After consolidation, each subarea sample was analyzed for the following:

- Water/moisture content.
- Organic content.

- Grain size distribution including hydrometer analysis.
- Total mercury and total lead.

Analytical methods are described in Section 3.3.

3.1.3 Preparation of Composite Area Samples

Composite samples for Areas X, Y, Z, and P were prepared by combining equal volumes from the consolidated subarea samples comprising each respective area. Four (4) liters was transferred from each of the four consolidated subarea samples into a flat plastic tub. The composited sediments were manually mixed and then stored in 5-gallon high-density polyethylene (HDPE) buckets with sealing lids. The procedure was performed twice for each area to provide approximately 8 gallons of composited sample for each area.

3.2 Sediment Solidification Test Methods

3.2.1 Round 1: Cup Testing of Composited Area Samples

Round 1 involved small scale "cup testing" on composite samples from Areas X, Y, Z, and P. The purpose of cup testing was to select candidate solidification agents or combinations of agents and to range-find likely doses for these agents/combinations of agent for the more expanded Round 2 testing. During cup testing, different solidification agents were applied at multiple mix ratios. The following solidification agents were tested:

- Ordinary (Type I) Portland cement
- Ground corn cobs
- Fly ash
- Polymer products:
  - ZappaTec "Low End" polymer
  - Real-Time Solidification RTS-1 polymer blend

To perform cup testing, approximately 100 g sediment specimens were placed in a translucent plastic drinking cup. A dose of solidification agent was added to the cup, which was then blended into the specimen using a wooden Popsicle stick. A series of cups were prepared, each with increasing doses of the solidification agent. Portland cement, fly ash, and ground corn cobs were added in individual cups over a range of 5 – 20% by weight. Polymer was added over a range of approximately 0.5% - 2% by weight. The following analyses were performed on the cup-tested specimens:

- Paint Filter Test
- Strength Index

The methods for analyzing samples are described in Section 3.3. The Portland cement and fly ash tested samples were allowed to cure for three (3) days before performing these analyses.

The corn cob and polymer tested samples were analyzed shortly after applying these solidification agents since adsorption and set-up occurred rapidly.

3.2.2 Round 2: Expanded Testing on Composite Area Samples

Round 2 of testing involved the application of solidification agents or combinations of agents to larger-size specimens of the Area X, Y, Z, and P composite samples at up to two (2) mix ratios. The following solidification agents or combination of agents were selected, based on Round 1 (Cup Testing) results along with on-going consultation with the project team:

- RTS-1 polymer blend
- ZappaTec Low End polymer
- Ordinary Portland cement
- Ordinary Portland cement with ZappaTec Low End polymer
- Ordinary Portland cement with ferrous chloride ($FeCl_2$) and sodium sulfide (Na_2S)
- Ordinary Portland cement with alum
- Ground corn cobs
- Ground corn cobs with alum

Sediment samples were re-homogenized prior to testing using a power drill mixer. Specimen sizes of 1,500 g were transferred to plastic containers. Solidification agents were mixed in by hand using a large stainless steel spoon. Samples treated with cement or cement in combination with polymer or chemical agents were allowed to cure for three (3) days; all other treated specimens were analyzed starting approximately five (5) minutes after application and mixing. The following analyses were performed on the test specimens:

- Paint filter test
- pH
- Water content
- Unit weight
- Strength Index
- TCLP – Metals

Visual observations were also made and documented during each Round 2 test. Analytical methods are described in Section 3.3.

3.2.3 Round 3: Individual Subarea Samples

Round 3 of testing was performed similarly to the testing for Round 2 except that the most promising solidification agents determined from Rounds 1 and 2, based on analytical measurements, qualitative observations, and project team discussions were applied to a discrete set of individual subarea samples. The samples selected were those that exhibited the highest

total lead and total mercury concentrations within each main area as determined during the initial characterization. The following analyses were performed on the tested specimens:

- Paint filter test
- pH
- Water/moisture content
- Unit weight
- Strength Index
- TCLP – Metals

3.3 Analytical Methods

The methods to evaluate the efficacy of each test are described in this section. They include measurements performed by Parsons as well as those performed by independent certified laboratory analysis.

3.3.1 Analyses Performed at Parsons Treatability Laboratory

Paint Filter Test

The paint filter test was performed in accordance with SW-846 Method 9095B. The paint filter test was used to determine the presence of free liquid to assess compliance with 40 CFR 264.314 and 265.314, and was one of the primary methods for evaluating the effectiveness and optimum mix ratios of solidification agents. The test was performed by placing approximately 100 grams of material in a 60-mesh paint filter cone suspended within a glass vessel. The sample was determined to contain free liquid if any liquid passed through and dropped from the filter within 5 minutes.

Strength Index

The strength index was measured on each tested sample during all rounds of testing. The strength index was measured using a Humboldt H-4200 penetrometer with H-4200F adapter foot. The adapter foot increased the surface area of the penetrometer piston 16-fold; the penetrometer reading was divided by 16 accordingly to give the actual strength index. Strength index readings in tons per square foot (tsf) were converted to pounds per square foot (psf) in Excel spreadsheets.

Unit Weight

The unit weight was measured using the set-up procedure for measuring unconfined compressive strength described in ASTM D-5102, in which a 2-inch diameter x 4-inch high mold is filled with solidified sediment. The empty mass of the cylinder M_{ce} was first measured and recorded. Then the cylinder was filled in accordance with ASTM D-5102. The filled cylinder was reweighed, giving M_{cf}. The unit weight was calculated as follows:

$$UnitWeight(\%) = \frac{M_{cf} - M_{ce}}{V_{ci}} x100\% \qquad \textbf{Equation (1)}$$

where: V_{ci} = empty volume of the cylinder.

Water Content and Moisture Content

Water content was measured in accordance with ASTM D-2216 for raw subarea samples as well as test specimens during Rounds 2 and 3 testing. Water content was determined by measuring the weight of sediment specimens before and after drying at 110 ± 5°C. A sample of moist sediment (approximately 50 g) was placed in a 70-mm disposable aluminum pan with mass M_c (weighed prior to adding specimen). The total mass of container + moist specimen M_{cms} was measured and recorded. The pan was then placed in a drying oven at 110 ± 5°C overnight to ensure the sample dried completely. The pan was then placed in a dessicator and allowed to cool down to room temperature. The mass of container + oven dry specimen M_{cds} was measured and recorded. All mass weight measurements were performed on a Mettler Toledo AT 261 DeltaRange® analytical balance with sensitivity set to 0.1 mg.

The water content was calculated as follows:

$$WaterContent = \frac{M_w}{M_s} x100\% \qquad \textbf{Equation (2)}$$

where: M_w = Mass of water in moist specimen = $M_{cms} - M_{cds}$

M_s = Mass of oven-dried specimen = $M_{cds} - M_c$

Since it is possible for sediment samples to be predominantly water, the water content as calculated by Equation (2) can be greater than 100%. To determine the actual percentage of water with respect to the wet sediment mass, the moisture content was also calculated:

$$MoistureContent = \frac{M_w}{M_{cms} - M_c} x100\% \qquad \textbf{Equation (3)}$$

where $M_{cms} - M_c$ is the mass of moist sediment. Since the mass of moist specimen = $M_w + M_s$, the moisture content calculated per Equation (3) can range only from 0 – 100%.

Organic Content

Organic content was determined in accordance with ASTM D-2974 in the raw subarea samples only. To make these measurements, each oven-dried sample from moisture content determination was placed in a muffle furnace set at 440 °C for at least one hour. (This is consistent with ASTM D-2974 in that samples are first oven-dried to obtain the dried sample mass.) The pan was then placed in a dessicator to reach room temperature, after which it was reweighed to give the mass of container + ignited residue M_{cir}. The organic content (%) was then calculated as follows:

$$OrganicContent(\%) = \frac{M_s - M_{ash}}{M_s} x100\% \qquad \textbf{Equation (4)}$$

where: M_{ash} = Mass of ash residue = $M_{cir} - M_c$

M_s was defined previously.

The organic content as calculated by Equation (4) provides the percent of organic material with respect to the total sediment dry weight (i.e., the percent of oven-dried sediment that is organic in nature based on ignition at 440 °C).

Soil pH

The pH of treated sediment samples during Rounds 2 and 3 of testing was performed in accordance with ASTM D-4972-01, with slight modification as described below. Two separate pH readings were performed for each sediment sample analyzed during Round 2 sampling:

- One using distilled water; and
- One using 0.01 M calcium chloride ($CaCl_2$)

Distilled Water Preparation: Oven-dried sediment was sieved through a No. 10 (2 mm) sieve. Approximately 10 grams of sieved dry sediment was placed in a 100 mL Pyrex beaker. 50 mL of distilled water was added to the beaker. The contents in the beaker was mixed thoroughly using a stainless steel spatula and allowed to stand for one hour. The pH of the mixture was then measured using an Orion 720A multi-meter fitted with a pH electrode. The results were recorded in the lab book and transferred to tables for review.

It should be noted that this methodology represents a departure from the ASTM-prescribed procedure, which calls for addition of 10 mL of water to the 10g of soil. This was necessary since addition of 10 mL resulted in a clump of moist sediment. The addition of 50 ml of distilled water provided an aqueous slurry in which pH could be measured using a pH electrode.

$CaCl_2$ Preparation: The method described for measuring sediment pH using distilled water was followed, except that 0.01 M $CaCl_2$ solution was used in place of distilled water. The 0.01 M $CaCl_2$ solution was prepared by diluting 1.109 g of $CaCl_2$ (0.01 mol) per liter of distilled water.

The pH meter / electrode were calibrated before commencing pH readings and periodically during pH readings. Standard pH 4, 7, and 10 buffer solutions were used. Two-point (pH 4 and 7 buffers) or three-point (pH 4, 7, and 10) calibrations were performed depending on the pH range of the sediment pH values.

Observations

Observations provided a qualitative check on the quantitative results obtained during testing. Observations were made on the visual appearance of treated versus untreated sediment; the relative effort required to apply the solidification agents at the prescribed doses; the presence of free water; the nature of solidified sediment over time (especially for cement-treated specimens);

and other observations specific to each application. All observations were recorded during each phase of testing and documented to help determine the most promising treatments or eliminate certain treatment based on unacceptable qualitative characteristics (e.g., odor, difficulty of application; presence of free water over time). Observations are included in reported results summaries presented in this report.

3.3.2 Analyses Performed by Independent Certified Analytical Laboratories

Total Mercury and Total Lead

Total mercury and total lead was analyzed on the raw discrete subarea samples. Total mercury and total lead was analyzed by Lancastar Laboratories, Lancaster, PA in accordance with EPA 245.1 and EPA 200.7 / 200.8.

Toxicity Characteristic Leaching Procedure (TCLP)

TCLP testing was also performed by Lancastar Labs. The TCLP was performed in accordance with EPA 1310 (leaching procedure) / 6010B (metals analysis). The TCLP analyses included analysis for "RCRA 8 Plus" metals including arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), selenium (Se), silver (Ag), and Zinc (Zn). TCLP testing and analysis was performed on tested samples from Rounds 2 and 3.

Grain Size Distribution with Hydrometer Analysis

Grain size distribution including hydrometer analysis was performed by JLT Laboratories, Canonsburg, PA. The grain size / hydrometer analyses were performed in accordance with ASTM D-422 on raw discrete subarea samples only.

4.0 RESULTS AND FINDINGS

4.1 Initial Characterization

The results from analyses on consolidated as-received subarea samples are presented in **Table 1**. The average and standard deviation within each area was calculated to illustrate the relative values for the various parameters between areas as well as the variation within each area.

4.2 Round 1 Test Results: Cup Testing of Composited Area Samples

Table 2 presents a summary of results obtained during cup testing of sediment samples. The results from Area Z only are presented to illustrate the factors that went into deciding how to proceed in Round 2. Table 2 presents objective measurements (e.g., paint filter test results, strength index) as well as descriptive observations that assisted in the selection or rejection of the various treatments for Round 2.

4.3 Round 2 Solidification Testing: Expanded Testing of Composited Area Samples

4.3.1 Dosing

Based on results from Round 1 – Cup Testing and subsequent discussions with the project team, the following agents were tested at the doses indicated:

Solidification Treatment	Dose (% w/w)[1]	
	Areas X, Y, and Z	Area P
RTS-1 Polymer Blend	1.0 and 2.0%	1.0 and 1.5%
ZappaTec Low End Polymer	1.0 and 1.5%	0.75 and 1.0%
Ordinary Portland Cement	10 and 20%	5.0 and 10%
Ordinary Portland Cement + ZappaTec Low End Polymer	10/0.25 and 10/0.5%	5.0/0.25 and 5.0/0.5%
Ordinary Portland cement + ferrous chloride ($FeCl_2$) + sodium sulfide (Na_2S)[2]	Note (2)	Note (2)
Ordinary Portland cement + Alum	15/2.0%	7.5/1.0%
Ground Corn Cobs	10 and 20%	10 and 15%
Ground Corn Cobs + Alum	15/2.0%	7.5/1.0%

(1) Percentage by weight, wet sediment basis.

(2) $FeCl_2$ and Na_2S were added to promote formation of ferrous sulfide (FeS) to promote binding of mercury. Cement was dosed at 10% and 20% (Areas X, Y, and Z) and 5.0% and 10% (Area P). $FeCl_2$ and $Na2_S$ were dosed to target 1.5 mol FeS per mol mercury based on chemical reaction $Na_2S + FeCl_2 \rightarrow FeS + 2\ NaCl$. Actual chemicals used were $Na_2S{\cdot}xH_2O$ (~38% water) and $FeCl_2{\cdot}4H_2O$; dosing accounted for mass of hydration; anhydrous versions would be prohibitively expensive.

4.3.2 Results

Round 2 solidification testing results are presented in **Tables 3 through 6**, respectively. Each table is divided into two sections: (1) general test results; and (2) TCLP concentrations for the RCRA 8 Plus metals. Each table presents the results of the various solidification agents or combination of agents in alphabetical order. The general test results include primarily measurements performed by Parsons including paint filter test; strength index; moisture content; soil pH; density; along with detailed observations. The TCLP results for mercury and lead are also presented. The TCLP concentrations portion of each table presents the reported concentrations for each of the RCRA 8 Plus metals for each treatment, and also presented the corresponding EPA hazardous waste standard for characteristic toxicity for each of the metals analyzed.

The following sections present a discussion of the test results, and the potential implications for full-scale handling.

4.3.2.1 Area X Results and Observations

The homogenized, completely mixed Area X composite sample was soupy in nature with very little apparent sand or gravel fraction. It was thicker and appeared less watery than the Area Y and Z composites.

RTS-1 Polymer

RTS-1 polymer is a proprietary blend of polymer and clay. RTS-1 polymer tested at 1% and 2% doses resulted in immediate passage of PFT, indicating that this solidification process would allow for immediate transport to a landfill. However, the low strength index and springy, elastic/rubbery nature of the treated sediment could result in adverse structural conditions at a landfill. The pH of the mixed agent and sediment was near neutral. The treated sediment was under the RCRA thresholds for characteristic toxicity, although TCLP lead concentrations were greater than 1 mg/L compared with < 0.01 mg/L for the most effective Area X treatments with regard to this parameter.

Zappa Tec Low-End Polymer:

Zappa Tec polymer tested at 1% and 1.5% applied doses resulted in immediate passage of the PFT. However, the strength index was only slightly higher than the RTS-1 treated sediment, and was bouncy/rubbery in nature. The pH of the mixed agent and sediment was near neutral. All TCLP results were acceptable, although the TCLP lead concentration was > 1 mg/L.

Ordinary Portland Cement

Except for pH, all parameters for cement were generally favorable including mercury and lead encapsulation. Ordinary Portland cement ("cement" in Table 2) passed the PFT at the one day point, it did not pass PFT at time zero at both 10% and 20%. The 10% application suffered from low strength index even after three days curing; conversely, the 20% application was among the highest of all Area X treatments. Another potential concern is that the pH is increased, reflecting lime as a key ingredient in Portland cement. Although the cement-treated pH of 10.5 did not contravene the characteristically hazardous threshold for corrosivity, a pH at this level could exceed limits imposed at the landfill for acceptance of the material.

Cement and Zappa Tec Low-End Polymer:

The combination of cement and Zappa Tec Low-End polymer was effective in binding the target metals as indicated in the TCLP results. Otherwise, this treatment led to mostly unfavorable results including low strength index (even with the presence of 10% cement); high pH; failure of PFT at time zero; high moisture content; and an overall sticky, spongy nature that was difficult to work with.

Portland Cement with $FeCl_2$ and $Na2_S$

Application of 10% cement combined with $FeCl_2$ and Na_2S (to form FeS) was of limited effectiveness, particularly with respect to strength index. On the other hand, application of 20% cement combined with $FeCl_2$ and Na_2S provided favorable results for all parameters except pH and provided for an improvement in strength index and unit weight (density) over the 20% cement applied by itself. This treatment also provided some marginal improvement in TCLP metal concentrations, although 20% cement alone resulted in acceptable TCLP concentrations. The 20% cement + $FeCl_2$ + Na_2S treatment did not pass the PFT at time zero, thereby subjecting treated sediment to the same transport limits and staging requirements as for 20% cement applied

alone. The mixture passed the PFT at the one day point, and the strength index was among the strongest of any treatment during Round 2 testing.

Portland Cement with Alum

The 15% cement/2% alum mix resulted in the 2nd highest strength index measured during Round 2 testing while also providing for some attenuation of pH versus cement applied by itself. Additionally, this treatment passed the PFT at time zero. The TCLP results were also among the best observed for binding lead and mercury. Based on these results, it appears this provided the best performance of all treatments tested for Area X composite sediment during Round 2. Further testing would allow for optimization of dosage while maintaining acceptable strength and TCLP results and improving pH.

Ground Corn Cobs

Applied at 10%, corn cobs passed PFT and provided for acceptable results for TCLP; however, this treatment resulted in a strength index of zero. The 20% application lowered the moisture content, increased the strength index, and generally provided for improved binding of the RCRA 8 Plus metals. Based solely on solidification and binding performance, corn cobs would be an attractive option to consider. However, a major drawback to using corn cobs was an observed expansion of treated sediment volume by approximately 20%, accompanied by a putrid odor. The observed expansion appeared to be greater than what would be expected solely from the corn cobs taking on water. It is hypothesized the expansion and accompanying putrescence was caused by a biochemical reaction. The formation of gas, depression of pH, and putrescence (due to possible formation of volatile fatty acids such as acetic, propionic, and butyric acids) would be consistent with an anaerobic biochemical reaction, which might be expected given that oxygen within the sediment may be limited. If this were the case, then it would pose serious safety risks since methane (CH_4) and possibly hydrogen sulfide (H_2S) would also form, possibly explaining at least in part the observed expansion.

The resulting treated sediment resembled dark topsoil in appearance and texture with no odor. However, due to potential safety and aesthetic concerns for workers and the local community, ground corn cobs were not considered for further testing.

Ground Corn Cobs with Alum

The combination of ground corn cobs with alum resulted in negligible improvements over ground corn cobs alone, and resulted in low pH values. Due to concerns with the causes of sediment expansion described above, treatment using ground corn cobs with alum was not considered further.

4.3.2.2 Subarea Y Results and Observations

The homogenized Area Y composite sample was soupy with little apparent sand or gravel and some vegetative debris. It was noticeably thinner and more watery than the X and P composite samples.

Treated Sediment

Similar results obtained during application of the various agents or combinations of agents to Area X composite sample specimens were also seen for the corresponding applications to Area Y specimens, including:

- RTS-1 Polymer: Immediate passage of PFT; very low strength index; springy/bouncy nature; and neutral pH. All TCLP concentrations were acceptable, although the TCLP lead concentration for the 2% application was > 2 mg/L (versus the EPA standard of 5.0 mg/L and over two orders of magnitude greater than the most effective Area Y treatments for this parameter).
- ZappaTec Low End Polymer: Immediate passage of PFT; low strength index (though higher than RTS-1 polymer at similar doses); neutral pH; and acceptable TCLP concentrations, although the TCLP lead concentrations at greater than 1 mg/L were among the highest of all Round 2 treatments for Area Y.
- Ordinary Portland Cement: Vastly improved strength index at 20% versus 10% application, with superior strength index after curing compared to other treatments; non-passage of PFT at time zero but passage after one day; acceptable TCLP results; and elevated pH which, though not characteristically hazardous, could potentially limit acceptance at a landfill.
- Cement and Zappa Tec Polymer: Decent strength index – much higher than corresponding treatment for Area X, although not as high as 20% cement alone; high pH; moderate moisture content; effective binding of metals as evidenced by TCLP concentrations; and sticky, spongy nature that was difficult to work.
- Cement with Ferric Chloride and Sodium Sulfide
    - 10% cement + $FeCl_2$ + Na_2S: Limited effectiveness particularly with respect to strength index.
    - 20% cement + $FeCl_2$ + Na_2S: Generally favorable results for all parameters except pH, although the strength index (250 psf) was only about half of that for 20% cement applied by itself, rather than the improved strength index that had been seen when applying this treatment versus 20% cement alone to Area X sediment. Acceptable TCLP results were obtained; however, there was a decline in TCLP performance versus 20% cement by itself rather than the slight improvement that had been seen with Area X sediment. As with Area X (and both Area X and Y with 20% cement alone), this treatment did not pass the PFT at time zero but passed at the one day point.
- Cement with Alum: Provided for 2nd highest strength index in Round 2 for Area Y, with a strength index similar to that provided by 20% cement; among the lowest TCLP concentrations for lead and mercury; and apparent passage of PFT at time zero (based on visual appearance; not confirmed).
- Ground Corn Cobs: Similar results at the 10% application. Due to difficulty working 20% ground corn cobs into Area X sediment, the 2nd dose applied to Area Y was reduced to 15%. At this lower dose, strength index was still low but slightly improved over 10% dose (31 psf). The pH was relatively low (5.60). The 15% application passed PFT at time zero and provided for acceptable TCLP results. Due to sediment expansion and accompanying odors then, for the reasons described for Area X, ground corn cobs were not considered for additional testing.

- Ground Corn Cobs with Alum: No substantial difference in solidification performance over ground cobs alone; lower pH to 4.25; similar safety and aesthetic concerns as ground corn cobs alone; not considered for Round 3 testing.

4.3.2.3 Area Z Results and Observations

The homogenized Area Z composite sample was similar in consistency and other physical parameters to the Y subarea sample. Mercury and lead concentrations were distinctly lower as presented in Table 1, above.

Treated Sediment

Treated Area Z composite sample specimens generally behaved similarly to the corresponding treated Area Y specimens. The similarities along with observed variations are described as follows:

- RTS Polymer: Low strength index; higher moisture contents than other treatments (except similar to ZappaTec Low End polymer); acceptable TLCP concentrations, although least effective for binding of lead and mercury of the Round 2 Area Z treated samples; near neutral pH. The sample passed PFT within the time that would be expected for full-scale treatment before treated sediment was loaded for transport.
- ZappaTec Low End Polymer: Low strength index similar to that for RTS-1 polymer; relatively high moisture content similar to RTS-1 polymer and higher than other treatment; passage of PFT; acceptable TCLP results; little change in pH.
- Ordinary Portland cement: Vastly improved strength index at 20% versus 10% application, with superior strength index after curing compared to other treatments; non-passage of PFT at time zero but passage after one day; acceptable TCLP results; and elevated pH which, though not characteristically hazardous, could potentially limit acceptance at a landfill.
- Cement and Zappa Tec Polymer: Decent strength index similar to corresponding treatment for Area Y and much higher than corresponding treatment for Area X, although not as high as 20% cement alone; high pH; moderate moisture content similar to corresponding treatment of Area Y sediment but improved compared to polymer alone as also seen for Area Y; acceptable TCLP results; somewhat spongy and pasty.
- Cement with $FeCl_2$ and Na_2S: Limited effectiveness at 10% cement particularly with respect to strength index; 20% cement provided favorable results for all parameters except pH and provided for comparable strength index and unit weight to 20% cement applied by itself and among the highest of all Area Z treatments; comparable to improved (especially for lead) TCLP metal concentrations to 20% cement applied alone.
- Cement with Alum: 15% cement + 2% alum improved strength index over 20% cement alone; high pH; acceptable TCLP results among the best observed for lead and mercury; apparent passage of PFT at time zero (based on visual appearance), unlike cement applied alone.
- Ground Corn Cobs: Generally similar results to those obtained during testing of Area Y at both 10% and 15% applications; similar adverse effects regarding sediment expansion and odor which, for reasons described previously, resulted in decision not to retain ground corn cobs for Round 3 testing.

- Ground Corn Cobs with Alum: No substantial difference in solidification performance over ground cobs alone; lowered pH to around 4.0; similar safety and aesthetic concerns as ground corn cobs alone; not considered for Round 3 testing.

4.3.2.4 Area P Results and Observations

The Area P composite sample had a slightly lower moisture content than the Area X, Y, and Z composite samples but a much "thicker" appearance that was more difficult to homogenize. It also had an average organic content approximately twice that of the Area X, Y, and Z composite samples. Cup testing demonstrated that doses approximately half that required for the Area X, Y, and Z samples would be required to obtain the same over solidification results (particularly with respect to PFT passage and strength index), with the exception that polymer would cover a range approximately 75% of that tested for the X, Y, and Z samples.

Generally similar observations were made for the treated Area P samples as for the corresponding treated X, Y, and Z composite samples, although some improvements were observed with polymer performance particularly with respect to strength index. The following is a synopsis of observations:

- RTS Polymer: Passed PFT at time zero; near neutral pH; acceptable TCLP results, although lead was among highest for all Area P treatment; much improved strength index at 1.5% application compared to 2% applied to Area X, Y, and Z, with a resulting soil-like consistency.
- ZappaTec Low End Polymer: Passed PFT at time zero; near neutral pH; acceptable TCLPs, although TCLP lead was among highest of treated Area P samples; much improved strength index at 0.75% and 1% applied doses compared to 1% and 1.5% treatments of Area X, Y, and Z samples, with a less elastic, more soil-like consistency.
- Ordinary Portland Cement: The 10% application performed similarly with regard to strength index as the 10% doses applied to Area X, Y, and Z samples, despite the apparently thicker nature of the raw sample. The pH was < 10 and a full unit lower than the X, Y, and Z 10% cement treatments; neither 5% not 10% passed PFT at time zero but did pass at the one day point. TCLP results were favorable.
- Cement and Zappa Tec Low End Polymer: The 5% cement + 0.5% polymer treatment resulted in a strength index of 144 psf, among the highest for the Area P treatments and comparable to corresponding 10% cement + Zappa Tec polymer for the Area X and Y samples. TCLP results were acceptable, with TCLP mercury and lead relatively low compared to other treatments. Furthermore, the consistency of the treated sediment was very favorable especially compared to sediment treated with cement alone. The pH of the 5% cement + 0.5% polymer treatment exceeded pH 10, a potential drawback. The mixture did not pass PFT at time zero but passed within one day of curing.
- Portland Cement with $FeCl_2$ and Na_2S: Cement applied at 5% with $FeCl_2$ and Na_2S had similar performance to 10% cement applied alone with respect to strength index, PFT, and pH. TCLP performance was better for mercury but resulted in the highest TCLP lead concentration for all Area P treatment, though all TCLP results were well within EPA limits for characteristic toxicity.

- Portland Cement with Alum: The application of this combination of agents at 7.5% cement + 1% alum resulted in a three-fold improvement in strength index over the 10% cement applied alone, and two-fold over 5% cement + 0.5% polymer. Another advantage was that this mixture passed the PFT at time zero, unlike most other cement treatments tested across the different composite samples. TCLP results were acceptable, with comparable mercury TCLP concentration but a higher TCLP lead concentration (though on par with several other treatments). The resulting pH was around 10.
- Ground corn cobs: Ground corn cobs applied at 10% and 15% resulted in immediate passage of PFT and a strength index approaching 100 psf. The ground corn cobs also provided for effective binding of both mercury and lead, along with acceptable TCLP results across all measured metals. As with the other composite samples, however, application of ground corn cobs to Area P sediment resulted in sediment expansion and purification and so was not considered for further testing.
- Ground corn cobs with Alum: Resulted in passage of PFT, a fair strength index, and acceptable TCLP results but a pH of less than 5. Further testing was not considered solely on the basis of potential concerns over apparently biochemical reactivity that was observed for ground corn cobs applied alone.

- Photographs from Round 2 Testing (taken at time of application of solidification agent(s) may be found in Attachments 1 through 4.

4.3.2.5 Summary of Advantages and Disadvantages

The various agents or combinations of agents showed generally similar advantages and disadvantages across all composite areas tested. A summary of the advantages and disadvantages are provided in **Table 7**. Table 7 considers only factors determined during testing and does not take into consideration other engineering considerations (e.g., facilities or equipment required to perform the various applications at full scale; relative added costs for materials; relative added costs for shipping additional weight owing to the various treatments). The table includes criteria that are intended to highlight the relative differences between the various treatments or, in the case of PFT, an absolute criterion of passage or failure as an advantage or disadvantage, respectively.

4.4 Round 3 Testing: Individual Subarea Samples

4.4.1 Test Samples and Conditions

Round 3 of testing was performed on individual subarea samples (versus composited area samples) using the solidification agents or combinations of agents deemed most effective in Round 2. Although chemical properties of each individual subarea sample within a given area varied widely, the physical attributes were relatively. Therefore, the focus on testing was on the individual subarea sample within each area that exhibited the highest concentrations of total mercury and total lead to provide for conservative TCLP results while obtaining representative results for the other tested parameters. These samples included the following:

- X-1
- Y-2

- Z-1
- P-1

Based on project team discussions, the following treatments were tested for Round 3:

- 10% (w/w) Ordinary Portland cement
- 20% (w/w) Ordinary Portland Cement
- 1.0% (w/w)

The following analyses were performed:

- Paint filter test (0, 1, and 3 day time points)
- Strength index (0, 1, and 3 day time points)
- pH
- Moisture content
- Unit weight
- Strength Index
- TCLP – Metals
- Visual observations

4.4.2 Results

The results and observations from Round 3 are summarized as follows:

- Day 0: **Table 8**
- Day 1: **Table 9**
- Day 3: **Table 10**

The Day 0 and Day 1 results are intended to illustrate the time required to attain strength and passage of PFT for the cement-based treatments. The Day 3 results include the comprehensive set of analyses summarized above.

The following generalities are made based on the results presented in these tables:

4.4.2.1 ZappaTec Polymer

The ZappaTec treated samples demonstrated the same advantages and disadvantages as seen during Round 2 testing, including immediate solidification; near-neutral pH; low strength index; and acceptable TCLP results, although the TCLP mercury and lead concentrations for each subarea sample were consistently higher than the corresponding cement treatments for the same subarea samples, generally an order of magnitude higher with TCLP lead concentration exceeding 2 mg/L versus the EPA standard of 5 mg/L.

4.4.2.2 Cement: Lower Dose

10% (X-1, Y-2, Z-1): The 10% cement treatments for X-1, Y-2, and Z-1 all failed PFT at time zero but passed after one day, similarly to Round 2 results. Another disadvantage was that pH approached or even exceeded pH 11. Strength indices were 63 psf or less, versus several hundred psf for 20% cement applications. Moisture contents were better than the polymer applications but higher than the 20% cement treatments. TCLP was not measured for the 10% cement treatments based on project team directives.

5% (P-1): The 5% cement treatment for P-1 passed PFT at time zero but exhibited an elevated pH above 10.3, although this was nearly a full pH unit below the 10% cement treatments of X-1, Y-2, and Z-1. The strength index was higher than those obtained at 10% cement dose for the X-1, Y-2, and Z-1 samples, but still only a fraction of that achieved at 10% dose for P-1. Moisture content was between those for polymer and the 10% dose for P-1.

4.4.2.3 Cement: Higher Dose

20% (X-1, Y-2, Z-1): The 20% cement treatments for X-1, Y-2, and Z-1 also failed PFT at time zero but passed after one day, and pH approached 11.5. Strength indices were at three days ranged from 340 – 560 psf, approximately an order of magnitude higher than the 10% cement treatments for the same subarea samples. Moisture contents were the lowest of the treatments tested. TCLP mercury concentrations were all < 0.000069 mg/L, with TCLP lead concentrations approximately one-half to one-tenth the corresponding polymer treatments.

10% (P-1): The 10% cement treatment for P-1 passed PFT at time zero but exhibited an elevated pH above 1. The strength index approached 300 psf. Moisture content was the lowest of the three treatments for P-1. TCLP mercury and lead concentrations approximately one-third those from the polymer-treated P-1 sample.

4.4.3 Cement Setup Time Study

The cement applications generally did not pass the paint filter test at the time of application, but did pass at the one day point. It was therefore of interest to determine at which point following application that these applications would be expected to pass PFT. Therefore the cement applications performed in Round 3 testing were repeated for each of the subarea samples (X-1, Y-2, Z-1, P-1). Additionally, a third cement application involving 10% cement + 2% alum (X-1, Y-2, Z-1) or 5% cement + 1% alum (P-1) was tested. The following were measured at time of application (0 hours) and at approximately 2-3 hour and 6-7 hour time points:

- Paint filter test
- Strength index

The results of this study are presented in **Table 11**. The study results are summarized as follows:

- Cement Only
  - The 10% and 20% applications to sample X-1 passed the PFT within the timeframe of the test, with the 10% application passing within approximately 2 ½ hours and the 20% application passing in less than 7 hours. However, there was no measurable strength within the test timeframe.

- The 10% and 20% applications to samples Y-2 and Z-1 did not pass the PFT within the approximately 7 hour timeframe of the test.
- The 5% and 10% applications to sample P-1 immediately passed the PFT, with measurable strength of 50 – 100 psf within six hours.

- Cement with Alum
  - The X-1 treated sample passed the PFT at time of application, versus 2.6 hours for the corresponding treatment without alum and nearly 7 hours for the 20% cement test. The alum also led to a measurable strength index of almost 50 psf within the timeframe of the test.
  - The Y-2 treated sample passed PFT within 2.2 hours, versus not passing within almost 7 hours without alum (both 10% and 20%). However, there was still no measurable strength within the test timeframe.
  - The Z-1 sample did not pass the PFT within the timeframe of the test.
  - Alum applied to the Area P sample resulted in a more rapid attainment of strength (63 psf by approximately 2.5 hours, versus 19 psf for the corresponding cement application without alum). However, by approximately 6 hours this gap largely closed.

Based on these results, cement applied alone to Area X sediment may results in passage of PFT the same day it is applied, but may require overnight curing for Area Y and Z sediment. Alum provided for more rapid passage of PFT for Area X and Y, although this was not demonstrated for Area Z within the timeframe of the test. Area P would be expected to pass PFT immediately upon application of cement with or without alum.

5.0 CONCLUSIONS

The following conclusions were drawn from the testing and analysis of the composite and focused subarea samples during:

- Homogenized Area X, Y, and Z sediment had a soupy consistency, with the Y and Z samples being somewhat thinner in texture. Area P samples were considerably thicker. All samples were comprised predominantly of fines which precluded grain size analysis; furthermore, the organic content precluded accurate hydrometer analysis. Total mercury and total lead concentrations up to 350 mg/kg and over 1000 mg/kg, respectively, were measured in discrete subarea samples.
- All treatments resulted in TCLP concentrations of target metals (including mercury and lead) that were below the respective EPA hazardous classification criteria for the metals. TCLP metals concentrations varied between treatments, sometimes by orders of magnitude.
- Cement solidification at 20% (w/w) addition resulted in high strength index and low TCLP mercury and lead concentrations, but led to potentially unacceptable soil pH and also did not pass PFT at the time of application

- Adding alum resulted in immediate passage of PFT and provided some attenuation of pH, while retaining high strength index. The aluminum sulfate is a coagulant that reacts with free metals to form precipitants. It is also an acidic salt that may help to reduce pH when mixed together with cement.
- Adding $FeCl_2$ and Na_2S did not confer any significant advantage over cement alone

- Ground corn cob solidification at 15-20% (w/w) addition resulted in immediate passage of PFT and low TCLP mercury concentrations, but had low strength index and density; additionally, solidification using ground corn cobs was accompanied by sediment expansion accompanied by a putrid odor, suggesting an adverse biochemical reaction that would potentially expose workers and the community to safety and aesthetic concerns.
- Polymer solidification using either ZappaTec Low End or Real-Time Solidification (RTS) proprietary polymer products added at 1-2% (w/w) resulted in immediate passage of PFT and circum-neutral pH, but had low strength index, relatively high (although still acceptable) TCLP lead concentrations, and high moisture content. Furthermore, the long-term integrity of solidified sediment was questionable (i.e., water released over time).
- Cement combined with ZappaTec Low End Polymer applied at 10%/0.5% (w/w) to Area X, Y, and Z sediment resulted in excellent TCLP lead concentrations, but retained several disadvantages that characterized each agent separately. Conversely, applied at 5%/0.5% (w/w) to Area P, this combination of agents provided for decent strength index and relatively low TCLP mercury and lead concentrations, with lower moisture content and better consistency than Area P sediment treated with cement alone.

Overall, the most favorable results for Area X, Y, and Z sediment were obtained using cement combined with alum. Additional testing would allow for optimization of the cement and alum doses that may allow for reduced cement doses, a particularly important consideration due to the added transport costs for the weight of cement added to the sediment.

The most favorable results for Area P were obtained using cement combined with ZappaTec Low End polymer. The combination of these two agents provided for very effective treatment as measured by physical attributes and TCLP metals concentrations.

Table 1. Initial Characterization Results

Area	Subarea	Water Content[1] (%)	Moisture Content[2] (%)	Organic Content[3] (%)	Total Mercury (mg/kg)	Total Lead (mg/kg)	Percent Retained on No. 200 Sieve[4]
X	X-1	230	70	11	268	1070	30
	X-2	360	78	12	110	577	59
	X-3	230	70	8	17.6	165	56
	X-4	335	77	11	71.2	478	18
	Area X Average[5]	289± 69	74 ± 4.5	10 ± 1.8	117 ± 108	573 ± 375	41 ± 20
Y	Y-1	280	74	11	341	587	35
	Y-2	250	72	11	327	1060	47
	Y-3	375	79	11	149	557	47
	Y-4	315	76	11	109	361	29
	Area Y Average[5]	305 ± 54	75 ± 3.2	11 ± 0.3	232 ± 120	641 ± 297	40 ± 9.0
Z	Z-1	375	79	11	124	363	6
	Z-2	325	76	12	41.6	251	44
	Z-3	260	72	10	26.4	216	45
	Z-4	285	74	10	38.1	211	58
	Area Z Average[5]	311 ± 50	75 ± 2.9	11 ± 0.9	58 ± 45	260 ± 71	38 ± 22
P	P-1	300	75	25	163	799	63
	P-2	405	80	33	101	395	55
	P-3	270	73	23	117	124	88
	P-4	165	62	12	307	474	85
	Area P Average[5]	285 ± 99	73 ± 7.4	23 ± 8.7	172 ± 94	448 ± 278	73 ± 16

Table 1. Initial Characterization Results (Continued)

Area	Subarea	Water Content[1] (%)	Moisture Content[2] (%)	Organic Content[3] (%)	Total Mercury (mg/kg)	Total Lead (mg/kg)	Percent Retained on No. 200 Sieve[4]
A	A-1	230	70	8	9.77	207	6
B	B-1	325	76	12	8.82	117	65

[1] Water content = Mass of water in wet sediment divided by mass of dry solids, expressed as a percent.

[2] Moisture content = Mass of water in wet sediment divided by total mass (wet + dry) of wet sediment, expressed as a percent.

[3] Organic content = Percent of dry solids that are organic in nature based on ignition at 440 °C.

[4] Results shown describe material other than organics retained on No. 200 sieve. Organic content precluded hydrometer analysis and precluded grain size test due to material clogging sieves.

[5] Average ± Standard Deviation calculated from subarea values to indicate relative values between areas and variation within areas.

Table 2. Round 1: Cup Testing Results

Agent	Applied Dose (w/w)	Observations	Strength Index (psf)	Recommended for Further Testing
ZappaTec Premium Polymer	0.5%	Stiffens w/in 2 minutes; crumbly; elastic/rubbery; formed gelatinous particles.	0.0	NO
	1.0%	Similar observations as 0.5%	15.6	
	2%	Stiffens w/in 0.5 minutes; stiffer than 1%; crumbly; somewhat elastic; gelatinous particles.	31.3	
ZappaTec Low End Polymer	0.5%	Stiffens within 1 min; somewhat rubbery/elastic; somewhat moist; no free water; hydrated gelatinous particles. **1-day**: Pasty and moist	0	YES
	1.0%	Stiffens quickly; stiffer than 0.5%; somewhat rubbery, but more crumbly than 0.5%; no free water; less moist than 0.5%; hydrated gelatinous particles. **1-day**: Moist; semi-pasty; crumbly after mixing	31.3	
	1.5%	Stiffens almost immediately; stiffer than 1%; somewhat rubbery; more crumbly than 0.5%; no free water; less moist than 1%; hydrated gelatinous particles. **1 day**: Moist; semi-crumbly upon remixing.	46.9	
RTS-1 Polymer Blend (Low Grade)	0.5%	Stiffens in 0.5-1 minute; no free water at time of preparation; not as stiff, and more moist than 1%. **At 5 hours**: Some free water; somewhat pasty; no improvement in strength.	0	YES
	1.0%	Stiffens almost immediately; somewhat moist; no noticeable temp increase (by feel); rubbery; very little structural strength.	0	
RTS-3 Polymer Blend (Mid Grade)	0.5%	Stiffens somewhat, but marginal; more pasty and more moist than 1%.	0	NO
	1.0%	Stiffens quickly; no free water; rubbery; very little structural strength.	0	
RTS-5 Polymer Blend (High Grade)	0.5%	Slop at 5 minutes; not binding free water. **At 4.25 hours**: No improvement.	0	NO
	1.0%	Stiffens in 0.5-1 minute; slightly wet compared to RTS-1; no free water.	0	

Table 2. Round 1: Cup Testing Results (Continued)

Agent	Applied Dose (w/w)	Observations	Strength Index (psf)	Recommended for Further Testing
Ordinary Type I Portland Cement (OPC)	General Observations	No noticeable heat generation; cement mixed easily with sediment; mixture has uniform appearance; mixed sediment stiffens as % cement increases.	--	YES
	5%	**1 day**: Moist, but no free liquid; stiff.	31.3	
		3 day: Water squeezed when measuring S.I.	93.8	
	10%	**1 day**: A little free liquid; stiff.	156	
		3 day: Water squeezed when measuring S.I.	344	
	15%	**1 day**: A little free liquid; stiff.	313	
		3 day: Water squeezed when measuring S.I.	> 563	
	20%	**1 day**: Moist; stiff/hard	438	
		3 day: Water squeezed when measuring S.I.	> 563	
OPC + ZappaTec Premium Polymer	General Observations	NOTE: Mixed cement in first; did not react as quickly as polymer alone; did not see hydration (globules); stiffer than cement alone; higher polymer doses: Lost strength over time.	--	NO
	10 / 0.25%	**1 day**: A little free liquid; stiff (firm underneath)	188	
		3 day: (Measured SI)	406	
	5 / 0.50%	**1 day**: A little free liquid; softer than 10/0.25%	188	
		3 day: (Measured SI)	93.8	
	10 / 0.50%	**1 day**: A little free liquid; stiff	313	
		3 day: (Measured SI)	438	
	5 / 1.0%	**1 day**: Lumpier; stiff; moister	188	
		3 day: Free liquid; pasty	0	

Table 2. Round 1: Cup Testing Results (Continued)

Agent	Applied Dose (w/w)	Observations	Strength Index (psf)	Recommended for Further Testing
OPC + ZappaTec Low End Polymer	General Observations	Temperature increase up to ~ 2.5°C; **After 1 day**: Higher polymer doses →less strength.	--	YES
	5 / 0.25%	**Time of Application**: Pasty (though stiffer than baseline); moist; some free water.	--	
		1 day: Cakey, moist, some free water.	37.5	
	5 / 0.50%	**Time of Application**: Pasty (not as much as 5 / 0.25%); moist; no free water (barely)	--	
		1 day: Cakey, some free water, pasty upon stirring.	0	
	5 / 1.0%	**Time of Application**: Stiffens quickly; lumpy; somewhat rubbery; much drier than 5/0.5%; resembles 1% polymer with no cement; temperature = 26.0°C after ~ 2 min.	--	
		1 day: Pasty; free water.	0	
	10 / 0.25%	**Time of Application**: Pasty; somewhat stiffer than 5/0.25%; very moist; minor free water.	--	
		1 day: Cakey; free water.	156	
	10 / 0.50%	**Time of Application**: Pasty; moist; no free water; somewhat stiffer than 5/0.5%	--	
		1 day: Hard; cakey; some water separation	219	
	10 / 1.0%	**Time of Application**: Similar to 5/1.0%; temperature = 26.8°C after ~ 3 min.	--	
		1 day: Moist; crumbly; some water release upon mixing.	31.3	

Table 2. Round 1: Cup Testing Results (Continued)

Agent	Applied Dose (w/w)	Observations	Strength Index (psf)	Recommended for Further Testing
Ground Corn Cobs	General Observations	Agent has low bulk density; potential concerns with ground corn dust if stored.	--	YES
	5%	Readily worked in; pasty; very moist; borderline free water	0	
	7.5%	Somewhat difficult to work in; pasty; moist; no free water.	0	
	10%	Difficult to work in; somewhat moist after intensive mixing; crumbly; temperature rise: 0.7°C.	81.3	
Fly Ash (Baghouse Outlet)	General Observations	No heat generation; mixed easily; uniform appearance; 5% had little change in consistency; as % increased, became slightly thicker.	--	NO
	5% - 1day	**1 day**: Soft, free liquid.	0	
	5% - 3day	**3 day**: No significant change.	0	
	10% - 1day	**1 day**: Soft, free liquid.	0	
	10% - 3day	**3 day**: No significant change.	0	
	15% - 1day	**1 day**: Somewhat stiffer than 10%; free liquid.	0	
	15% - 3day	**3 day**: No significant change.	0	
	20% - 1day	**1 day**: Stiffer still; a little free liquid.	0	
	20% - 3day	**3 day**: No significant change.	0	

Table 3. Round 2 Test Results – Area X Composite Sample

Sample ID	Solidification Agent	Application	Paint Filter Test	TCLP Characteristic Waste	TCLP Mercury (mg/L)	TCLP Lead (mg/L)	Moisture Content[(1)] (%)	Soil pH[(2)] (Std Units)	Density (g/mL)	Strength Index (psf)	Observations and Remarks
X-5	Cement	10%	Pass	No	0.0014	0.177	64%	10.43	1.18	13	Some water separation, pasty **(High pH)**
X-6	Cement	20%	Pass	No	0.000064	< 0.0069	56%	10.63	1.12	313	Dry, crumbly. No free standing water tightly packed after 1st mixing. **(High pH)**
X-13	Cement, Alum	15%/2%	Pass	No	0.0006	< 0.0069	58%	10.10	1.24	406	No standing water, very dry, very hard and stiff. Hardest sample to date. Once it is mixed it crumbles into small clumps like dirt. **(High pH)**
X-11	Cement, Na_2S, $FeCl_2$	10%	Pass	No	0.00061	0.238	65%	10.77	1.19	0.0	Free standing water present, stiff at first, moist when mixed. Large clumps, semi crumbly, semi moist, sticky. **(High pH)**
X-12	Cement, Na_2S, $FeCl_2$	20%	Pass	No	< 0.000056	< 0.0069	55%	10.88	1.28	438	Standing water present, stiff effort to mix, dry when mixed. Breaks apart into small clumps. **(High pH)**
X-7	Cement/ZappaTec	10%/0.25%	Pass	No	0.0085	0.142	63%	10.40	1.14	50	Cakey, no free standing water. Becomes pasty upon mixing **(High pH)**
X-8	Cement/ZappaTec	10%/0.5%	Pass	No	0.0022	0.11	63%	10.67	1.17	13	Some free standing water, cakey. Spongy, pasty upon remixing, some water pressed out upon remix. **(High pH)**
X-3	Corn Cobs	10%	Pass	No	< 0.000056	0.517	69%	5.58	1.13	0.0	Wetter than 1% polymer, almost like a wet soil, pasty, borderline free water. No hydrated granules. Holds its shape okay. **NOTE**: Expanded in TCLP container - pressed against lid; putrid odor.
X-4	Corn Cobs	20%	Pass	No	0.00014	0.352	63%	5.59	0.96	119	Stiffens quickly, not very forgiving for homogenization. Hard to set uniform. Quite dry relatively; clumpy, but no free water. Ground corn visible. **NOTE**: Expanded in TCLP container - pressed against lid; putrid odor.
X-14	Corn cobs, Alum	15%/2%	Pass	No	0.000058	0.743	57%	4.18	1.15	31	Free standing water, sticky, moist, wet, large sticky clumps. Sticks to spoon.
X-2	RTS-1 Polymer	1.0%	Pass	No	0.00017	1.23	74%	6.69	1.05	6.3	Stiffens but somewhat forgiving. Homogenizes okay, Easy to mix, not as many hydrated globules. RTS-1 is 50% polymer and 50% clay.
X-10	RTS-1 Polymer	2.0%	Pass	No	0.00034	1.29	73%	7.18	1.09	6.3	Clumpy, small clumps, not real moist, springy, bouncy, some hydrated globules, no free water, soft, moist to touch
X-1	ZappaTec Polymer	1.0%	Pass	No	0.00045	1.06	74%	6.81	1.02	13	Stiffens quickly but is forgiving. Homogenizes okay but requires 2 or 3 minutes manually. Hydrated globules present.
X-9	ZappaTec Polymer	1.5%	Pass	No	0.00034	1.13	74%	7.43	1.09	25	Clumpy, not sticky, fluffy, moist, bouncy, hydrated globules, no free water

KEY

- Best
- Relatively low or high value
- Fail Paint Filter or TCLP

Table 3. Round 2 Test Results – Area X Composite Sample (Continued)

Sample ID	Solidification Agent	Application	TCLP Concentrations (mg/L)									
			SILVER	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	MERCURY	LEAD	SELENIUM	ZINC
X-5	Cement	10%	< 0.0023	< 0.0098	0.658	0.0071	0.0152	0.118	0.0014	0.177	0.0114	1.21
X-6	Cement	20%	< 0.0023	< 0.0098	0.295	0.002	0.0557	1.25	6.4E-05	< 0.0069	0.0206	< 0.0081
X-13	Cement, Alum	15%/2%	< 0.0023	< 0.0098	0.452	< 0.002	0.0062	0.218	0.0006	< 0.0069	0.0094	0.0511
X-11	Cement, Na_2S, $FeCl_2$	10%	< 0.0023	< 0.0098	0.705	0.0051	0.0148	0.0758	0.00061	0.238	< 0.0089	1.25
X-12	Cement, Na_2S, $FeCl_2$	20%	< 0.0023	< 0.0098	0.315	< 0.002	0.0451	0.656	< 0.000056	< 0.0069	0.0179	< 0.0081
X-7	Cement/ZappaTec	10%/0.25%	< 0.0023	< 0.0098	0.622	0.0072	0.0176	0.202	0.0085	0.142	0.0184	1.3
X-8	Cement/ZappaTec	10%/0.5%	< 0.0023	< 0.0098	0.624	0.0044	0.0153	0.141	0.0022	0.11	0.0098	1.07
X-3	Corn Cobs	10%	< 0.0023	0.0185	0.237	0.0075	< 0.0034	0.543	< 0.000056	0.517	< 0.0089	1.12
X-4	Corn Cobs	20%	< 0.0023	< 0.0098	0.151	0.0061	0.0052	0.482	0.00014	0.352	< 0.0089	0.862
X-14	Corn cobs, Alum	15%/2%	< 0.0023	0.0149	0.127	0.009	0.0103	0.606	5.8E-05	0.743	< 0.0089	1.44
X-2	RTS-1 Polymer	1.0%	< 0.0023	0.0171	0.254	0.0102	0.0131	0.662	0.00017	1.23	< 0.0089	1.28
X-10	RTS-1 Polymer	2.0%	< 0.0023	0.0252	0.266	0.0056	0.0625	0.0707	0.00034	1.29	< 0.0089	0.753
X-1	ZappaTec Polymer	1.0%	< 0.0023	0.0201	0.266	0.0.0074	0.0191	0.538	0.00045	1.06	< 0.0089	1.02
X-9	ZappaTec Polymer	1.5%	< 0.0023	0.0273	0.278	0.0055	0.0186	0.0989	0.00034	1.13	< 0.0089	0.744
		EPA Limits:	**5.0 mg/l**	**5.0 mg/l**	**100 mg/l**	**1.0 mg/l**	**5.0 mg/l**	**N/A**	**0.2 mg/l**	**5.0 mg/l**	**1.0 mg/l**	**N/A**

Table 4. Round 2 Test Results – Area Y Composite Sample

Sample ID	Solidification Agent	Application	Paint Filer Test	TCLP Characteristic Waste	TCLP Mercury (mg/L)	TCLP Lead (mg/L)	Moisture Content[(1)] (%)	Soil pH[(2)] (Std Units)	Density (g/mL)	Strength Index (psf)	Observations and Remarks
Y-1	Cement	10%	Pass	No	0.000058	< 0.0069	65%	10.33	1.15	106	No free standing water, moist, semi- pasty, cakey. **(High pH)**
Y-2	Cement	20%	Pass	No	0.000058	< 0.0069	57%	10.85	1.11	531	Dry, very stiff, crumbly upon remix, no free standing water.**(High pH)**
Y-13	Cement, Alum	15%/2%	Pass	No	< 0.000056	< 0.0069	59%	10.40	1.21	450	No standing water, dry, hard and stiff. Once it is mixed it crumbles into small clumps like dirt. **(High pH)**
Y-11	Cement, Na_2S, $FeCl_2$	10%	Pass	No	< 0.000056	0.753	63%	10.87	1.18	0.0	Free standing water present, sticky, moist, wet, Large clumps, semi crumbly, sticks to spoon. **(High pH)**
Y-12	Cement, Na_2S, $FeCl_2$	20%	Pass	No	0.00017	0.182	57%	11.15	1.28	250	Very little standing water present, stiff, effort to mix, dry when mixed. Breaks apart into small clumps. **(High pH)**
Y-3	Cement/ZappaTec	10%/0.25%	Pass	No	0.0025	0.115	64%	10.47	1.16	56	No free standing water. Cakey and somewhat moist. Spongy, crumbly upon remixing and somewhat pasty. **(High pH)**
Y-4	Cement/ZappaTec	10%/0.5%	Pass	No	0.0126	0.143	63%	10.57	1.16	125	No free standing water. Stiff **(High pH). NOTE:** Expanded in TCLP container - pressed against lid; putrid odor.
Y-7	Corn Cobs	10%	Pass	No	0.000075	0.549	68%	5.82	1.15	0.0	Pasty, cakey, moisture. No free water, soft texture, semi stiff . **NOTE**: Expanded in TCLP container - pressed against lid; putrid odor.
Y-8	Corn Cobs	15%	Pass	No	0.00027	0.389	65%	5.60	1.15	31	Clumpy, semi-dry, corn cobs present in mix.
Y-14	Corn cobs, Alum	15%/2%	Pass	No	< 0.000056	0.703	64%	4.25	1.13	25	No free standing water, sticky, moist, wet, large sticky clumps. Sticks to spoon, odor of sulfide
Y-6	RTS-1 Polymer	1.0%	Pass	No	0.00048	1.06	73%	7.03	1.08	13	Crumbly but pasty, sticks to spoon. No free water.
Y-10	RTS-1 Polymer	2.0%	Pass	No	0.0011	2.04	72%	7.05	1.09	31	Real Springy, bouncy, semi dry, some hydrated globules, less moist. No standing water, crumbly, not sticky
Y-5	ZappaTec Polymer	1.0%	Pass	No	0.0016	1.3	73%	7.26	1.03	25	Stiffens quickly, crumbly, spongy, no free water, hydrated globules present.
Y-9	ZappaTec Polymer	1.5%	Pass	No	0.0036	1.28	72%	7.10	1.11	38	Bouncy Springy, semi dry, some hydrated globules, less moist, no free water, crumbly not sticky

KEY

- Best
- Relatively low or high value
- Fail Paint Filter or TCLP

Table 4. Round 2 Test Results – Area Y Composite Sample (Continued)

Sample ID	Solidification Agent	Application	TCLP Concentrations (mg/L)									
			SILVER	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	MERCURY	LEAD	SELENIUM	ZINC
Y-1	Cement	10%	< 0.0023	< 0.0098	0.277	< 0.0020	0.0291	0.804	0.000058	< 0.0069	0.0145	< 0.0081
Y-2	Cement	20%	< 0.0023	< 0.0098	0.391	< 0.0020	0.0464	1.06	0.000058	< 0.0069	0.009	< 0.0081
Y-13	Cement, Alum	15%/2%	< 0.0023	< 0.0098	0.318	< 0.0020	0.0348	0.229	< 0.000056	< 0.0069	0.0107	< 0.0081
Y-11	Cement, Na_2S, $FeCl_2$	10%	< 0.0023	0.0147	0.133	0.0089	0.0089	0.595	< 0.000056	0.753	< 0.0089	1.45
Y-12	Cement, Na_2S, $FeCl_2$	20%	< 0.0023	< 0.0098	0.696	0.005	0.0122	0.0661	0.00017	0.182	< 0.0089	1.28
Y-3	Cement/ZappaTec	10%/0.25%	0.0023	< 0.0098	0.717	0.0048	0.0118	0.144	0.0025	0.115	< 0.0089	1.2
Y-4	Cement/ZappaTec	10%/0.5%	< 0.0023	< 0.0098	0.687	0.0049	0.015	0.178	0.0126	0.143	< 0.0089	1.26
Y-7	Corn Cobs	10%	< 0.0023	0.0158	0.354	0.0087	0.0123	0.826	0.000075	0.549	< 0.0089	1.47
Y-8	Corn Cobs	15%	0.0024	0.0158	0.304	0.0074	0.0064	0.828	0.00027	0.389	< 0.0089	1.26
Y-14	Corn cobs, Alum	15%/2%	< 0.0023	0.0165	0.115	0.0083	0.0085	0.595	< 0.000056	0.703	< 0.0089	1.48
Y-6	RTS-1 Polymer	1.0%	< 0.0023	0.0321	0.352	0.0051	0.0148	0.316	0.00048	1.06	< 0.0089	0.991
Y-10	RTS-1 Polymer	2.0%	< 0.0023	0.0413	0.382	0.0052	0.0219	0.14	0.0011	2.04	< 0.0089	0.891
Y-5	ZappaTec Polymer	1.0%	< 0.0023	0.037	0.383	0.0049	0.0191	0.291	0.0016	1.3	< 0.0089	0.951
Y-9	ZappaTec Polymer	1.5%	< 0.0023	0.0382	0.346	0.0038	0.0187	0.197	0.0036	1.28	< 0.0089	0.801
		EPA Limits:	**5.0 mg/l**	**5.0 mg/l**	**100 mg/l**	**1.0 mg/l**	**5.0 mg/l**	**N/A**	**0.2 mg/l**	**5.0 mg/l**	**1.0 mg/l**	**N/A**

Table 5. Round 2 Test Results – Area Z Composite Sample

Sample ID	Solidification Agent	Application	Paint Filer Test	TCLP Characteristic Waste	TCLP Mercury (mg/L)	TCLP Lead (mg/L)	Moisture Content[(1)] (%)	Soil pH[(2)] (Std Units)	Density (g/mL)	Strength Index (psf)	Observations and Remarks
Z-1	Cement	10%	Pass	No	0.00044	0.073	65%	10.40	1.14	63	No free standing water, moist, pasty, spongy. Seems to lose strength when tamping down **(High pH).**
Z-2	Cement	20%	Pass	No	0.000056	< 0.0069	57%	10.81	1.15	469	Dry, stiff, crumbly, no free standing water. **(High pH)**
Z-13	Cement, Alum	15%/2%	Pass	No	0.00014	< 0.0069	61%	10.52	1.25	538	No standing water, dry, hard and stiff. Once it is mixed it crumbles into small clumps like dirt. **(High pH)**
Z-11	Cement, Na_2S, $FeCl_2$	10%	Pass	No	< 0.000056	0.058	66%	10.88	1.20	13	No free standing water present, semi dry, not too stiff, easy to mix, semi sticky, gets moist when mixed.**(High pH)**
Z-12	Cement, Na_2S, $FeCl_2$	20%	Pass	No	< 0.000056	< 0.0069	58%	10.99	1.29	406	No standing water present, dry, hard, stiff, effort to mix, dry when mixed. Breaks apart into small clumps. **(High pH)**
Z-3	Cement/ZappaTec	10%/0.25%	Pass	No	0.000065	< 0.0069	64%	10.37	1.09	156	No free standing water. Mostly dry, cakey. Spongy, crumbly upon remixing and somewhat pasty. **(High pH)**
Z-4	Cement/ZappaTec	10%/0.5%	Pass	No	0.000059	< 0.0069	64%	10.27	1.05	131	No free standing water. Mostly dry, cakey. Spongy, crumbly upon remixing and somewhat pasty. **(High pH)**
Z-7	Corn Cobs	10%	Pass	No	< 0.000056	0.0965	69%	5.71	1.14	0.0	Wet, moist, smooth, creamy, soft texture, not stiff, no standing water. **NOTE**: Expanded in TCLP container - pressed against lid; putrid odor.
Z-8	Corn Cobs	15%	Pass	No	< 0.000056	0.0917	66	5.67	1.15	31	Dry, clumpy, semi-sticky, smooth surface area. Feels like bread dough. No standing water. **NOTE**: Expanded in TCLP container - pressed against lid; putrid odor.
Z-14	Corn cobs, Alum	15%/2%	Pass	No	< 0.000056	0.213	66%	4.07	1.15	38	No free standing water, sticky, moist, wet, large sticky clumps. Sticks to spoon.
Z-6	RTS-1 Polymer	1.0%	Pass	No	0.00054	0.138	73%	7.15	1.14	13	Fluffy, spongy, moist. No standing water, hydrated globules present. Sticky, sticks to everything, very mess
Z-10	RTS-1 Polymer	2.0%	Pass	No	0.00011	0.576	68%	7.19	1.08	31	Crumbly, spongy, springy, does not stick to spoon, semi moist, no free water, hydrated globules.
Z-5	ZappaTec Polymer	1.0%	Pass	No	0.0012	0.213	73%	7.20	1.10	25	Stiffens quickly, removes moisture and dries sediment quickly. Crumbly but not too spongy. Hydrated globules.
Z-9	ZappaTec Polymer	1.5%	Pass	No	0.0005	0.367	71%	7.22	1.08	31	Spongy, clumpy, springy, hydrated globules present. No standing water, semi-moist

KEY

Best

Relatively low or high value

Fail Paint Filter or TCLP

Table 5. Round 2 Test Results – Area Z Composite Sample (Continued)

Sample ID	Solidification Agent	Application	TCLP Concentrations (mg/L)									
			SILVER	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	MERCURY	LEAD	SELENIUM	ZINC
Z-1	Cement	10%	< 0.0023	< 0.0098	0.811	0.0062	0.0162	0.085	0.00044	0.073	< 0.0089	1.42
Z-2	Cement	20%	< 0.0023	< 0.0098	0.375	< 0.0020	0.031	0.41	0.000056	< 0.0069	< 0.0089	< 0.0081
Z-13	Cement, Alum	15%/2%	< 0.0023	< 0.0098	0.344	< 0.0020	0.0105	0.275	0.00014	< 0.0069	0.009	0.0085
Z-11	Cement, Na_2S, $FeCl_2$	10%	< 0.0023	< 0.0098	0.69	0.0028	0.0101	0.0543	< 0.000056	0.058	< 0.0089	1.16
Z-12	Cement, Na_2S, $FeCl_2$	20%	< 0.0023	< 0.0098	0.307	< 0.0020	0.0399	0.209	< 0.000056	< 0.0069	< 0.0089	< 0.0081
Z-3	Cement/ZappaTec	10%/0.25%	0.0035	< 0.0098	0.219	< 0.0020	0.0404	0.59	0.000065	< 0.0069	< 0.0089	< 0.0081
Z-4	Cement/ZappaTec	10%/0.5%	< 0.0023	< 0.0098	0.22	< 0.0020	0.0342	0.451	0.000059	< 0.0069	< 0.0089	< 0.0081
Z-7	Corn Cobs	10%	< 0.0023	0.0195	0.28	0.0068	0.0049	0.18	< 0.000056	0.0965	< 0.0089	1.4
Z-8	Corn Cobs	15%	< 0.0023	0.0175	0.189	0.0063	0.0065	0.198	< 0.000056	0.0917	< 0.0089	1.3
Z-14	Corn cobs, Alum	15%/2%	< 0.0023	0.0149	0.143	0.0071	0.0093	0.229	< 0.000056	0.213	< 0.0089	1.55
Z-6	RTS-1 Polymer	1.0%	< 0.0023	0.0285	0.381	0.0042	0.0108	0.0848	0.00054	0.138	< 0.0089	1.05
Z-10	RTS-1 Polymer	2.0%	< 0.0023	0.032	0.313	0.0034	0.0275	0.0658	0.00011	0.576	< 0.0089	0.882
Z-5	ZappaTec Polymer	1.0%	< 0.0023	0.0291	0.444	0.003	0.186	0.0805	0.0012	0.213	< 0.0089	0.925
Z-9	ZappaTec Polymer	1.5%	< 0.0023	0.0274	0.295	0.0027	0.0226	0.0801	0.0005	0.367	< 0.0089	0.781
		EPA Limits:	**5.0 mg/l**	**5.0 mg/l**	**100 mg/l**	**1.0 mg/l**	**5.0 mg/l**	**N/A**	**0.2 mg/l**	**5.0 mg/l**	**1.0 mg/l**	**N/A**

Table 6. Round 2 Test Results – Area P Composite Sample

Sample ID	Solidification Agent	Application	Paint Filer Test	TCLP Characteristic Waste	TCLP Mercury (mg/L)	TCLP Lead (mg/L)	Moisture Content[(1)] (%)	Soil pH[(2)] (Std Units)	Density (g/mL)	Strength Index (psf)	Observations and Remarks
P-1	Cement	5%	Pass	No	0.00021	< 0.0069	66%	9.45	1.18	13	Moist, sticky, wet, clumpy, spongy, slight fishy odor, sticks to spoon, mushy **(High pH)**
P-2	Cement	10%	Pass	No	0.0003	0.182	61%	9.87	1.19	94	Crumbly, semi-dry but somewhat moist. Does not stick to spoon. Small clumps no free standing water. **(High pH)**
P-13	Cement, Alum	7.5%/1%	Pass	No	0.0002	0.341	65%	9.98	1.20	275	No standing water, dry, hard and stiff. Once it is mixed it crumbles into small clumps like dirt. **(High pH)**
P-11	Cement, Na_2S, $FeCl_2$	5%	Pass	No	0.00008	0.401	69%	10.22	1.15	94	No free standing water present, stiff at first, but easy to mix. Moist and sticky after mixed. Large clumps. Sticks to spoon. **(High pH)**
P-12	Cement, Na_2S, $FeCl_2$	10%	Pass	No	0.00025	0.133	63%	10.58	1.20	188	No standing water present, dry, hard, effort to mix, dry when mixed. Breaks apart into small clumps.**(High pH)**
P-3	Cement/ZappaTec	5%/0.25%	Pass	No	0.000088	0.135	71%	6.07	1.15	0.0	Standing water present, wet, mushy, pasty
P-4	Cement/ZappaTec	5%/0.5%	Pass	No	0.00035	0.096	60%	10.05	1.21	144	Hard, clumpy, crumbly, and dry
P-7	Corn Cobs	10%	Pass	No	0.00061	0.0998	66%	5.58	1.14	94	Clumpy, sticky, moist, not bouncy, not springy, easy to pack and mold. No free standing water. **Note**: Expanded; putrid odor.
P-8	Corn Cobs	15%	Pass	No	0.00029	0.0922	63%	5.54	0.91	63	Crumbly, dry, not sticky, not springy, packs good, no free standing water. **Note**: Expanded; putrid odor.
P-14	Corn cobs, Alum	7.5%/1%	Pass	No	< 0.000056	0.156	65%	4.72	1.15	75	No free standing water, sticky, moist, wet, large sticky clumps. Sticks to spoon.
P-6	RTS-1 Polymer	1%	Pass	No	0.001	0.377	71%	6.69	1.08	44	Bouncy, clumpy, semi-dry, breaks apart into small pieces when stirred. No standing water, some hydrated globules.
P-10	RTS-1 Polymer	1.5%	Pass	No	0.0005	0.349	72%	6.74	1.10	94	Small clumps, breaks up easy, does not stick to spoon, semi-moist, hydrated globules present. No free water, very good results, similar to top soil.
P-5	ZappaTec Polymer	1%	Pass	No	0.0022	0.356	70%	6.85	1.05	94	Crumbly, dry, fluffy, lighter weight, not too springy, looks like top soil, no standing water, hydrated globules present.
P-9	ZappaTec Polymer	0.75%	Pass	No	0.00053	0.22	70%	6.57	1.11	75	Clumpy, big clumps, sticky, less bouncy, a little spongy, less hydrated globules, no free water, semi-moist.

KEY

- Best
- Relatively low or high value
- Fail Paint Filter or TCLP

Table 6. Round 2 Test Results – Area P Composite Sample (Continued)

Sample ID	Solidification Agent	Application	TCLP Concentrations (mg/L)									
			SILVER	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	MERCURY	LEAD	SELENIUM	ZINC
P-1	Cement	5%	< 0.0023	0.0119	0.24	< 0.0020	0.0059	0.0596	0.00021	< 0.0069	0.013	0.0139
P-2	Cement	10%	< 0.0023	< 0.0098	0.521	0.0045	0.0348	0.187	0.0003	0.182	0.0163	0.829
P-13	Cement, Alum	7.5%/1%	< 0.0023	< 0.0098	0.571	0.0056	0.0411	0.301	0.0002	0.341	< 0.0089	1.05
P-11	Cement, Na_2S, $FeCl_2$	5%	< 0.0023	< 0.0098	0.548	0.0051	0.0325	0.2	0.00008	0.401	< 0.0089	0.881
P-12	Cement, Na_2S, $FeCl_2$	10%	< 0.0023	< 0.0098	0.538	0.0034	0.0193	0.263	0.00025	0.133	< 0.0089	0.644
P-3	Cement/ZappaTec	5%/0.25%	< 0.0023	< 0.0098	0.167	< 0.0020	< 0.0034	0.0733	0.000088	0.135	< 0.0089	0.357
P-4	Cement/ZappaTec	5%/0.5%	< 0.0023	< 0.0098	0.504	< 0.0020	0.034	0.158	0.00035	0.096	0.0131	0.615
P-7	Corn Cobs	10%	< 0.0023	0.0136	0.2	< 0.0020	< 0.0034	0.142	0.00061	0.0998	< 0.0089	0.366
P-8	Corn Cobs	15%	< 0.0023	0.0166	0.246	< 0.0020	0.0046	0.19	0.00029	0.0922	< 0.0089	0.305
P-14	Corn cobs, Alum	7.5%/1%	< 0.0023	0.0135	0.235	< 0.0020	< 0.0034	0.155	< 0.000056	0.156	< 0.0089	0.369
P-6	RTS-1 Polymer	1%	< 0.0023	0.0183	0.22	< 0.0020	0.0095	0.0777	0.001	0.377	< 0.0089	0.279
P-10	RTS-1 Polymer	1.5%	< 0.0023	0.0185	0.182	< 0.0020	0.0062	0.0678	0.0005	0.349	< 0.0089	0.22
P-5	ZappaTec Polymer	1%	< 0.0023	0.0184	0.182	< 0.0020	0.0091	0.108	0.0022	0.356	< 0.0089	0.301
P-9	ZappaTec Polymer	0.75%	< 0.0023	0.0172	0.193	< 0.0020	0.0057	0.07	0.00053	0.22	< 0.0089	0.241
		EPA Limits:	**5.0 mg/l**	**5.0 mg/l**	**100 mg/l**	**1.0 mg/l**	**5.0 mg/l**	**N/A**	**0.2 mg/l**	**5.0 mg/l**	**1.0 mg/l**	**N/A**

Table 7. Advantages and Disadvantages for Various Solidification Treatments Based on Round 2 Testing of Area Composite Samples[1]

Agent	Paint Filter Test		TCLP		Moisture Content	Soil pH	Unit Weight	Strength Index
	Time Zero	Ultimate	Mercury	Lead				
Criteria	A: Pass D: Fail	A: Pass D: Fail	A: < 0.0001 mg/L D: > 0.01 mg/L	A: < 0.1 mg/L D: > 1 mg/L	A: < 60% D: > 70%	A: 6-9 D: < 5 or > 10	D: < 1 g/mL	A: > 200 psf D: < 50 psf
Cement	D	A	A	A[3]	A[3]	D	↔	A[3]
Cement + Alum	A	A	↔	A	A	D[4]	↔	A
Cement + $FeCl_2$ + Na_2S	D	A	A	A	↔	D	↔	A[5]
Cement + ZappaTec Low End	D	A	↔[6]	↔/A	↔	D	↔	D
Ground Corn Cobs	A	A	↔/A	↔	↔	↔	D	D
Ground Corn Cobs + Alum	A	A	A	↔	↔	D	↔	D
RTS-1 Polymer	A	A	↔	D	D	A	↔	D
ZappaTec Low End Polymer	A	A	↔	D	D	A	↔	D

[1] Criteria established to assist in comparison of performance between alternatives. "A" = Advantage; "D" = Disadvantage; "↔" = Between the criteria for Advantage and Disadvantage (or > 1 g/mL for Unit Weight)

[2] All treatments resulted in acceptable TCLP concentrations for all metals

[3] 20% application (Area X, Y, and Z)

[4] Alum provides some pH attenuation

[5] 20% cement

[6] Results varied by area

Table 8. Round 3 Testing: Day 0 Results and Observations

Test Area	Sample ID	Agent	Application	Time Zero Paint Filter Test	Time Zero Strength Index (psf)	Time Zero Observations
Area-X	X-1	ZappaTec Polymer	1%	Pass	0.0	Semi dry, large clumps when stirred, spongy, hydrated globules present
		Cement	20%	Fail	0.0	Wet, mushy, soft, with some standing water.
		Cement	10%	Fail	0.0	Wet, mushy, soft, and sticky.
Area-Y	Y-2	ZappaTec Polymer	1%	Pass	0.0	Moist, spongy, sticky, large clumps when stirred, semi-stiff, hydrated globules present
		Cement	20%	Fail	0.0	Wet, soupy, mushy, soft, some standing water present
		Cement	10%	Fail	0.0	Wet, mushy, soft, with standing water present.
Area-Z	Z-1	ZappaTec Polymer	1%	Pass	0.0	Wet at first but dried quickly after addition of polymer. The sediment clumped up and became spongy.
		Cement	20%	Fail	0.0	Wet, mushy, soft, muddy looking, with standing water present.
		Cement	10%	Fail	0.0	Wet; cement made very little difference in the sample appearance at time zero.
Area-P	P-1	ZappaTec Polymer	1%	Pass	93.8	Dry, clumpy, hard to mix, not sticky, some hydrated globules present.
		Cement	10%	Pass	12.5	Stiff when mixing, sticky, semi-moist, not clumpy, no standing water present.
		Cement	5%	Fail	0.0	Wet, mushy, sticky, soft, no standing water present.

KEY

	Best
	Relatively low or high value
	Fail Paint Filter or TCLP

Table 9. Round 3 Testing: Day 1 Results and Observations

Test Area	Sample ID	Agent	Application	1st Day Paint Filter Test	1st Day Strength Index (psf)	1st Day Observations
Area-X	X-1	ZappaTec Polymer	1%	Pass	0.0	Still moist, sticky, springy, bigger hydrated globules, and wetter than at time zero.
		Cement	20%	Pass	218.8	Standing water on the hardened surface. Stiff, hard, strong, when mixed makes small clumps, not sticky, and crumbles easily.
		Cement	10%	Pass	31.3	Standing water on surface when opened. Easy to mix, wetter and softer than 20% mixes.
Area-Y	Y-2	ZappaTec Polymer	1%	Pass	0.0	Moist, wet, mushy, sticky, enlarged hydrated globules present.
		Cement	20%	Pass	250.0	Standing water on the hardened surface. Stiff, hard, strong, when mixed makes small clumps, not sticky, and crumbles easily.
		Cement	10%	Pass	31.3	Standing water on surface when opened. Easy to mix, wetter and softer than 20% mixes.
Area-Z	Z-1	ZappaTec Polymer	1%	Pass	0.0	Mushy, wet, wetter than the time zero mix, sticky, big clumps.
		Cement	20%	Pass	156.3	Standing water on the hardened surface. Stiff, hard, strong, when mixed makes small clumps, not sticky, and crumbles easily.
		Cement	10%	Pass	12.5	Standing water on top of surface, sticky, moist, big clumps.
Area-P	P-1	ZappaTec Polymer	1%	Pass	93.8	Clumpy but not sticky, globules present. No change from time zero, although the sample appears bouncy, spongy, and springy it feels fairly stiff when mixed.
		Cement	10%	Pass	312.5	Dry, crumbles easily when mixed. Not sticky, small clumps after mixing.
		Cement	5%	Pass	93.8	No standing water present.

KEY

Best

Relatively low or high value

Fail Paint Filter or TCLP

Table 10. Round 3 Testing: Final Results and Observations

Test Area	Sample ID	Agent	Application	3rd Day Paint Filter Test	TCLP Characteristic Waste	TCLP Mercury (mg/L)	TCLP Lead (mg/L)	Average Moist Content	Soil pH Distilled Water	Density (g/mL)	3rd Day Strength Index (psf)	3rd Day Observations
Area-X	X-1	ZappaTec Polymer	1.0%	Pass	No	0.034	2.23	67%	6.94	1.19	0.0	Wet, mushy, sticks to the spoon, big wet clumps when mixed.
		Cement	20%	Pass	No	<0.000056	<0.069	54%	11.24	1.32	468.7	Fairly dry, small clumps when mixed, stiff, requires some effort to break up and mix with a large spoon.
		Cement	10%	Pass	No	N/A	N/A	60%	10.99	1.29	62.5	Semi dry, moist, sticky, but stiff. Clumps when mixed.
Area-Y	Y-2	ZappaTec Polymer	1.0%	Pass	No	0.0017	1.93	69%	7.13	1.12	0.0	Mushy, wet, sticky, large sticky clumps when mixed. Large hydrated globules present. Spongy and bouncy
		Cement	20%	Pass	No	<0.000056	0.231	56%	11.31	1.29	562.5	Dry, hard, stiff, small clumps, easy to crush, no odors, good sample results.
		Cement	10%	Pass	No	N/A	N/A	62%	11.13	1.22	50.0	Mushy, sticky, wet, soft, and not clumpy
Area-Z	Z-1	ZappaTec Polymer	1.0%	Pass	No	0.0005	0.55	77%	7.25	1.09	0.0	Soft, mushy, wet, bouncy, fluffy, hydrated globules present, not stiff, sticky.
		Cement	20%	Pass	No	<0.000056	0.349	63%	11.43	1.25	343.8	Dry, stiff, hard, small clumps when mixed. Breaks up but requires some effort.
		Cement	10%	Pass	No	N/A	N/A	70	11.19	1.18	31.2	Sticky, moist, clumpy, semi dry. Very easy to break into clumps.
Area-P	P-1	ZappaTec Polymer	1.0%	Pass	No	0.0012	0.669	73%	6.60	1.05	100.0	Fluffy, spongy, bouncy, not sticky. Crumbles into small clumps. Large hydrated globules present. Semi stiff
		Cement	10%	Pass	No	0.00047	0.208	65%	11.13	1.19	293.8	Semi-dry, clumpy, easier to break up. Small clumps, semi-stiff, not too moist.
		Cement	5%	Pass	No	N/A	N/A	71%	10.34	1.16	112.5	Semi-soft, sticky, large clumps when mixed. Sticks to mixing spoon.

KEY

- Best
- Relatively low or high value
- Fail Paint Filter or TCLP

Table 10. Round 3 Testing: Final Results and Observations (Continued)

Test Area	Sample ID	Agent	Application	TCLP Concentrations (mg/L)										LAB SAMPLE ID
				SILVER	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	MERCURY	LEAD	SELENIUM	ZINC	
Area-X	X-1	ZappaTec Polymer	1.0%	<0.0023	0.0298	0.393	0.0083	0.0216	1.04	0.034	2.23	<0.0089	1.13	X-1ZT-1
		Cement	20%	<0.0023	<0.0098	0.67	<0.002	0.0395	0.956	<0.000056	<0.069	0.0198	<-0.0081	X-120C-1
Area-Y	Y-2	ZappaTec Polymer	1.0%	<0.0023	0.0392	0.356	0.0075	0.0199	0.825	0.0017	1.93	<0.0089	1.25	Y-2ZT-1
		Cement	20%	<0.0023	<0.0098	0.421	<0.002	0.0515	1.15	<0.000056	0.231	0.02	<-0.0081	Y-220C-1
Area-Z	Z-1	ZappaTec Polymer	1.0%	<0.0023	0.033	0.426	0.0056	0.0265	0.219	0.0005	0.55	<0.0089	1.19	Z-1ZT-1
		Cement	20%	<0.0023	<0.0098	0.461	<0.002	0.038	0.409	<0.000056	0.349	<0.0089	<-0.0081	Z-120C-1
Area-P	P-1	ZappaTec Polymer	1.0%	<0.0023	0.0204	0.199	<0.002	0.0069	0.27	0.0012	0.669	0.0114	0.354	P-1ZT-1
		Cement	10%	<0.0023	<0.0098	0.776	0.0045	0.0221	0.188	0.00047	0.208	0.177	0.812	P-120C-1
			EPA Limits:	**5.0 mg/l**	**5.0 mg/l**	**100 mg/l**	**1.0 mg/l**	**5.0 mg/l**	**N/A**	**0.2 mg/l**	**5.0 mg/l**	**1.0 mg/l**	**N/A**	

Table 11. Cement Short-Term Solidification Test Results

Cement Set-Up Test 10/8/10		X-1			Y-2			Z-1			P-1		
Cement %		10%	20%	10%	10%	20%	10%	10%	20%	10%	5%	10%	5%
Alum %		--	--	2%	--	--	2%	--	--	2%	--	--	1%
T_0	PFT	FAIL	FAIL	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS
	SI (psf)	0	0	0	0	0	0	0	0	0	0	0	0
T_1	Elapsed (hr)	2.6	2.6	2.5	2.4	2.3	2.2	2.9	2.8	2.7	2.6	2.5	2.3
	PFT	PASS	FAIL	PASS	FAIL	FAIL	PASS	FAIL	FAIL	PASS	--	--	--
	SI (psf)	0	0	6	0	0	0	0	0	0	19	88	63
T_2	Elapsed (hr)	6.8	6.7	6.6	6.5	6.3	6.3	6.2	6.1	6.1	5.9	5.8	5.7
	PFT	--	PASS	--	FAIL	FAIL	--	FAIL	FAIL	--	--	--	--
	SI (psf)	0	0	44	0	0	0	0	0	50	50	94	62.5

NOTE: Once sample passed paint filter test, it was not tested at subsequent time points (exception: X-1, 10% cement/2% alum, T_0 and T_1 time points) and was considered to pass paint filter test at all subsequent time points.

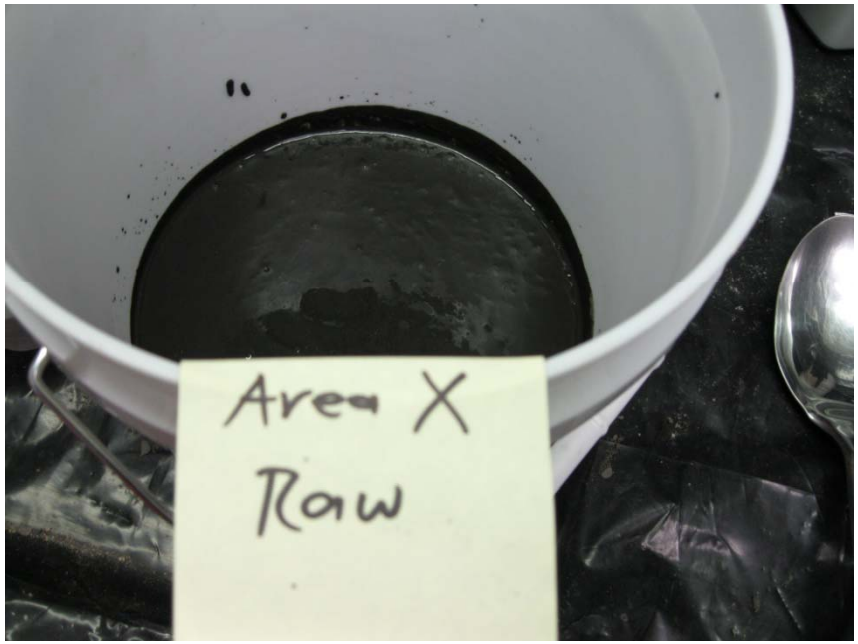
Attachment 1

Photographs from Round 2 Testing
Area X

ROUND 2 TESTING

Area X Composite Sample

Area X Raw Composite Sample



Area X Raw Composite Sample

ROUND 2 TESTING

Area X Composite Sample

X-1*

ZappaTec Low End Polymer, 1.0%

X-2*

RTS-1 Polymer, 1.0%

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area X Composite Sample

X-3*

Ground Corn Cobs, 10%

X-4*

Ground Corn Cobs, 20%

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area X Composite Sample

X-5

Ordinary Portland Cement (OPC), 10%

X-6

OPC, 20%

ROUND 2 TESTING

Area X Composite Sample

X-7

10% OPC + 0.25% ZappaTec Low End Polymer

X-8

10% OPC + 0.5% ZappaTec Low End Polymer

ROUND 2 TESTING

Area X Composite Sample

X-9

ZappaTec Low End Polymer, 1.5%

X-10

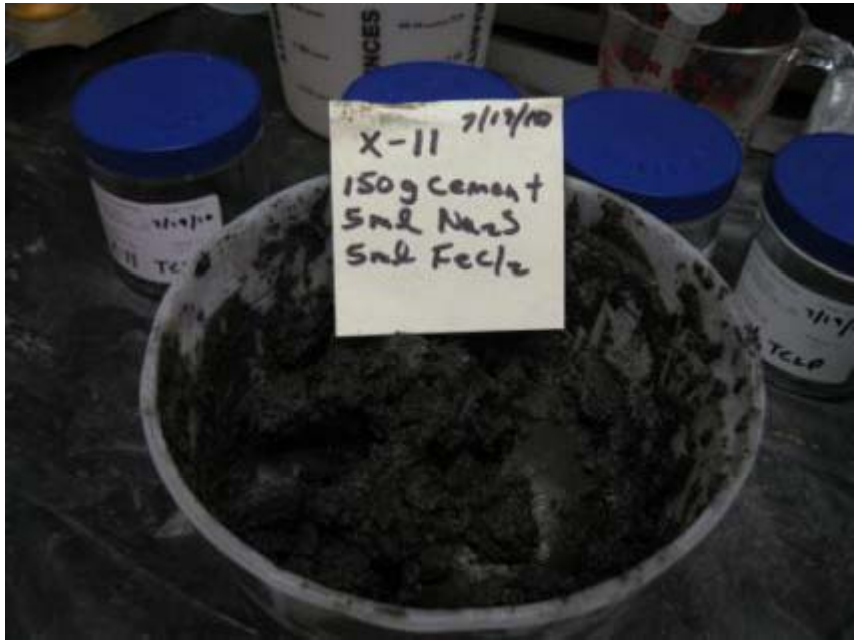
RTS-1 Polymer, 2.0%

ROUND 2 TESTING

Area X Composite Sample

X-11

OPC (10%) + $FeCl_2$ + $Na2_S$



X-12

OPC (20%) + $FeCl_2$ + $Na2_S$

ROUND 2 TESTING

Area X Composite Sample

X-13

15% OPC + 2.0% Alum

X-14

15% Ground Corn Cobs + 2.0% Alum

ROUND 2 TESTING

Area X Composite Sample

Dried Treated Sediment

Attachment 2

Photographs from Round 2 Testing
Area Y

ROUND 2 TESTING

Area Y Composite Sample

Area Y Raw Composite Sample

Area Y Raw Composite Sample

ROUND 2 TESTING

Area Y Composite Sample

Y-1*

Ordinary Portland Cement (OPC), 10%

Y-2*

OPC, 20%

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area Y Composite Sample

Y-3*

10% OPC + 0.25% ZappaTec Low End Polymer

- No Pictures available

Y-4*

10% OPC + 0.5% ZappaTec Low End Polymer

- No pictures available

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

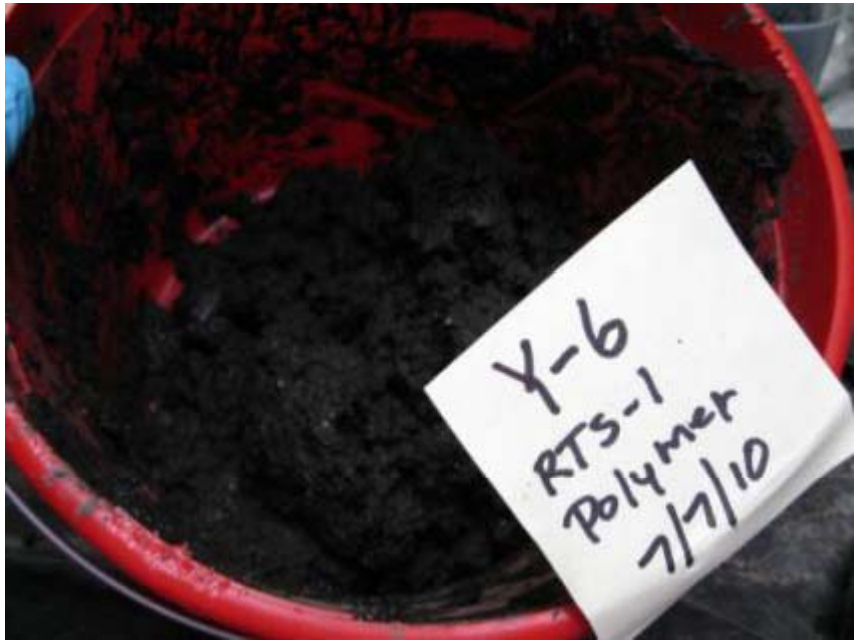
Area Y Composite Sample

Y-5

ZappaTec Low End Polymer, 1.0%

Y-6

RTS-1 Polymer, 1.0%



ROUND 2 TESTING

Area Y Composite Sample

Y-7

Ground Corn Cobs, 10%

Y-8

Ground Corn Cobs, 15%

ROUND 2 TESTING

Area Y Composite Sample

Y-9

ZappaTec Low End Polymer, 1.5%

Y-10

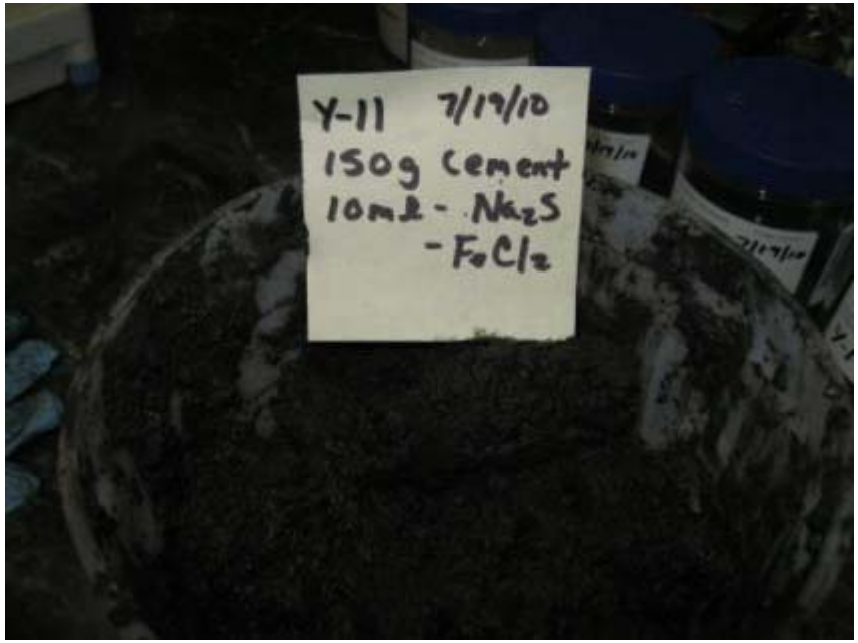
RTS-1 Polymer, 2.0%

ROUND 2 TESTING

Area Y Composite Sample

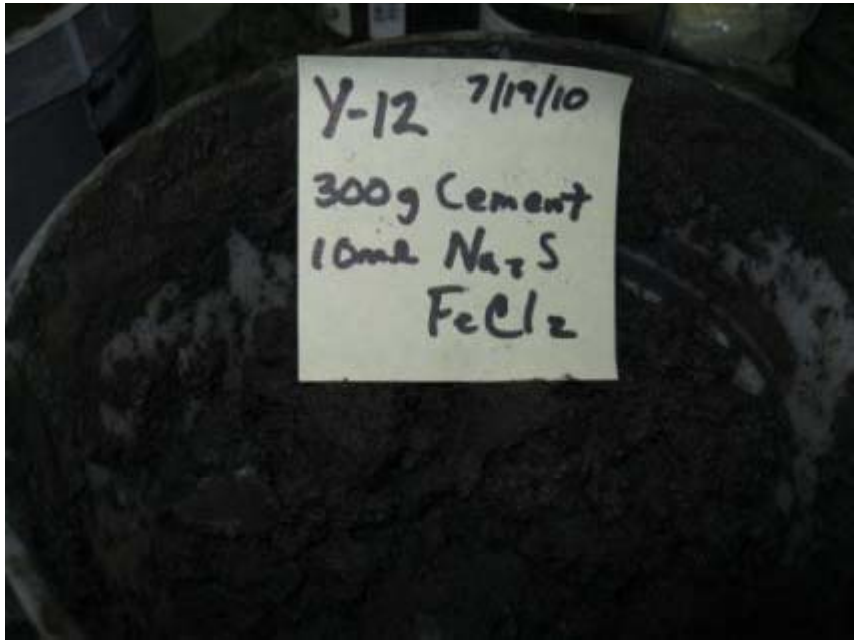
Y-11

OPC (10%) + $FeCl_2$ + $Na2_S$



Y-12

OPC (20%) + $FeCl_2$ + $Na2_S$



ROUND 2 TESTING

Area Y Composite Sample

Y-13

15% OPC + 2.0% Alum

Y-14

15% Ground Corn Cobs + 2.0% Alum

ROUND 2 TESTING

Area Y Composite Sample

Dried Treated Sediment

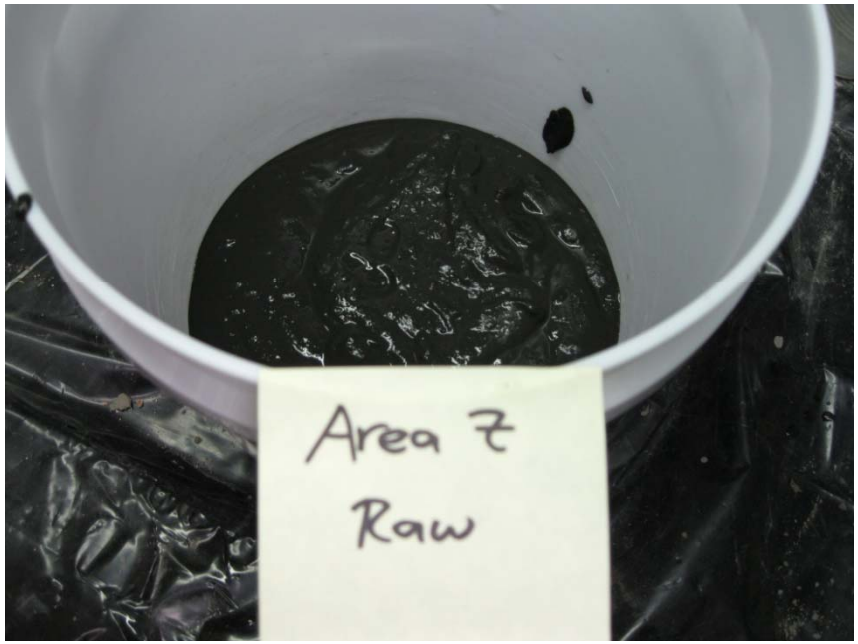
Attachment 3

Photographs from Round 2 Testing
Area Z

ROUND 2 TESTING

Area Z Composite Sample

Area Z Raw Composite Sample



Area Z Raw Composite Sample

ROUND 2 TESTING

Area Z Composite Sample

Z-1*

Ordinary Portland Cement (OPC), 10%

Z-2*

OPC, 20%

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area Z Composite Sample

Z-3*

10% OPC + 0.25% ZappaTec Low End Polymer

Z-4*

10% OPC + 0.5% ZappaTec Low End Polymer

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area Z Composite Sample

Z-5

ZappaTec Low End Polymer, 1.0%

Z-6

RTS-1 Polymer, 1.0%

ROUND 2 TESTING

Area Z Composite Sample

Z-7

Ground Corn Cobs, 10%

- No pictures available

Z-8

Ground Corn Cobs, 15%

- No picture available

ROUND 2 TESTING

Area Z Composite Sample

Z-9

ZappaTec Low End Polymer, 1.5%

Z-10

RTS-1 Polymer, 2.0%

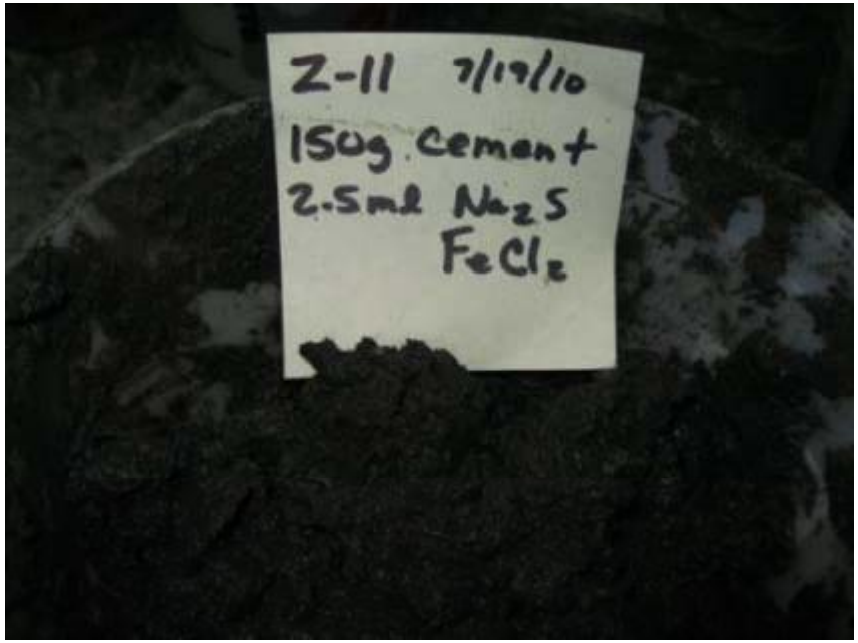
- No picture available

ROUND 2 TESTING

Area Z Composite Sample

Z-11

OPC (10%) + $FeCl_2$ + $Na2_S$



Z-12

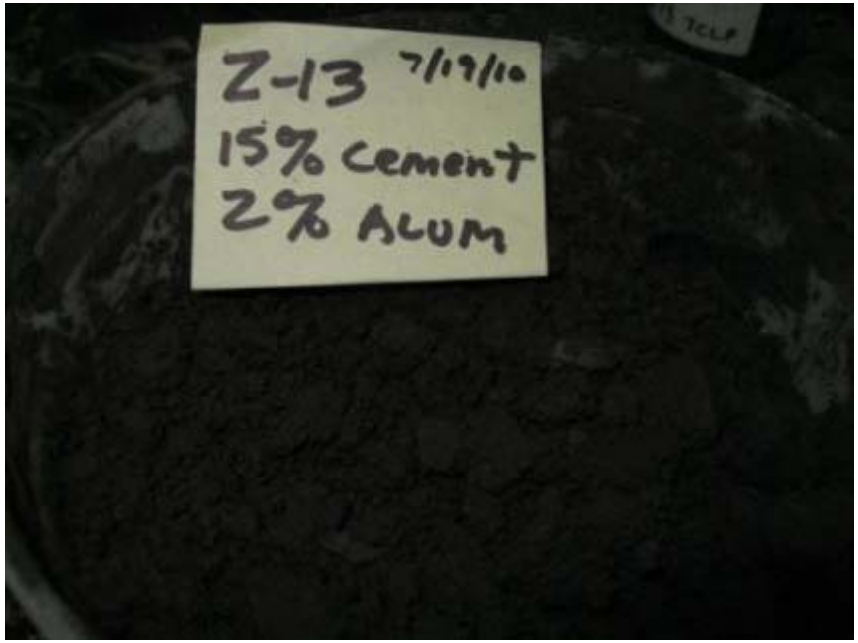
OPC (20%) + $FeCl_2$ + $Na2_S$

ROUND 2 TESTING

Area Z Composite Sample

Z-13

15% OPC + 2.0% Alum



Z-14

15% Ground Corn Cobs + 2.0% Alum

ROUND 2 TESTING

Area Z Composite Sample

Dried Treated Sediment

Attachment 4

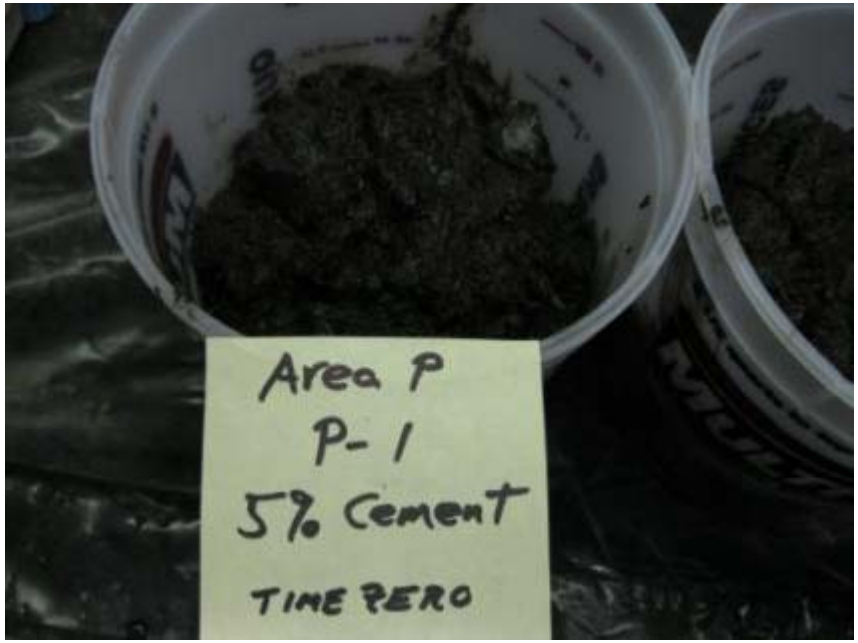
Photographs from Round 2 Testing
Area P

ROUND 2 TESTING

Area P Composite Sample

P-1*

Ordinary Portland Cement (OPC), 10%



P-2*

OPC, 20%

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area P Composite Sample

P-1* AND P-2*

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

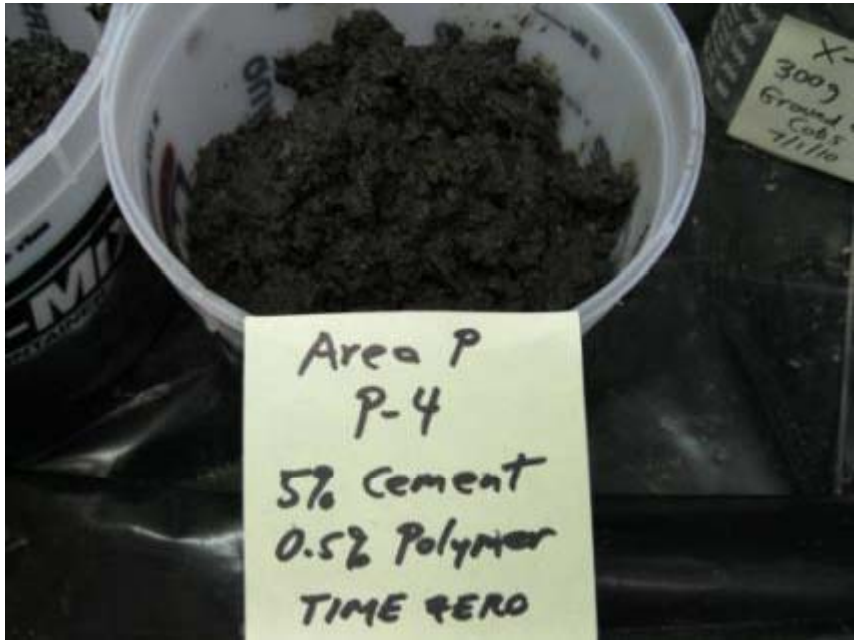
Area P Composite Sample

P-3*

5% OPC + 0.25% ZappaTec Low End Polymer

P-4*

5% OPC + 0.5% ZappaTec Low End Polymer



* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area P Composite Sample

P-3* AND P-4*

* Designation refers to treated sample ID, not subarea

ROUND 2 TESTING

Area P Composite Sample

P-5

ZappaTec Low End Polymer, 1.0%

P-6

RTS-1 Polymer, 1.0%

ROUND 2 TESTING

Area P Composite Sample

P-7

Ground Corn Cobs, 10%

P-7

Ground Corn Cobs, 10%

ROUND 2 TESTING

Area P Composite Sample

P-8

Ground Corn Cobs, 15%

P-8

Ground Corn Cobs, 15%

ROUND 2 TESTING

Area P Composite Sample

P-9

ZappaTec Low End Polymer, 0.75%

P-10

RTS-1 Polymer, 1.5%

ROUND 2 TESTING

Area P Composite Sample

P-11

OPC (5%) + $FeCl_2$ + $Na2_S$

- No picture available

P-12

OPC (10%) + $FeCl_2$ + $Na2_S$

- No picture available

ROUND 2 TESTING

Area P Composite Sample

P-13

7.5% OPC + 1.0% Alum

- No picture available

P-14

7.5% Ground Corn Cobs + 1.0% Alum

ROUND 2 TESTING

Area P Composite Sample

Appendix I3

Spring 2010
Solidification/Stabilization
Testing Addendum

Waste Stream Technology
Addendum to Treatability Study Report
Acid Brook Delta- Pompton Lakes, NJ
October 2010

1.0 Scope of Work

A treatability study was performed at Waste Stream Technology (WST) during November 2008 and June 2009 on samples received from Acid Brook Delta (ABD) in Pompton Lakes, NJ. Geotextile dewatering was examined as a means of possible dewatering. The remaining filtrate from the dewatering tests was filtered through a series of filters to decrease the mercury concentrations in the water.

Further testing was performed, on the remaining sediment samples to evaluate the effectiveness of mechanical dewatering with filter press, belt press, and centrifuge technology. This Addendum to the Arcadis Acid Brook Delta Treatability Study Report (January 2009) and filtration testing from June 2009 provides a summary of the mechanical dewatering tests.

2.0 Initial Characterization

Initial characterization, including percent solids and specific gravity, was performed on the remaining sediment samples. Each sediment bucket was mixed to apparent homogeneity prior to subsampling for initial analyses. Particle size analysis was performed on Sediment 5 and Sediment 10. The complete results from these analyses are given in Appendix A. Table 1 below summarizes the analytic methods used for analysis.

The average percent solids of the sediment samples was 30.30%. The average specific gravity of the samples analyzed was 1.27. A randomly selected bucket of site water was analyzed for specific gravity, TSS, and mercury. A sample from the bucket labeled Water 1 was found to have a specific gravity of 0.99, TSS of 47ppm, and <0.0002mg/L of mercury.

Table 1.
Arcadis- Acid Brook Delta Treatability Study
Addendum to Treatability Study
Analytical Methods Utilized for Sample Characterization

Analysis	Method
% Solids	Standard Method 2540G
Specific Gravity	Standard Method 2710F
Total Suspended Solids (TSS)	Standard Method 2540D
Particle Size	Modified ASTM D-422

3.0 Dewatering

In this treatability study, dewatering technologies were evaluated to determine an appropriate remedial approach for sediments obtained from Acid Brook Delta. Specifically, centrifuge dewatering, belt press, and filter press technologies were investigated and assessed based on their efficiency and applicability to the sediments received. Sediment was passed through a #200 sieve with site water in order to obtain fine solids (<75 μm) for mechanical dewatering. This process attempts to simulate the feed material after desanding operations in the field, typically through the use of a hydrocyclone.

Dewatering was facilitated through chemical pretreatment of the sediment. Commercially available polymers were tested in order to determine the polymer charge and molecular weight most appropriate for the given sample, thereby enhancing mechanical dewatering and maximizing solids recovery and filtrate clarity. The use of polymer is advantageous because it does not increase the bulk of the sediments, and it does not affect the pH of the resulting cake or filtrate. An initial polymer screening was performed on small test samples to determine the approximate dose required for floc formation. However, reliable dose rates to achieve optimum dewatering results can only be determined through actual testing on dewatering test equipment. A visible floc formation will not always results in optimum results when mechanically dewatered.

3.1 Belt Press

Dewatering through belt press technology was evaluated using a Crown Press™ Belt Press Simulator. For each test, 100 milliliters of slurry at approximately 7% solids was pretreated with polymer until an acceptable floc was achieved. A fine, weak floc, is not a suitable characteristic for this dewatering technology due to cloth blinding and sediment migration. A thick, chunky floc is ideal to minimize sediment migration. Satisfactory pretreated samples were tested on the belt press simulator by applying a pressure of 25 psi for four cycles of 15 seconds each.

The percent solids from the belt press tests ranged from 31.92 to 37.94. In general the cakes were fairly thin and stuck to the cloths. Belt press results are found in Appendix B.

3.2 Centrifugation

Centrifugation technology was evaluated using an IEC Laboratory Tube Centrifuge. Sediment samples were diluted to approximately 7% solids and pretreated with polymer until a good floc was achieved. A good floc is one that does not break up significantly with mixing and releases free water easily. Treated sample aliquots were then spun for three minutes at 2000 rpm before analyzing the centrifuge cake for percent solids. Results for the individual centrifuge tests are provided in Appendix C.

The results from the testing indicate that centrifugation is not the appropriate technology for sediment dewatering. Percent solids of the centrifuge cake reached a high of 29.26% in test CF-8.

3.3 Filter Press

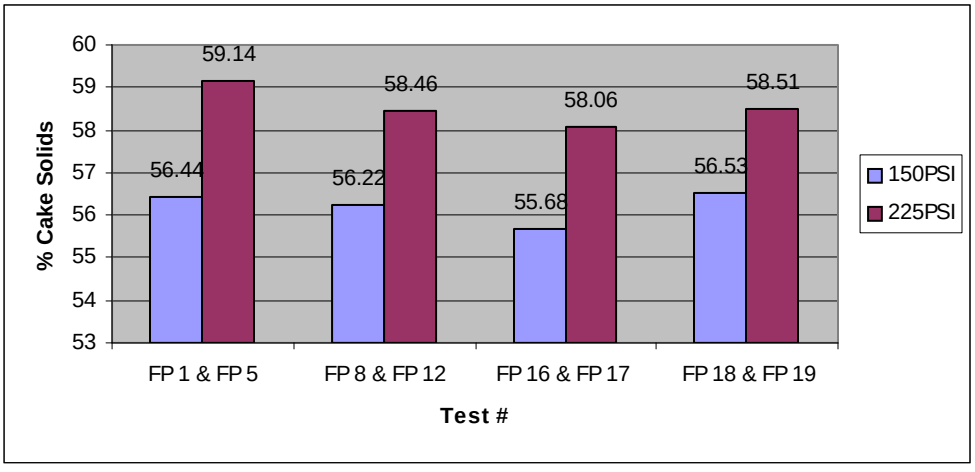
Filter press testing was conducted using a JWI/US Filter bench top recessed-chamber filter press. Test volumes between 1 and 1.5 liters were chemically pretreated with various polymers at varying dosages, and filter pressed for a specified period of time at a low pressure of 150 pounds per square inch (PSI), or high pressure of 225 PSI. The

resultant filter cake and filtrate was then evaluated for quality. An excellent filter cake can be defined as one that has a high solids recovery and good handling characteristics – more specifically, is solid and dry, releases easily from the filter cloths, and does not have a sticky consistency. A total of 19 filter press tests were performed on Acid Brook Delta sediment. A summary of the results of these tests is presented in Appendix D.

Polymers of various electrical charge and molecular weight were tested for their applicability to the subject material. With the use of polymer as a pretreatment chemical, filtrate pH is not affected, and secondary water treatment for pH reduction is reduced or eliminated. While several polymers were effective in enhancing floc formation, cationic solution polymers formed a small pin floc most applicable to filter press technology.

The average percent solids of the filter press tests performed on the <#200, Sediment 10 were 56.47%. Filter press tests were run on <#200, Sediment 5 to confirm that the similar results could be obtained under the same press conditions. The average percent solids of the filter cakes of Sediment 5 were 55.10%. Filter cake quality was improved with increased pressure as demonstrated in Table 2 below. The cake solids of filter presses ran at 225 PSI were consistently higher than those ran at 150 PSI.

Table 2.
Arcadis- Acid Brook Delta Treatability Study
Addendum to Treatability Study
Effect of Pressure on Filter Cake Percent Solids



4.0 Mercury Testing

Mercury is a contaminant of concern in the sediment from the Acid Brook Delta site. Several tests were performed to examine the presence of mercury in the water throughout the treatment process. The first tests involved mixing 15% "as is" sediment with 85% site water. Testing was performed on Sediments 5, 6, and 10. The slurry was mixed for 1 minute and settled for 5 minutes. After 5 minutes a portion of the supernatant was decanted and bottled for Hg analysis. The remaining supernatant was filtered through a 0.5μm filter and then bottled for Hg analysis. These results are found in Table 3 below. Another test evaluated the presence of Hg after filter press operations. The <#200 sediment was diluted to 7% solids, mixed at 30rpm for 5 minutes, treated with polymer and then filter pressed. This series of events is represents filter press operations in the field. The filtrate from the subsequent filter press tests (FP 14 & FP 15) was analyzed for Hg. A portion of the filtrate was also filtered through a 0.5μm filter and analyzed for Hg. The results of these analysis are in Table 3.

Table 3.
Arcadis- Acid Brook Delta Treatability Study
Addendum to Treatability Study
Mercury Results

Samle ID	Site Water	Sediment 5 Supernatant	Sediment 6 Supernatant	Sediment 10 Supernatant	FP 14 Filtrate	FP 15 Filtrate
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Mercury	<0.0002	**0.0006**	**0.0003**	**0.002**	**0.0005**	<0.0002
Mercury (<0.5μm)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

5.0 Summary and Conclusions

The results of this treatability study indicate that pretreatment with polymer and dewatering by recessed chamber filter press technology is an appropriate, effective, and cost efficient regimen for the dewatering of sediments from the Acid Brook Delta project in Pompton Lakes, NJ. Dewatering was investigated by belt press, centrifuge and filter

press using 7% feed solids material. Belt pressing and centrifugation resulted in low solids recovery as compared to that achieved through filter press technology.

Appendix A

Arcadis
Acid Brook Delta- Pompton Lakes, NJ
Addendum to Treatability Study Report

Initial Characterization Data

Sample ID	% Solids	SG	Physical Description
Sediment 1	31.94	1.21	Peat and sand mixture.
Sediment 2	14.91	1.08	Peat and sand mixture.
Sediment 5	25.78	1.13	Peat and sand mixture.
Sediment 6	46.92	1.33	Sandy sediment with some peat.
Sediment 7	21.55	1.10	Peat and sand mixture.
Sediment 8	18.21	1.09	Peat and sand mixture.
Sediment 9	26.98	1.53	Sandy sediment with some peat.
Sediment 10	56.13	1.70	Sandy sediment with some peat.

Sieve Data

Sample I.D. and Initial Dry Weight	Sieve #	Aperture (μm)	Tare Wt. (g)	Dry Weight (g)	Weight Retained (g)	% Weight Retained	% Weight Passed
Sediment # 5 120.1 g wet/ 31.0 g dry (25.78% solids)	60	250	309.2	316.9	7.7	24.84	75.16
	100	150	365.6	368.2	2.6	8.39	66.77
	140	106	346.3	347.6	1.3	4.19	62.58
	200	75	335.7	336.8	1.1	3.55	**59.03**
	325	45	340	342.4	2.4	7.74	51.29
	400	38	341.6	342.4	0.8	2.58	48.71
	< 400	< 38	--	--	15.1	48.71	---

Sample I.D. and Initial Dry Weight	Sieve #	Aperture (μm)	Tare Wt. (g)	Dry Weight (g)	Weight Retained (g)	% Weight Retained	% Weight Passed
Sediment #10 79.0 g wet/ 44.4 g dry (56.13% solids)	60	250	309.2	315.8	6.6	14.86	85.14
	100	150	366	367.7	1.7	3.83	81.31
	140	106	346.4	347.3	0.9	2.03	79.28
	200	75	335.7	336.3	0.6	1.35	**77.93**
	325	45	340.1	340.1	0.0	0.00	77.93
	400	38	341.6	343.4	1.8	4.05	73.87
	< 400	< 38	--	--	32.8	73.87	---

Appendix B

Arcadis
Acid Brook Delta- Pompton Lakes, NJ
Addendum to Treatability Study Report

Belt Press Data

Each involves 4 cycles of 15 seconds at 25 PSI

Test Number	Slurry ID	Feed Solids	Additive/ Dosage	Sample Volume (mL)	Cake Solids (%)	Comments
1	Sediment 10 <#200	7.00	150ppm 814	100	33.02	Thin cake, migrates off cloths, sticks to cloths. Clear filtrate, but many solids in filtrate.
2	Sediment 10 <#200	7.00	250ppm 814	100	39.03	Fair cake, thin, sticks to cloths. Clear filtrate but many fines.
3	Sediment 10 <#200	7.00	100ppm 814 + 50ppm AM 26	100	37.94	Fair cake, thin. Slightly clouldy filtrate.
4	Sediment 10 <#200	7.00	150ppm 849	100	32.41	Thin cake, migrates off cloths, sticks to cloths.
5	Sediment 10 <#200	7.00	250ppm 849	100	32.33	Fair cake, thin, sticks to cloths. Slightly clouldy filtrate.
6	Sediment 10 <#200	7.00	100ppm 849 + 50ppm AM 26	100	31.92	Fair cake, thin. Clouldy filtrate.

Appendix C

Arcadis
Acid Brook Delta- Pompton Lakes, NJ
Addendum to Treatability Study Report

Centrifuge Data

Test Number	Sample ID	Feed Solids	Additive and Dosage	Spin Time and Speed	Cake Solids (%)	Comments
1	Sediment 10 <#200	7.00	200ppm 757	3 min @ 2000rpm	30.41	Firm cake, slightly sticky. 44mL, clear centrate.
2	Sediment 10 <#200	7.00	200ppm 757 + 50ppm AM 26	3 min @ 2000rpm	29.20	Firm cake, slightly sticky. 44mL, clear centrate.
3	Sediment 10 <#200	7.00	50ppm AM 26	3 min @ 2000rpm	28.67	Firm cake. 46mL, cloudy, brown centrate
4	Sediment 10 <#200	7.00	50ppm 814	3 min @ 2000rpm	29.19	Firm cake. 45mL, clear centrate.
5	Sediment 10 <#200	7.00	100ppm 814	3 min @ 2000rpm	8.27	Sloppy cake, mushy. 46mL, clear centrate.
6	Sediment 10 <#200	7.00	100ppm 849	3 min @ 2000rpm	22.20	Firm cake. 45mL, clear centrate.
7	Sediment 10 <#200	7.00	50ppm 849 + 50ppm AM 26	3 min @ 2000rpm	27.04	Firm cake. 45mL, cloudy, yellow centrate.
8	Sediment 10 <#200	7.00	50ppm 814 + 25ppm AM 26	3 min @ 2000rpm	29.26	Firm cake. 45mL, cloudy, yellow centrate.

Appendix D

Arcadis
Acid Brook Delta- Pompton Lakes, NJ
Addendum to Treatability Study Report

Filter Press Data

Filter Press #	Sample ID	% Feed Solids	Additive and Dosage	Press Time/ Pressure	Filtrate	Release/ Blinding	% Cake Solids	Comments
1	Sediment 10 <#200	7.00	200ppm 757	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	56.44	Excellent cake, hard throughout.
2	Sediment 10 <#200	7.00	200ppm 626	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	56.17	Very good cake, slightly soft top.
3	Sediment 10 <#200	7.00	200ppm 814	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Good release/ cake stuck slighty to cloth	54.80	Very good cake, slightly soft top. Press blew out after 50 minutes.
4	Sediment 10 <#200	7.00	200ppm 757 + 50ppm AM 26	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	56.66	Excellent cake, hard throughout.
5	Sediment 10 <#200	7.00	200ppm 757	60min/ 225PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	59.14	Excellent cake, hard throughout.
6	Sediment 10 <#200	7.00	100ppm 757	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	57.32	Excellent cake, hard throughout.
7	Sediment 10 <#200	7.00	300ppm 757	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	58.47	Excellent cake, hard throughout.

8	Sediment 10 <#200	7.00	200ppm 757	45min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	56.22	Excellent cake, hard throughout.
9	Sediment 10 <#200	7.00	200ppm 757	75min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	58.07	Excellent cake, hard throughout.
10	Sediment 10 <#200	7.00	100ppm 757	45min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	50.76	Good cake, soft top
11	Sediment 10 <#200	7.00	100ppm 757	45min/ 225PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	53.94	Very good cake, slightly soft top.
12	Sediment 10 <#200	7.00	200ppm 757	45min/ 225PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	58.46	Excellent cake, hard throughout.
13	Sediment 10 <#200	7.00	100ppm PAX XL 19 + 200ppm 757	60min/ 150PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	57.17	Excellent cake, hard throughout.
14	Sediment 5 <#200	7.00	200ppm 757	45min/ 225PSI	Clear and colorless.	Very good release/ no noticeable blinding.	46.70	Good cake. Soft top. Press blew out after 40 minutes.
15	Sediment 10 <#200	7.00	200ppm 757	45min/ 225PSI	Clear and colorless, but becomes slightly yellow over time.	Very good release/ no noticeable blinding.	56.97	Excellent cake, hard throughout.

16	Sediment 5 <#200	7.00	200ppm 757	60min/ 150PSI	Clear and colorless.	Very good release/ no noticeable blinding.	55.68	Excellent cake, hard throughout. 1.5L feed.
17	Sediment 5 <#200	7.00	200ppm 757	60min/ 225PSI	Clear and colorless.	Very good release/ no noticeable blinding.	58.06	Excellent cake, hard throughout. 1.5L feed.
18	Sediment 5 <#200	7.00	200ppm 757	45min/ 150PSI	Clear and colorless.	Very good release/ no noticeable blinding.	56.53	Excellent cake, hard throughout. 1.5L feed.
19	Sediment 5 <#200	7.00	200ppm 757	45min/ 225PSI	Clear and colorless.	Very good release/ no noticeable blinding.	58.51	Excellent cake, hard throughout. 1.5L feed.

WASTE STREAM TECHNOLOGY, INC.

302 Grote Street
Buffalo, NY 14207
(716) 876-5290

Analytical Data Report
Report Date: 09/24/10
Work Order Number: 0I20003

Prepared For
Mike Crystal

Sevenson Treatability Studies

2749 Lockport Road

Niagara Falls, NY 14305

Fax: (716) 284-1796

Site: Arcadis - Acid Brook Delta

Enclosed are the results of analyses for samples received by the laboratory on 09/20/10. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Brian S. Schepart, Ph.D., Laboratory Director

ENVIRONMENTAL LABORATORY ACCREDITATION CERTIFICATION NUMBERS

NYSDOH ELAP #11179 NJDEPE #73977 PADEP #68757 CTDPH #PH-0306 MADEP #M-NY068 FLDOH #E87662

Sevenson Treatability Studies	Project: Arcadis - Acid Brook Delta	
2749 Lockport Road	Project Number: Arcadis - Acid Brook Delta	**Reported:**
Niagara Falls NY, 14305	Project Manager: Mike Crystal	09/24/10 08:37

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Site Water	0I20003-01	Water	09/20/10 10:30	09/20/10 11:42
Site Water <0.5um	0I20003-02	Water	09/20/10 10:30	09/20/10 11:42
Sediment 5 Supernatant	0I20003-03	Water	09/20/10 10:30	09/20/10 11:42
Sediment 5 Supernatant <0.5um	0I20003-04	Water	09/20/10 10:30	09/20/10 11:42
Sediment 10 Supernatant	0I20003-05	Water	09/20/10 10:30	09/20/10 11:42
Sediment 10 Supernatant <0.5um	0I20003-06	Water	09/20/10 10:30	09/20/10 11:42

Sevenson Treatability Studies	Project: Arcadis - Acid Brook Delta	
2749 Lockport Road	Project Number: Arcadis - Acid Brook Delta	**Reported:**
Niagara Falls NY, 14305	Project Manager: Mike Crystal	09/24/10 08:37

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Site Water (0I20003-01) Water Sampled: 09/20/10 10:30 Received: 09/20/10 11:42									
Mercury	ND	0.0002	mg/L	1	AI02311	09/23/10	09/23/10	EPA 7470A	
Site Water <0.5um (0I20003-02) Water Sampled: 09/20/10 10:30 Received: 09/20/10 11:42									
Mercury	ND	0.0002	mg/L	1	AI02311	09/23/10	09/23/10	EPA 7470A	
Sediment 5 Supernatant (0I20003-03) Water Sampled: 09/20/10 10:30 Received: 09/20/10 11:42									
Mercury	**0.0006**	0.0002	mg/L	1	AI02311	09/23/10	09/23/10	EPA 7470A	
Sediment 5 Supernatant <0.5um (0I20003-04) Water Sampled: 09/20/10 10:30 Received: 09/20/10 11:42									
Mercury	ND	0.0002	mg/L	1	AI02311	09/23/10	09/23/10	EPA 7470A	
Sediment 10 Supernatant (0I20003-05) Water Sampled: 09/20/10 10:30 Received: 09/20/10 11:42									
Mercury	**0.002**	0.0002	mg/L	1	AI02311	09/23/10	09/23/10	EPA 7470A	
Sediment 10 Supernatant <0.5um (0I20003-06) Water Sampled: 09/20/10 10:30 Received: 09/20/10 11:42									
Mercury	ND	0.0002	mg/L	1	AI02311	09/23/10	09/23/10	EPA 7470A	

Sevenson Treatability Studies	Project:	Arcadis - Acid Brook Delta	
2749 Lockport Road	Project Number:	Arcadis - Acid Brook Delta	**Reported:**
Niagara Falls NY, 14305	Project Manager:	Mike Crystal	09/24/10 08:37

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
**	Denotes a promulgated method, but not the most updated version.

WASTE STREAM TECHNOLOGY, INC.

302 Grote Street
Buffalo, NY 14207
(716) 876-5290

Analytical Data Report
Report Date: 09/28/10
Work Order Number: 0I24012

Prepared For
Mike Crystal

Sevenson Treatability Studies

2749 Lockport Road

Niagara Falls, NY 14305

Fax: (716) 284-1796

Site: Arcadis - Acid Brook Delta

Enclosed are the results of analyses for samples received by the laboratory on 09/24/10. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Brian S. Schepart, Ph.D., Laboratory Director

ENVIRONMENTAL LABORATORY ACCREDITATION CERTIFICATION NUMBERS

NYSDOH ELAP #11179 NJDEPE #73977 PADEP #68757 CTDPH #PH-0306 MADEP #M-NY068 FLDOH #E87662

Sevenson Treatability Studies	Project: Arcadis - Acid Brook Delta	
2749 Lockport Road	Project Number: Arcadis - Acid Brook Delta	**Reported:**
Niagara Falls NY, 14305	Project Manager: Mike Crystal	09/28/10 12:46

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
FP 14 Filtrate	0I24012-01	Water	09/24/10 12:00	09/24/10 12:33
FP 14 Filtrate < 0.5um	0I24012-02	Water	09/24/10 12:00	09/24/10 12:33
FP 15 Filtrate	0I24012-03	Water	09/24/10 12:00	09/24/10 12:33
FP 15 Filtrate < 0.5um	0I24012-04	Water	09/24/10 12:00	09/24/10 12:33
Sediment 6 Supernatant	0I24012-05	Water	09/24/10 12:15	09/24/10 12:33
Sediment 6 Supernatant <0.5um	0I24012-06	Water	09/24/10 12:15	09/24/10 12:33

Sevenson Treatability Studies	Project: Arcadis - Acid Brook Delta	
2749 Lockport Road	Project Number: Arcadis - Acid Brook Delta	**Reported:**
Niagara Falls NY, 14305	Project Manager: Mike Crystal	09/28/10 12:46

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
FP 14 Filtrate (0I24012-01) Water Sampled: 09/24/10 12:00 Received: 09/24/10 12:33									
Mercury	**0.0005**	0.0002	mg/L	1	AI02704	09/27/10	09/27/10	EPA 7470A	
FP 14 Filtrate < 0.5um (0I24012-02) Water Sampled: 09/24/10 12:00 Received: 09/24/10 12:33									
Mercury	ND	0.0002	mg/L	1	AI02704	09/27/10	09/27/10	EPA 7470A	
FP 15 Filtrate (0I24012-03) Water Sampled: 09/24/10 12:00 Received: 09/24/10 12:33									
Mercury	ND	0.0002	mg/L	1	AI02704	09/27/10	09/27/10	EPA 7470A	
FP 15 Filtrate < 0.5um (0I24012-04) Water Sampled: 09/24/10 12:00 Received: 09/24/10 12:33									
Mercury	ND	0.0002	mg/L	1	AI02704	09/27/10	09/27/10	EPA 7470A	
Sediment 6 Supernatant (0I24012-05) Water Sampled: 09/24/10 12:15 Received: 09/24/10 12:33									
Mercury	**0.0003**	0.0002	mg/L	1	AI02704	09/27/10	09/27/10	EPA 7470A	
Sediment 6 Supernatant <0.5um (0I24012-06) Water Sampled: 09/24/10 12:15 Received: 09/24/10 12:33									
Mercury	ND	0.0002	mg/L	1	AI02704	09/27/10	09/27/10	EPA 7470A	

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
**	Denotes a promulgated method, but not the most updated version.

Appendix I4

2015 Treatability Testing Results

Sevenson Environmental Services
Treatability Study Report
Dupont Pompton Lakes

I. Objective

The treatability study looked at matrices in 3 separate areas:

1. The solidification and stabilization of solid and semi-solid soils excavated from the uplands area,
2. The dewatering of sediments dredged in the Acid Brook Delta, Area A, and Island Area, and
3. The treatment of water generated during dewatering, lake water, and storm water events.

Each remedial approach is described separately below.

All research was performed in the Sevenson Environmental Services Treatability Laboratory (EPA ID NYR000185033). The laboratory is permitted by the US EPA to accept toxic and hazardous materials, and to perform treatability studies on these materials focusing in the remediation of contaminated soils, sediments, and waters.

II. Treatability Study

Samples of Pompton Lake sediment and water were received at the Sevenson treatability laboratory on August 3rd, 2015. A copy of the chain-of-custody form that accompanied the samples is presented in Appendix A.

Buckets were segregated according to sample location and matrix. Each was mixed to homogeneity and analyzed as described.

Treatability data are presented according to sample location and remedial approach.

A. Uplands Area

1. Initial Characterization

The as-received soils from the Uplands area were mixed to homogeneity and analyzed for the parameters outlined in Table 1.

Table 1.
Dupont Pompton Lakes Treatability
Analyses of "As Received" Uplands Soils

Analysis	Method
Solids	Standard Method 2540G
Density	Standard Method 2710F
pH	EPA SW 846 Method 9045C
Paint Filter	EPA SW846 Method 9095
TCLP Metals	SW846 Method 1311, 6010, 7000, 7470
Particle Size <75 µm	Modified ASTM D-422

2. Initial Analysis

The results from the initial analyses of Uplands soils are summarized in Table 2. The Uplands material is a reddish brown soil that is high in solids, rocky/sandy, slightly acidic, and passed the paint filter test. Most of the material was retained on the #200 sieve.

Table 2.
Dupont Pompton Lakes Treatability
Results of "As Received" Uplands Soils Physical Analyses

Sample	% sol	pH	SG	Pass paint filter?	% retained #200 sieve	Description
Uplands excavation area F-01	71.31	6.51	1.44	Yes	90.26	black soil with lot of rocks and sticks, slight odor
Uplands excavation area F-02	95.15	5.99	1.46	Yes	87.00	brown/redish soil with lots of rocks
Uplands excavation area F-03	94.05	6.60	1.40	Yes	95.12	brown soil with LOTS of big/medium rocks

Chemical leachate analyses by TCLP showed that none of the Uplands Soils was hazardous according to RCRA characterization (Appendix B).

3. Treatability Study Results

Since soils from this location passed paint filter test, and did not leach hazardous metals, it was not examined further in this study.

B. Acid Brook Delta Area

1. Initial Characterization

The as-received Acid Brook Delta Area material was mixed thoroughly and analyzed according to the parameters outlined previously in Table 1.

2. Initial Analyses

The results of these analyses are summarized in Table 3 and Appendix C. The Acid Brook Delta Area material was a brown silty sludge with some organics, has a 40-56% solids content, was slightly acidic, 32.25% retained on the #200 sieve, and did not pass the paint filter test.

Further, chemical leachate analyses by TCLP showed that none of the Acid Brook Delta Area material was hazardous according to RCRA characterization.

Table 3.
Dupont Pompton Lakes Treatability
Results of "As Received" Acid Brook Delta Area Physical Analyses

Sample	% sol	pH	SG	Pass paint filter?	% retained #200 sieve	Description
ABD dredge material-01	40.89	6.27	1.50	No		brown silty sludge with light organics
ABD dredge material-02	55.91	6.28	1.52	No		brown silty sludge with light organics and some clay
ABD dredge material-03	43.61	6.29	1.40	No	32.28	brown silty sludge with light organics and some clay

3. Treatability Studies and Results

Mechanical Dewatering with Recessed Chamber Filter Press

Polymer Screening. Selected Hexafloc (Hexagon Technologies, Louisville, KY), and Dixie Chemical (Pasadens, TX) polymers at various polymer doses, were screened for their ability to generate a sediment flocculent conducive to dewatering technologies by utilizing Jar Test methods.

Sediment samples were diluted to 5-10% solids with tap water, and 100 ml aliquots were added to 250 ml tri-pour beakers and used for study. Polymer was added incrementally to sediment, and samples were mixed thoroughly by pouring between two beakers after addition of each dose. While mixing, sediment was carefully evaluated for any coagulation formation or generation of sediment flocculent.

Results of polymer screening showed the 200-400 ppm of polymer 757 was appropriate for use in filter press dewatering of acid brook delta sediments.

Bench Scale Plate Frame Filter Press. The equipment utilized for this study was a JWI bench scale filter press unit with custom mixer assembly with Crosible 85x/5 filter cloth (4-6CFM). A 1L aliquot of treated feed slurry was placed into the feed vessel, which was then sealed and the mixing unit energized.

The test cycle began when compressed nitrogen gas was initially applied to the sealed feed vessel. Pressure was increased from 0 psi at the start of the test cycle up to the target pressure over a period of 3 minutes. Filtrate collected prior to reaching target pressure was discarded from analysis.
The test cycle is complete after 60 minutes had elapsed from initial pressurization. At this time, pressure was relieved from the system, the unit is disassembled, observations made, and samples collected for analyses.

The results of filter press tests are summarized in Table 4.

Table 4.
Dupont Pompton Lakes Treatability
Results of Acid Brook Delta Area Filter Press Test

FP#	Sample	%Feed	Feed Vol	Polymer & Dose	Time / Presure	Filtrate Vol	TSS	Filtrate Comments	Cloth Comments	Cake Comments	% Sol	SG
1	sieved ABD	10.45	1L	400ppm 757	60 min/ 150 psi	400 ml		initial sediment discharge, then clear	Good release	Excellent hard cake, slightly clogged neck	60.76	
2	sieved ABD	10.45	1L	400ppm 757	60 min/ 150 psi	400 ml		initial sediment discharge, then clear	Good release	Excellent hard cake, slightly clogged neck	61.67	
3	sieved ABD	10.45	1L	400ppm 757	60 min/ 150 psi	300 ml		initial sediment discharge, then clear	Good release	Excellent hard cake, slightly clogged neck	60.38	
4	sieved ABD	10.00	1L	200ppm 757	60 min/ 125 psi	400 ml	6	Clear	Good release	Excellent hard cake, slightly clogged neck	60.87	1.47
5	sieved ABD	10.00	1L	200ppm 757	60 min/ 225 psi	500 ml	6	Clear	Good release	Excellent hard cake, slightly clogged neck	64.14	1.48
6	sieved ABD	10.00	1L	400ppm 757	60 min/ 125 psi	400 ml	2	Clear	Good release	Excellent hard cake, slightly clogged neck	58.63	1.43
7	sieved ABD	10.00	1L	400ppm 757	60 min/ 225 psi	470 ml	5	Clear	Good release	Excellent hard cake, slightly clogged neck	62.78	1.48

The tests show that, using a feed solids of 10%, 200 ppm polymer 757 at 125 psi pressure with a cycle time of 60 minutes was adequate to yield a filter cake with excellent handling properties and good filtrate. The filter cake showed a solids content of 60.87%, and clear filtrate of 6 ppm suspended solids.

Complete chemical analyses of filter press feed, filter cake, and filtrate is presented in Section E of this report.

C. Mechanical Dredge, Island Dredge, Area A, and Lead Areas

1. Initial Characterization

All as-received material from these areas was mixed thoroughly and analyzed according to the parameters outlined previously in Table 1.

2. Initial Analysis

The results of the analyses for the Mechanical Dredge Area are summarized in Table 4 and Appendix D. The as-received Mechanical Dredge Area material was a black silty sludge with an abundance of leaves, sticks, and other organics. Sludge had a wide ranging solids content, was slightly acidic, and had 55.60% retained on the #200 sieve. None of the material passed the paint filter test.

Chemical leachate analyses by TCLP showed that none of the Mechanical Dredge Area material was hazardous according to RCRA characterization (Appendix D).

Table 4.
Dupont Pompton Lakes Treatability
Results of "As Received" Mechanical Dredge Area Physical Analyses

Sample	% sol	pH	SG	Pass paint filter?	% retained #200 sieve	Description
Mechanical dredge area 1-01	26.48	5.97	1.21	No		Black silty sludge with lot of organics (leaves, sticks, and roots, etc.)
Mechanical dredge area 1-02	49.53	6.11	1.48	No		Black silty sludge with lot of organics (leaves, sticks, and roots, etc.)
Mechanical dredge area 1-03	73.03	6.02	1.77	No		Black silty sludge with some organics (leaves, sticks, roots, etc.) and some rocks
Mechanical dredge area 1-04	31.64	5.81	1.26	No	55.60	Black silty sludge with some organics (leaves, sticks, roots)
Mechanical dredge area 1-05	48.34	6.07	1.41	No		Black silty sludge with some organics (leaves, sticks, roots)

Initial analyses for the Island Dredge Area are shown in Table 5 and Appendix E . The Island Dredge Area as-received material was a black/brown silt with some organics. Sludge had a solids content between 14-22%, was slightly acidic, and had 22.06% retained on the #200 sieve. None of the material passed the paint filter test.

Chemical leachate analyses by TCLP showed that none of the Island Area Dredge Area material was hazardous according to RCRA characterization (Appendix E).

Table 5.
Dupont Pompton Lakes Treatability
Results of "As Received" Island Dredge Area Physical Analyses

Sample	% sol	pH	SG	Pass paint filter?	% retained #200 sieve	Description
Island dredge material-01	20.84	6.47	1.13	No	22.06	black/brown silt with some organics
Island dredge material-02	21.84	6.27	1.14	No		black/brown silt with some organics
Island dredge material-03	16.14	6.24	1.12	No		black/brown silt with some organics
Island dredge material-04	14.58	6.30	1.08	No		black/brown silt with some organics
Island dredge material-05	22.15	6.55	1.21	No		black/brown silt with some organics

The results of the analyses for Area A are summarized in Table 6 and Appendix F. The Area A material was a brown silt, with a solids content between 14-22%, was slightly acidic, and had 15.10% retained on the #200 sieve. This material did not pass the paint filter test.

Chemical leachate analyses by TCLP showed that none of the Area A material was hazardous according to RCRA characterization (Appendix F).

Table 6.
Dupont Pompton Lakes Treatability
Results of "As Received" Area A Physical Analyses

Sample	% sol	pH	SG	Pass paint filter?	% retained #200 sieve	Description
Area A dredge material-01	30.64	6.45	1.21	No	15.10	brown silt

The results of the analyses for the Lead Area are summarized in Table 7 and Appendix G. The Lead Area material was a brown/black silt with some organics. The Lead Area sludge had a solids content between 19-25%, was slightly acidic, and had 62.87% retained on the #200 sieve. None of the material passed the paint filter test.

Chemical leachate analyses by TCLP showed that none of the Lead Area material was hazardous according to RCRA characterization (Appendix G). The highest concentration of leachable lead was 1.29 ppm found in sample Lead Area-03.

Table 7.
Dupont Pompton Lakes Treatability
Results of "As Received" Lead Area Physical Analyses

Sample	% sol	pH	SG	Pass paint filter?	% retained #200 sieve	Description
Lead area-01	20.16	5.81	1.15	No	62.87	brown/black sludge with LOTS of leaves/sticks
Lead area-02	19.41	6.38	1.14	No		brown silt/sludge with light organics
Lead area-03	25.57	5.90	1.20	No		brown silt/sludge light organics

3. Treatability Studies and Results

The following treatability studies were done on the materials from these areas.

Solidification and Stabilization

Sediments from these areas were decanted for standing free liquid, analyzed for percent solids, and treated with either 2% or 5% commercially available Type I Portland Cement (w/w). Mechanical Dredge Area sample -01 also received a treatment with 10% Type I Portland. Treated material was allowed to cure over a 48-hour period, and was analyzed for Paint Filter test after 24 and 48 hours. Because the

Island Dredge Areas are comparable in solids and appearance, Island Area 1 was chosen as representative of all the samples for solidification testing. Similarly, Lead Area Samples 2 & 3 are comparable in solids and appearance, so Area 3 was selected for stabilization testing.

The results of solidification/stabilization tests for all three areas are presented in Table 8.

Table 8.
Dupont Pompton Lakes Treatability
Results of Stabilization Analyses

Sample	%sol after decanting water	treatment	Pass 24 hr paint filter?	Pass 48 hr paint filter?
Mechanical dredge 1	26.45	2% PCI	N	Y
Mechanical dredge 1	26.45	5% PCI	Y	Y
Mechanical dredge 1	26.45	10% PCI	Y	Y
Mechanical dredge 2	60.57	2% PCI	Y	Y
Mechanical dredge 2	60.57	5% PCI	Y	Y
Mechanical dredge 3	69.85	2% PCI	Y	Y
Mechanical dredge 3	69.85	5% PCI	Y	Y
Mechanical dredge 4	38.55	2% PCI	N	N
Mechanical dredge 4	38.55	5% PCI	Y	Y
Mechanical dredge 5	44.90	2% PCI	Y	Y
Mechanical dredge 5	44.90	5% PCI	Y	Y
Island dredge area 1	24.28	2% PCI	N	N
Island dredge area 1	24.28	5% PCI	N	Y
Area A	31.65	2% PCI	Y	Y
Area A	31.65	5% PCI	Y	Y
Lead area 1	24.50	2% PCI	N	N
Lead area 1	24.50	5% PCI	N	Y
Lead area 3	25.59	2% PCI	N	N
Lead area 3	25.59	5% PCI	Y	Y

The results showed that for the Mechanical Dredge areas, 2% Type I Portland Cement (PCI) and 24 hour cure time was sufficient to allow samples 2, 3, and 5 to pass the paint filter test. For sample 1, 2% Portland Cement required 48 hours curing, whereas sample 4 did not pass the paint filter test with 2% PCI over 48 hours cure. Treatment of samples 1 and 4 with 5% PCI removed free liquid so that both passed the paint filter test after 24 hours cure.

The Island Dredge Area required 5% PCI and 48 hours cure time to remove free liquid so that end product passed the paint filter test. Area A sediment required 2% PCI and 24 hours curing. Lead Area 1 required 5% PCI and 48 hours curing, and Lead Area 3 required 5% PCI and 24 hours curing to remove free liquids for a passing paint filter test result.

D. Water Treatment

1. Initial Characterization

Water generated during sediment dewatering, as well as accumulated lake water and storm water, may all require treatment prior to discharge. Further, all water must meet the NJDEP discharge permit requirements.

Water samples included Pompton Lake Water, and decant water from the Island Dredge Area, Mechanical Dredge Area, and the Lead Area. Lake water was composited for metals analyses.

Water was analyzed for total metals, which includes metals associated with undissolved solids within the aqueous matrix, as well as dissolved metals. Dissolved metals include those metals associated in the aqueous fraction after solids are removed by filtration. All water samples were analyzed according to the parameters outlined in Table 9.

Table 9.
Dupont Acid Brook Delta Treatability
Analysis of Water Samples

Analysis	Method
Total Suspended Solids	EPA SW 846 Method 160.2
pH	EPA SW 846 Method 9045C
Metals	SW846 Method 6010, 7000, 7470
Ammonia	Standard Method 4500 NH3
Sulfide	Standard Method 4500 S

The results of pH and total suspended solids analyses of water samples is presented in Table 10 and metals analyses presented in Appendix H.

Table 10.
Dupont Acid Brook Delta Treatability
Water Sample pH and TSS Results

Sample	pH	TSS
Island dredge material water decant	6.63	848
Mechanical dredge area water decant	6.32	2340
Lake water-01	6.69	10
Lake water-02		7
Lake water-03		53
Lake water-04		5
Lake water-05		3
Lead area water decant	6.52	6510

Results show that that water is slightly acidic, and that the decant water has a much higher solids concentration when compared to the “as received” lake water.

The metals analyses show that some metals, particularly lead, were indeed found in the decanted water. Some low level mercury was also present. However these metals were mostly associated with the solids fraction and were removed when filtered and samples analyzed for dissolved metals. No ammonia or sulfide was detected in the lake water, though there was some ammonia contained in the Island Dredge, Mechanical Dredge, and Lead Area dredge decant. No sulfides were found in these water samples.

2. Water Treatment Recommendations

Metals associated with these samples and detected in analyses of these samples were mostly associated with the solids fraction of the water samples. Therefore, the water treatment process should focus on removing solids from dredge water as solids are generated and released.

E. Filter Press Feed, Cake, and Filtrate Analyses

An Acid Brook Delta sample was sieved, diluted to approximately 10% solids with lake water, and treated with 200 ppm polymer 757. This feed material was then analyzed according to the parameters outlined in Table 11.

The sample was then filter pressed according to methods outlined in Section B.2. of this report, at 125 psi for 60 minutes. A TCLP analyses was performed on the filter cake according to the methods outlined in Table 12, and physical and chemical analyses were performed on the filtrate according to the methods outlined in Table 13.

Table 11.
Dupont Pompton Lakes Treatability
Analyses of Acid Brook Delta Filter Press Feed Material

Analysis	Method
Solids	Standard Method 2540G
Total Metals	SW846 Method 6010, 7000, 7470
PCBs	SW846 Method 8082
Volatile Organic Hydrocarbons	SW846 Method 8260B
Semi-Volatile Organic Hydrocarbons	SW846 Method 8270C

Table 12.
Dupont Pompton Lakes Treatability
Analyses of Acid Brook Delta Filter Press Filter Cake Material

Analysis	Method
TCLP Metals	SW846 Method 1311, 6010, 7000, 7470

Table 13.
Dupont Pompton Lakes Treatability
Analyses of Acid Brook Delta Filter Press Filtrate Material

Analysis	Method
Total Suspended Solids	EPA SW 846 Method 160.2
pH	EPA SW 846 Method 9045C
Total Metals	SW846 Method 6010, 7000, 7470
Ammonia	Standard Method 4500 NH3
Sulfide	Standard Method 4500 S
PCBs	SW846 Method 8082
Volatile Organic Hydrocarbons	SW846 Method 8260B
Semi-Volatile Organic Hydrocarbons	SW846 Method 8270C

The results of filter press feed material analyses are presented in Appendix I. They show that this material had a solids concentration of 9.8%, and was contaminated with several heavy metals, including mercury, arsenic, barium, cadmium, chromium, lead and selenium.

There were no detectable PCBs, volatile organic hydrocarbons, or semi-volatile organic hydrocarbons (compounds listed in the report are very low and are common laboratory contaminants). The filter cake yielded from filter press dewatering was extracted by TCLP, and analyzed for RCRA metals. Results showed that the extract did not contain any metals above RCRA hazardous concentrations (Appendix I).

Analyses of the filter press filtrate showed that it had a pH of 6.73, and a low total suspended solids concentration of 4 ppm. There were no significant concentrations of heavy metals detected in the filtrate. Further, there were no detectable PCBs, volatile organic hydrocarbons, or semi-volatile organic hydrocarbons detected (Appendix I). Finally, filter press filtrate contained 1.2 ppm ammonia and no detectable sulfide (Appendix I).

III. Conclusions

The results of this study show that dredged sediment from the Pompton Lakes site is readily stabilized using commercially available reagents (Type I Portland Cement). In addition, this sediment is readily dewatered with a good cake with good handling properties that does not require hazardous material disposal.

Acid Brook Delta Area filter press filtrate is clear with minimal secondary water treatment necessary; filter press feed material analytical, when compared to the filtrate analytical, show that most of the metals are associated with the solids fraction, so solids removal during filter pressing should mitigate further water treatment. Iron is the only metal that, at 1,050 ppb, is below the daily maximum allowable limit but exceeds the allowable monthly average (Table 14) and its removal may need to be addressed in the field.

Table 14.
Dupont Pompton Lakes Treatability
Comparison of ABD Filter Press Filtrate with New Jersey Standards

Analyte	Filter Press Filtrate (µg/L)	Monthly Average (µg/L)	Daily Maximum (µg/L)
Arsenic	10	50	100
Cadmium	ND	50	100
Chromium	0.5	50	100
Copper	4	50	100
Iron	1050	1000	2000
Lead	ND	50	100
Mercury	0.6		1
Nickel	2	72	144
Selenium	ND	50	100
Silver	ND	25	50
Zinc	41	100	200
Cyanide	Not analyzed	100	200

Appendix A

Pompton Lakes Treatability Study

Chain-of-Custody forms for "As Received" Sediments and Waters

Sevenson Environmental Services, Inc.

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

SR #

2701 Lockport Road, Niagara Falls, NY 14305; (716) 284-0431 (T) (716) 282-2481 (F)

Project Name	Project Number
Pompton Lakes Treatability Sampling	50-6022
Report To: Gaetano.Termini@hdrinc.com	Report CC:
Company/Address: Pompton Lakes Works, 2000 Cannonball Rd., Pompton Lakes, New Jersey, 07442	
Phone #: 973-492-7703	FAX #: 973-492-7749
Sampler's Signature: George Nemeth	Sampler's Printed Name: George Nemeth

ANALYSIS REQUESTED (Include Method Number and Container Preservative)

Preservative: 0

CLIENT SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	Matrix	NUMBER OF CONTAINERS		Sevenson Assigned Treatability Testing	REMARKS
UPLANDS EXCAVATION-AREA F-01		7/24/15	0920	soil	1		X	
UPLANDS EXCAVATION-AREA F-02		7/24/15	0940	soil	1		X	
UPLANDS EXCAVATION-AREA F-03		7/24/15	1025	soil	1		X	
MECAHNICAL DREDGE AREA 1-01		7/27/15	1415	sed	1		X	
MECAHNICAL DREDGE AREA 1-02		7/27/15	1400	sed	1		X	
MECAHNICAL DREDGE AREA 1-03		7/27/15	1505	sed	1		X	
MECAHNICAL DREDGE AREA 1-04		7/27/15	1430	sed	1		X	
MECAHNICAL DREDGE AREA 1-05		7/27/15	1445	sed	1		X	

Preservative Key: 0. None; 1. HCL; 2. HNO3; 3. H2SO4; 4. NaOH; 5. Zn. Acetate; 6. MeOH; 7. NaHSO4; 8. Other

Special Instructions/Comments: Sed=sediment, SW=Surface Water.
Sevenson Lab to properly manage and store the samples/leftover sample material until Sevenson starts remediating material at the site for this project. Sevenson will send the samples back to the site at that time for disposal via truck to the approved landfill.

TURNAROUND REQUIREMENTS
- ____ RUSH (SURCHARGES APPLY)
- ____ STANDARD
- REQUESTED FAX DATE
- REQUESTED REPORT DATE

REPORT REQUIREMENTS
- ____ I. Results Only
- ____ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
- ____ III. Results + QC and Calibration Summaries
- ____ IV. Data Validation Report with Raw Data
- Edata ____ Yes ____ No

INVOICE INFORMATION
- P.O. # ____
- Bill to Sevenson Environmental
- Job #1119

Relinquished By	Received By	Relinquished By	Received By	Relinquished By	Received By
Signature: George Nemeth	Signature: Tom Sehell	Signature:	Signature: [illegible] Ph.D	Signature:	Signature:
Printed Name: George Nemeth	Printed Name: Tom Sehell	Printed Name:	Printed Name: James B. Hyde, Ph.D	Printed Name:	Printed Name:
Firm: HDR	Firm: Sevenson	Firm:	Firm: SES	Firm:	Firm:
Date/Time: 7-29-15/1500	Date/Time: 7/29/15/1500	Date/Time:	Date/Time: 8/3/15 1500	Date/Time:	Date/Time:

Sevenson Environmental Services, Inc.

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

SR #

2701 Lockport Road, Niagara Falls, NY 14305; (716) 284-0431 (T) (716) 282-2481 (F)

Project Name	Project Number
Pompton Lakes Treatability Sampling	50-6022
Report To: Gaetano.Termini@hdrinc.com	Report CC:
Company/Address: Pompton Lakes Works, 2000 Cannonball Rd., Pompton Lakes, New Jersey, 07442	
Phone #: 973-492-7703	FAX #: 973-492-7749
Sampler's Signature: George Nemeth	Sampler's Printed Name: George Nemeth

ANALYSIS REQUESTED (Include Method Number and Container Preservative)

Preservative: 0

CLIENT SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	Matrix	NUMBER OF CONTAINERS		Sevenson Assigned Treatability Testing
LEAD AREA-01		7/27/15	1500	Sed	1		X
LEAD AREA-02		7/23/15	0933	Sed	1		X
LEAD AREA-03		7/22/15	1700	Sed	1		X
ABD DREDGE MATERIAL-01		7/23/15	1500	Sed	1		X
ABD DREDGE MATERIAL-02		7/23/15	1030	Sed	1		X
ABD DREDGE MATERIAL-03		7/23/15	1300	Sed	1		X
AREA A DREDGE MATERIAL-01		7/23/15	1350	Sed	1		X

Preservative Key: 0. None; 1. HCL; 2. HNO3; 3. H2SO4; 4. NaOH; 5. Zn. Acetate; 6. MeOH; 7. NaHSO4; 8. Other

REMARKS

Special Instructions/Comments: Sed=sediment, SW=Surface Water.
Sevenson Lab to properly manage and store the samples/leftover sample material until Sevenson starts remediating material at the site for this project. Sevenson will send the samples back to the site at that time for disposal via truck to the approved landfill.

TURNAROUND REQUIREMENTS
- ____ RUSH (SURCHARGES APPLY)
- ____ STANDARD

REQUESTED FAX DATE

REQUESTED REPORT DATE

REPORT REQUIREMENTS
- ____ I. Results Only
- ____ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
- ____ III. Results + QC and Calibration Summaries
- ____ IV. Data Validation Report with Raw Data

Edata ____ Yes ____ No

INVOICE INFORMATION

P.O. #

Bill to: Sevenson Environmental

Job #1119

Relinquished By	Received By	Relinquished By	Received By	Relinquished By	Received By
Signature: George Nemeth	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: George Nemeth	Printed Name:	Printed Name:	Printed Name: James B. Murphy, PhD	Printed Name:	Printed Name:
Firm: HDR	Firm:	Firm:	Firm: SES	Firm:	Firm:
Date/Time: 7-29-15/ 1500	Date/Time: 7/29/15 1500	Date/Time:	Date/Time: 8/3/15 1500	Date/Time:	Date/Time:

Sevenson Environmental Services, Inc.

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

SR #

2701 Lockport Road, Niagara Falls, NY 14305; (716) 284-0431 (T) (716) 282-2481 (F)

Project Name	Project Number
Pompton Lakes Treatability Sampling	50-6022
Report To: Gaetano.Termini@hdrinc.com	Report CC:
Company/Address: Pompton Lakes Works 2000 Cannonball Rd. Pompton Lakes, New Jersey, 07442	
Phone #: 973-492-7703	FAX #: 973-492-7749
Sampler's Signature: George Nemeth	Sampler's Printed Name: George Nemeth

ANALYSIS REQUESTED (Include Method Number and Container Preservative)

Preservative: 0

Preservative Key: 0. None; 1. HCL; 2. HNO3; 3. H2SO4; 4. NaOH; 5. Zn Acetate; 6. MeOH; 7. NaHSO4; 8. Other

CLIENT SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	Matrix	NUMBER OF CONTAINERS		Sevenson Assigned Treatability Testing	REMARKS
LAKE WATER-01		7/23/15	1445	SW	1		X	
LAKE WATER-02		7/23/15	1035	SW	1		X	
LAKE WATER-03		7/23/15	1250	SW	1		X	
LAKE WATER-04		7/23/15	1240	SW	1		X	
LAKE WATER-05		7/23/15	1230	SW	1		X	
ISLAND AREA DREDGE MATERIAL-01		7/22/15	1630	Sed	1		X	
ISLAND AREA DREDGE MATERIAL-02		7/22/15	1615	Sed	1		X	
ISLAND AREA DREDGE MATERIAL-03		7/22/15	1600	Sed	1		X	
ISLAND AREA DREDGE MATERIAL-04		7/22/15	1530	Sed	1		X	
ISLAND AREA DREDGE MATERIAL-05		7/22/15	1450	Sed	1		X	

Special Instructions/Comments: Sed=sediment, SW=Surface Water.
Sevenson Lab to properly manage and store the samples/leftover sample material until Sevenson starts remediating material at the site for this project. Sevenson will send the samples back to the site at that time for disposal via truck to the approved landfill.

TURNAROUND REQUIREMENTS
___ RUSH (SURCHARGES APPLY)
___ STANDARD
REQUESTED FAX DATE
REQUESTED REPORT DATE

REPORT REQUIREMENTS
___ I. Results Only
___ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
___ III. Results + QC and Calibration Summaries
___ IV. Data Validation Report with Raw Data
Edata ___ Yes ___ No

INVOICE INFORMATION
P.O. #
Bill to: Sevenson Environmental
Job #1819

Relinquished By	Received By	Relinquished By	Received By	Relinquished By	Received By
Signature: George Nemeth	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: George Nemeth	Printed Name:	Printed Name:	Printed Name: James B. Corey, Ph.D	Printed Name:	Printed Name:
Firm: HDR	Firm:	Firm:	Firm: SES	Firm:	Firm:
Date/Time: 7-29-15 / 1500	Date/Time:	Date/Time:	Date/Time: 8/3/15 1500	Date/Time:	Date/Time:

Appendix B

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Uplands Excavation Sediments

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:02

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Uplands Excavation-Area F-01	5H05019-01	Soil	07/24/15 09:20	08/03/15 08:00
Uplands Excavation-Area F-02	5H05019-02	Soil	07/24/15 09:40	08/03/15 08:00
Uplands Excavation-Area F-03	5H05019-03	Soil	07/24/15 10:25	08/03/15 08:00

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:02

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Uplands Excavation-Area F-01 (5H05019-01) Soil	**Sampled: 07/24/15 09:20**	**Received: 08/03/15 08:00**								
Mercury	**0.0002**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	
Silver	**ND**	0.025		"	5	AH50534	08/05/15	08/05/15	6010B**	U
Arsenic	**0.020**	0.050		"	"	"	"	"	"	U
Barium	**0.338**	0.025		"	"	"	"	"	"	
Cadmium	**0.009**	0.005		"	"	"	"	"	"	
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.528**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.528**	0.050		"	"	"	"	"	EPA 6010B**	
Uplands Excavation-Area F-02 (5H05019-02) Soil	**Sampled: 07/24/15 09:40**	**Received: 08/03/15 08:00**								
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50534	08/05/15	08/05/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.281**	0.025		"	"	"	"	"	"	
Cadmium	**0.003**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.098**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.098**	0.050		"	"	"	"	"	EPA 6010B**	
Uplands Excavation-Area F-03 (5H05019-03) Soil	**Sampled: 07/24/15 10:25**	**Received: 08/03/15 08:00**								
Mercury	**0.0001**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50534	08/05/15	08/05/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.287**	0.025		"	"	"	"	"	"	
Cadmium	**0.003**	0.005		"	"	"	"	"	"	U
Chromium	**0.004**	0.025		"	"	"	"	"	"	U
Lead	**0.065**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.065**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Appendix C

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Acid Brook Delta Sediments

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: ABD Dredge Initials	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:28

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ABD DREGE MATERIAL-01 Initial	5I14014-01	Soil	07/23/15 15:00	08/03/15 15:53
ABD DREGE MATERIAL-02 Initial	5I14014-02	Soil	07/23/15 10:30	08/03/15 15:53
ABD DREGE MATERIAL-03 Initial	5I14014-03	Soil	07/23/15 13:00	08/03/15 15:53

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: ABD Dredge Initials	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:28

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
ABD DREGE MATERIAL-01 Initial (5I14014-01) Soil Sampled: 07/23/15 15:00 Received: 08/03/15 15:53										
Mercury	**0.0008**	0.0002		mg/L	1	AI52236	09/22/15	09/22/15	EPA 7470A	
Silver	**ND**	0.025		"	5	AI51523	09/15/15	09/15/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.316**	0.025		"	"	"	"	"	"	
Cadmium	**0.004**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.338**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
ABD DREGE MATERIAL-02 Initial (5I14014-02) Soil Sampled: 07/23/15 10:30 Received: 08/03/15 15:53										
Mercury	**ND**	0.0002		mg/L	1	AI52236	09/22/15	09/22/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AI51523	09/15/15	09/15/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.292**	0.025		"	"	"	"	"	"	
Cadmium	**0.003**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.049**	0.050		"	"	"	"	"	"	U
Selenium	**ND**	0.100		"	"	"	"	"	"	U
ABD DREGE MATERIAL-03 Initial (5I14014-03) Soil Sampled: 07/23/15 13:00 Received: 08/03/15 15:53										
Mercury	**0.00003**	0.0002		mg/L	1	AI52236	09/22/15	09/22/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AI51523	09/15/15	09/15/15	6010B**	U
Arsenic	**0.017**	0.050		"	"	"	"	"	"	U
Barium	**0.352**	0.025		"	"	"	"	"	"	
Cadmium	**0.005**	0.005		"	"	"	"	"	"	
Chromium	**0.002**	0.025		"	"	"	"	"	"	U
Lead	**0.098**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Appendix D

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Mechanical Dredge Area Sediments

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:07

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Mechanical Dredge Area 1-01	5H05019-07	Soil	07/27/15 14:15	08/03/15 08:00
Mechanical Dredge Area 1-02	5H05019-08	Soil	07/27/15 14:00	08/03/15 08:00
Mechanical Dredge Area 1-03	5H05019-09	Soil	07/27/15 15:05	08/03/15 08:00
Mechanical Dredge Area 1-04	5H05019-10	Soil	07/27/15 14:30	08/03/15 08:00
Mechanical Dredge Area 1-05	5H05019-11	Soil	07/27/15 14:45	08/03/15 08:00

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:07

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Mechanical Dredge Area 1-01 (5H05019-07) Soil Sampled: 07/27/15 14:15 Received: 08/03/15 08:00										
Mercury	**0.001**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	
Silver	**ND**	0.025		"	5	AH50602	08/06/15	08/06/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.394**	0.025		"	"	"	"	"	"	
Cadmium	**0.013**	0.005		"	"	"	"	"	"	
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**2.90**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**2.90**	0.050		"	"	"	"	"	EPA 6010B**	
Mechanical Dredge Area 1-02 (5H05019-08) Soil Sampled: 07/27/15 14:00 Received: 08/03/15 08:00										
Mercury	**0.00002**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50602	08/06/15	08/06/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.468**	0.025		"	"	"	"	"	"	
Cadmium	**0.006**	0.005		"	"	"	"	"	"	
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.762**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.762**	0.050		"	"	"	"	"	EPA 6010B**	
Mechanical Dredge Area 1-03 (5H05019-09) Soil Sampled: 07/27/15 15:05 Received: 08/03/15 08:00										
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50602	08/06/15	08/06/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.289**	0.025		"	"	"	"	"	"	
Cadmium	**0.004**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.326**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.326**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:07

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Mechanical Dredge Area 1-04 (5H05019-10) Soil Sampled: 07/27/15 14:30 Received: 08/03/15 08:00										
Mercury	**0.0004**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	
Silver	**ND**	0.025		"	5	AH50602	08/06/15	08/06/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.271**	0.025		"	"	"	"	"	"	
Cadmium	**0.005**	0.005		"	"	"	"	"	"	
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.750**	0.050		"	"	"	"	"	"	
Selenium	**0.038**	0.100		"	"	"	"	"	"	U
Lead	**0.750**	0.050		"	"	"	"	"	EPA 6010B**	
Mechanical Dredge Area 1-05 (5H05019-11) Soil Sampled: 07/27/15 14:45 Received: 08/03/15 08:00										
Mercury	**0.0008**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	
Silver	**ND**	0.025		"	5	AH50602	08/06/15	08/06/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.470**	0.025		"	"	"	"	"	"	
Cadmium	**0.004**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.578**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.578**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Appendix E

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Island Area Dredge Sediments

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:12

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Island Area Dredge Material -01	5H05019-15	Soil	07/22/15 16:30	08/03/15 08:00
Island Area Dredge Material -02	5H05019-16	Soil	07/22/15 16:15	08/03/15 08:00
Island Area Dredge Material -03	5H05019-17	Soil	07/22/15 16:00	08/03/15 08:00
Island Area Dredge Material -04	5H05019-18	Soil	07/22/15 15:30	08/03/15 08:00
Island Area Dredge Material -05	5H05019-19	Soil	07/22/15 14:50	08/03/15 08:00

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:12

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Island Area Dredge Material -01 (5H05019-15) Soil	**Sampled: 07/22/15 16:30**	**Received: 08/03/15 08:00**								
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50702	08/07/15	08/07/15	6010B**	U
Arsenic	**0.018**	0.050		"	"	"	"	"	"	U
Barium	**0.549**	0.025		"	"	"	"	"	"	
Cadmium	**0.006**	0.005		"	"	"	"	"	"	
Chromium	**0.002**	0.025		"	"	"	"	"	"	U
Lead	**0.073**	0.050		"	"	"	"	"	"	
Selenium	**0.056**	0.100		"	"	"	"	"	"	U
Lead	**0.073**	0.050		"	"	"	"	"	EPA 6010B**	
Island Area Dredge Material -02 (5H05019-16) Soil	**Sampled: 07/22/15 16:15**	**Received: 08/03/15 08:00**								
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50702	08/07/15	08/07/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.388**	0.025		"	"	"	"	"	"	
Cadmium	**0.003**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.049**	0.050		"	"	"	"	"	"	U
Selenium	**0.033**	0.100		"	"	"	"	"	"	U
Lead	**0.049**	0.050		"	"	"	"	"	EPA 6010B**	
Island Area Dredge Material -03 (5H05019-17) Soil	**Sampled: 07/22/15 16:00**	**Received: 08/03/15 08:00**								
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50702	08/07/15	08/07/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.368**	0.025		"	"	"	"	"	"	
Cadmium	**0.003**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.050**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.050**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:12

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Island Area Dredge Material -04 (5H05019-18) Soil	**Sampled: 07/22/15 15:30**	**Received: 08/03/15 08:00**								
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50702	08/07/15	08/07/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.261**	0.025		"	"	"	"	"	"	
Cadmium	**0.002**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.041**	0.050		"	"	"	"	"	"	U
Selenium	**0.035**	0.100		"	"	"	"	"	"	U
Lead	**0.041**	0.050		"	"	"	"	"	EPA 6010B**	
Island Area Dredge Material -05 (5H05019-19) Soil	**Sampled: 07/22/15 14:50**	**Received: 08/03/15 08:00**								
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50702	08/07/15	08/07/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.503**	0.025		"	"	"	"	"	"	
Cadmium	**0.008**	0.005		"	"	"	"	"	"	
Chromium	**0.005**	0.025		"	"	"	"	"	"	U
Lead	**0.126**	0.050		"	"	"	"	"	"	
Selenium	**0.039**	0.100		"	"	"	"	"	"	U
Lead	**0.126**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Appendix F

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Area A Dredge Sediments

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:17

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Area A Dredge Material -01	5H05019-20	Soil	07/23/15 13:50	08/03/15 08:00

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:17

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Area A Dredge Material -01 (5H05019-20) Soil Sampled: 07/23/15 13:50 Received: 08/03/15 08:00										
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50702	08/07/15	08/07/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.422**	0.025		"	"	"	"	"	"	
Cadmium	**0.005**	0.005		"	"	"	"	"	"	
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.088**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.088**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Appendix G

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Lead Area Dredge Sediments

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:19

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Lead Area -01	5H05019-04	Soil	07/27/15 15:00	08/03/15 08:00
Lead Area -02	5H05019-05	Soil	07/23/15 09:33	08/03/15 08:00
Lead Area -03	5H05019-06	Soil	07/22/15 17:00	08/03/15 08:00

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:19

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Lead Area -01 (5H05019-04) Soil Sampled: 07/27/15 15:00 Received: 08/03/15 08:00										
Mercury	**ND**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50534	08/05/15	08/05/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.168**	0.025		"	"	"	"	"	"	
Cadmium	**0.003**	0.005		"	"	"	"	"	"	U
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**0.075**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.075**	0.050		"	"	"	"	"	EPA 6010B**	
Lead Area -02 (5H05019-05) Soil Sampled: 07/23/15 09:33 Received: 08/03/15 08:00										
Mercury	**0.0003**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	
Silver	**ND**	0.025		"	5	AH50534	08/05/15	08/05/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.221**	0.025		"	"	"	"	"	"	
Cadmium	**0.008**	0.005		"	"	"	"	"	"	
Chromium	**0.008**	0.025		"	"	"	"	"	"	U
Lead	**0.732**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**0.732**	0.050		"	"	"	"	"	EPA 6010B**	
Lead Area -03 (5H05019-06) Soil Sampled: 07/22/15 17:00 Received: 08/03/15 08:00										
Mercury	**0.0001**	0.0002		mg/L	1	AI52117	09/21/15	09/21/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AH50534	08/05/15	08/05/15	6010B**	U
Arsenic	**0.020**	0.050		"	"	"	"	"	"	U
Barium	**0.519**	0.025		"	"	"	"	"	"	
Cadmium	**0.012**	0.005		"	"	"	"	"	"	
Chromium	**ND**	0.025		"	"	"	"	"	"	U
Lead	**1.29**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U
Lead	**1.29**	0.050		"	"	"	"	"	EPA 6010B**	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Appendix H

Pompton Lakes Treatability Study

Chemical Analyses of "As Received" Water Decant and Lake Water Samples

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:24

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Mechanical Dredge Area Decant Composite of Area 1-01-1-05	5H05019-12	Water	08/06/15 08:00	08/03/15 08:00
Island Area Dredge Material Decant Composite of Area-01-05	5H05019-13	Water	08/06/15 08:00	08/03/15 08:00
Lake Water Composite of -01-05	5H05019-14	Water	08/06/15 08:00	08/03/15 08:00
Lead Area Composite 01-03 Decant	5H05019-21	Water	08/13/15 00:00	08/03/15 08:00

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:24

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Mechanical Dredge Area Decant Composite of Area 1-01-1-05 (5H05019-12) Water Sampled: 08/06/15 08:00 Received: 08/03/15 08:										
Mercury	**0.0005**	0.0002		mg/L	1	AI52235	09/22/15	09/22/15	EPA 7470A	
Silver	**ND**	0.005		"	"	AH50605	08/06/15	08/06/15	EPA 6010B**	
Arsenic	**0.021**	0.010		"	"	"	"	"	"	
Barium	**0.412**	0.005		"	"	"	"	"	"	
Cadmium	**0.005**	0.001		"	"	"	"	"	"	
Chromium	**0.055**	0.005		"	"	"	"	"	"	
Lead	**2.96**	0.010		"	"	"	"	"	"	
Selenium	**0.007**	0.020		"	"	"	"	"	"	
Lead	**2.96**	0.010		"	"	"	"	"	"	
Island Area Dredge Material Decant Composite of Area-01-05 (5H05019-13) Water Sampled: 08/06/15 08:00 Received: 08/03/15 08										
Mercury	**ND**	0.0002		mg/L	1	AI52235	09/22/15	09/22/15	EPA 7470A	
Silver	**ND**	0.005		"	"	AH50605	08/06/15	08/06/15	EPA 6010B**	
Arsenic	**ND**	0.010		"	"	"	"	"	"	
Barium	**0.285**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**0.009**	0.005		"	"	"	"	"	"	
Lead	**0.025**	0.010		"	"	"	"	"	"	
Selenium	**0.016**	0.020		"	"	"	"	"	"	
Lead	**0.025**	0.010		"	"	"	"	"	"	
Lake Water Composite of -01-05 (5H05019-14) Water Sampled: 08/06/15 08:00 Received: 08/03/15 08:00										
Mercury	**ND**	0.0002		mg/L	1	AI52235	09/22/15	09/22/15	EPA 7470A	
Silver	**ND**	0.005		"	"	AH50605	08/06/15	08/06/15	EPA 6010B**	
Arsenic	**ND**	0.010		"	"	"	"	"	"	
Barium	**0.030**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**0.002**	0.005		"	"	"	"	"	"	
Lead	**ND**	0.010		"	"	"	"	"	"	
Selenium	**0.008**	0.020		"	"	"	"	"	"	
Lead	**ND**	0.010		"	"	"	"	"	"	

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:24

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Lead Area Composite 01-03 Decant (5H05019-21) Water Sampled: 08/13/15 00:00 Received: 08/03/15 08:00										
Mercury	**0.0008**	0.0002		mg/L	1	AI52235	09/22/15	09/22/15	EPA 7470A	
Silver	**0.005**	0.005		"	"	AH51302	08/13/15	08/13/15	EPA 6010B**	
Arsenic	**0.034**	0.010		"	"	"	"	"	"	
Barium	**0.816**	0.005		"	"	"	"	"	"	
Cadmium	**0.017**	0.001		"	"	"	"	"	"	
Chromium	**0.268**	0.005		"	"	"	"	"	"	
Lead	**5.81**	0.010		"	"	"	"	"	"	
Selenium	**ND**	0.020		"	"	"	"	"	"	
Lead	**5.81**	0.010		"	"	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:24

Metals (Dissolved) by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Mechanical Dredge Area Decant Composite of Area 1-01-1-05 (5H05019-12) Water Sampled: 08/06/15 08:00 Received: 08/03/15 08:										
Silver	**ND**	0.005		mg/L	1	AH50604	08/06/15	08/06/15	EPA 6010B**	U
Arsenic	**ND**	0.0100		"	"	"	"	"	"	U
Barium	**0.212**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**ND**	0.005		"	"	"	"	"	"	
Mercury	**0.0002**	0.0002		"	"	AI52237	09/22/15	09/22/15	EPA 7470A	
Lead	**0.009**	0.010		"	"	AH50604	08/06/15	08/06/15	EPA 6010B**	
Selenium	**ND**	0.020		"	"	"	"	"	"	
Island Area Dredge Material Decant Composite of Area-01-05 (5H05019-13) Water Sampled: 08/06/15 08:00 Received: 08/03/15 08										
Silver	**ND**	0.005		mg/L	1	AH50604	08/06/15	08/06/15	EPA 6010B**	U
Arsenic	**ND**	0.0100		"	"	"	"	"	"	U
Barium	**0.213**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**ND**	0.005		"	"	"	"	"	"	
Mercury	**ND**	0.0002		"	"	AI52237	09/22/15	09/22/15	EPA 7470A	
Lead	**ND**	0.010		"	"	AH50604	08/06/15	08/06/15	EPA 6010B**	
Selenium	**0.008**	0.020		"	"	"	"	"	"	
Lake Water Composite of -01-05 (5H05019-14) Water Sampled: 08/06/15 08:00 Received: 08/03/15 08:00										
Silver	**ND**	0.005		mg/L	1	AH50604	08/06/15	08/06/15	EPA 6010B**	U
Arsenic	**ND**	0.0100		"	"	"	"	"	"	U
Barium	**0.043**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**ND**	0.005		"	"	"	"	"	"	
Mercury	**ND**	0.0002		"	"	AI52237	09/22/15	09/22/15	EPA 7470A	
Lead	**0.003**	0.010		"	"	AH50604	08/06/15	08/06/15	EPA 6010B**	
Selenium	**ND**	0.020		"	"	"	"	"	"	

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/23/15 11:24

Metals (Dissolved) by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Lead Area Composite 01-03 Decant (5H05019-21) Water Sampled: 08/13/15 00:00 Received: 08/03/15 08:00										
Silver	**ND**	0.005		mg/L	1	AH51301	08/13/15	08/13/15	EPA 6010B**	U
Arsenic	**ND**	0.0100		"	"	"	"	"	"	U
Barium	**0.105**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**ND**	0.005		"	"	"	"	"	"	
Mercury	**0.00007**	0.0002		"	"	AI52237	09/22/15	09/22/15	EPA 7470A	
Lead	**0.005**	0.010		"	"	AH51301	08/13/15	08/13/15	EPA 6010B**	
Selenium	**ND**	0.020		"	"	"	"	"	"	

Client Sample ID: LAKE SURFACE WATER 1

Lab Sample ID: 480-85012-1
Matrix: Water

Date Collected: 08/04/15 13:00
Date Received: 08/04/15 16:23

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as NH3	ND	F1	0.024	0.011	mg/L			08/07/15 10:22	1
Sulfide	ND		0.10	0.052	mg/L			08/11/15 03:30	1

Client Sample ID: MECHANICAL DREDGE AREA 1,2

Lab Sample ID: 480-85012-2
Matrix: Water

Date Collected: 08/04/15 13:00
Date Received: 08/04/15 16:23

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as NH3	8.8		0.12	0.055	mg/L			08/12/15 12:31	5
Sulfide	ND		0.10	0.052	mg/L			08/11/15 03:30	1

Client: Sevenson Environmental Services, Inc.
Project/Site: Pomton Lakes

TestAmerica Job ID: 480-85263-1

Client Sample ID: Island Dredge
Date Collected: 08/06/15 13:00
Date Received: 08/07/15 14:48

Lab Sample ID: 480-85263-1
Matrix: Water

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as NH3	21.2		0.48	0.22	mg/L			08/18/15 12:14	20
Sulfide	ND		0.10	0.052	mg/L			08/11/15 03:30	1

Client: Sevenson Environmental Services, Inc.
Project/Site: Sevenson Environmental Services, Inc.

TestAmerica Job ID: 480-85593-1

Client Sample ID: LEAD AREA DECANT
Date Collected: 08/13/15 13:00
Date Received: 08/13/15 16:30

Lab Sample ID: 480-85593-2
Matrix: Water

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia	2.9		0.040	0.018	mg/L			08/18/15 11:58	2
Sulfide	ND		1.0	0.67	mg/L			08/18/15 05:35	1

Appendix I

Pompton Lakes Treatability Study

Chemical Analyses of Filter Press Feed, Filter Cake, and Filtrate

SEVENSON ENVIRONMENTAL SERVICES, INC.
2701 Lockport Road
Niagara Falls, NY 14305
(716) 282-2469

Analytical Data Report
Report Date: 09/24/15
Work Order Number: 5I15025

Prepared For
Jim Hyzy
Sevenson Treatability Studies
2749 Lockport Road
Niagara Falls, NY 14305
Fax: (716) 284-1796

Site: Pompton Lakes

Enclosed are the results of analyses for samples received by the laboratory on 09/15/15. If you have any questions concerning this report, please feel free to contact me.

DISCLAIMER: The Sevenson Laboratory is not certified by any State or Federal agency - these results are for informational purposes **only**.

Sincerely,

James B. Hyzy, Ph.D., Director of Operations

Sevenson Environmental Services, Inc.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Filter Press Feed Material	5I15025-01	Soil	09/14/15 00:00	09/15/15 09:37
Filter Press Filtrate	5I15025-02	Water	09/14/15 00:00	09/15/15 09:37
ABD Filter Cake	5I15025-03	Soil	09/14/15 00:00	09/15/15 09:37

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	10/15/15 10:27

Metals by EPA 6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil Sampled: 09/14/15 00:00 Received: 09/15/15 09:37										
Copper	**828**	1.12		mg/kg dry	1	AI51629	09/16/15	09/17/15	EPA 6010B**	
Iron	**21300**	8.93		"	"	"	"	"	"	
Mercury	**938**	6.80		"	400	AI51706	09/17/15	09/17/15	EPA 7471A**	
Silver	**ND**	0.446		"	1	AI51629	09/16/15	09/17/15	EPA 6010B**	
Arsenic	**7.47**	1.79		"	"	"	"	"	"	
Barium	**130**	0.893		"	"	"	"	"	"	
Cadmium	**0.905**	0.446		"	"	"	"	"	"	
Chromium	**55.7**	0.893		"	"	"	"	"	"	
Lead	**679**	1.79		"	"	"	"	"	"	
Selenium	**14.7**	1.79		"	"	"	"	"	"	
Nickel	**24.3**	0.89		"	"	"	"	"	"	
Zinc	**471**	1.79		"	"	"	"	"	"	
Filter Press Filtrate (5I15025-02) Water Sampled: 09/14/15 00:00 Received: 09/15/15 09:37										
Copper	**0.004**	0.012		mg/L	1	AI51526	09/15/15	09/15/15	EPA 6010B**	
Iron	**1.05**	0.100		"	"	"	"	"	"	
Mercury	**0.0006**	0.0002		"	"	AI52235	09/22/15	09/22/15	EPA 7470A	
Silver	**ND**	0.005		"	"	AI51526	09/15/15	09/15/15	EPA 6010B**	
Arsenic	**0.010**	0.010		"	"	"	"	"	"	
Barium	**0.076**	0.005		"	"	"	"	"	"	
Cadmium	**ND**	0.001		"	"	"	"	"	"	
Chromium	**0.0005**	0.005		"	"	"	"	"	"	
Lead	**ND**	0.010		"	"	"	"	"	"	
Selenium	**ND**	0.020		"	"	"	"	"	"	
Nickel	**0.002**	0.010		"	"	"	"	"	"	
Zinc	**0.041**	0.020		"	"	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

TCLP Metals by 1311/6000/7000 Series Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
ABD Filter Cake (5115025-03) Soil	**Sampled: 09/14/15 00:00**	**Received: 09/15/15 09:37**								
Mercury	**0.00009**	0.0002		mg/L	1	AI52236	09/22/15	09/22/15	EPA 7470A	U
Silver	**ND**	0.025		"	5	AI51634	09/16/15	09/17/15	6010B**	U
Arsenic	**ND**	0.050		"	"	"	"	"	"	U
Barium	**0.569**	0.025		"	"	"	"	"	"	
Cadmium	**0.008**	0.005		"	"	"	"	"	"	
Chromium	**0.025**	0.025		"	"	"	"	"	"	
Lead	**1.07**	0.050		"	"	"	"	"	"	
Selenium	**ND**	0.100		"	"	"	"	"	"	U

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Polychlorinated Biphenyls by EPA Method 8082

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil	**Sampled: 09/14/15 00:00**			**Received: 09/15/15 09:37**						
Aroclor 1016	**ND**	6.59		ug/kg dry	1	AI51702	09/15/15	09/22/15	8082**	U
Aroclor 1221	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1232	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1242	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1248	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1254	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1260	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1262	**ND**	6.59		"	"	"	"	"	"	U
Aroclor 1268	**ND**	6.59		"	"	"	"	"	"	U
Surrogate: Tetrachloro-meta-xylene		*85.3 %*		*80-125*		"	"	"	"	
Surrogate: Decachlorobiphenyl		*80.8 %*		*60-130*		"	"	"	"	
Filter Press Filtrate (5I15025-02) Water	**Sampled: 09/14/15 00:00**			**Received: 09/15/15 09:37**						
Aroclor 1016	**ND**	0.050		ug/l	1	AI51703	09/16/15	09/22/15	8082**	U
Aroclor 1221	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1232	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1242	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1248	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1254	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1260	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1262	**ND**	0.050		"	"	"	"	"	"	U
Aroclor 1268	**ND**	0.050		"	"	"	"	"	"	U
Surrogate: Tetrachloro-meta-xylene		*84.2 %*		*45-135*		"	"	"	"	
Surrogate: Decachlorobiphenyl		*103 %*		*55-120*		"	"	"	"	

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Volatile Organic Compounds by EPA Method 8260B

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil	**Sampled: 09/14/15 00:00**	**Received: 09/15/15 09:37**								
chloromethane	**ND**	10		ug/kg dry	1	AI51524	09/15/15	09/24/15	8260B**	U
vinyl chloride	**ND**	10		"	"	"	"	"	"	U
bromomethane	**ND**	10		"	"	"	"	"	"	U
chloroethane	**ND**	10		"	"	"	"	"	"	U
1,1-dichloroethene	**ND**	2		"	"	"	"	"	"	U
acetone	**189**	10		"	"	"	"	"	"	
carbon disulfide	**12**	2		"	"	"	"	"	"	
methylene chloride	**347**	10		"	"	"	"	"	"	
trans-1,2-dichloroethene	**ND**	2		"	"	"	"	"	"	U
1,1-dichloroethane	**ND**	2		"	"	"	"	"	"	U
vinyl acetate	**ND**	10		"	"	"	"	"	"	U
2-butanone	**ND**	10		"	"	"	"	"	"	U
cis-1,2-dichloroethene	**ND**	2		"	"	"	"	"	"	U
chloroform	**12**	2		"	"	"	"	"	"	
1,1,1-trichloroethane	**ND**	2		"	"	"	"	"	"	U
carbon tetrachloride	**ND**	2		"	"	"	"	"	"	U
benzene	**ND**	2		"	"	"	"	"	"	U
1,2-dichloroethane	**ND**	2		"	"	"	"	"	"	U
trichloroethene	**ND**	2		"	"	"	"	"	"	U
1,2-dichloropropane	**ND**	2		"	"	"	"	"	"	U
bromodichloromethane	**ND**	2		"	"	"	"	"	"	U
4-Methyl-2-pentanone (MIBK)	**ND**	10		"	"	"	"	"	"	U
cis-1,3-dichloropropene	**ND**	2		"	"	"	"	"	"	U
toluene	**ND**	2		"	"	"	"	"	"	U
trans-1,3-dichloropropene	**ND**	2		"	"	"	"	"	"	U
1,1,2-trichloroethane	**ND**	2		"	"	"	"	"	"	U
2-hexanone	**ND**	10		"	"	"	"	"	"	U
tetrachloroethene	**ND**	2		"	"	"	"	"	"	U
1,3-dichloropropane	**ND**	2		"	"	"	"	"	"	U
dibromochloromethane	**ND**	2		"	"	"	"	"	"	U
chlorobenzene	**ND**	2		"	"	"	"	"	"	U
ethylbenzene	**ND**	2		"	"	"	"	"	"	U
m,p-xylene	**ND**	4		"	"	"	"	"	"	U
o-xylene	**ND**	2		"	"	"	"	"	"	U
styrene	**ND**	2		"	"	"	"	"	"	U
bromoform	**ND**	2		"	"	"	"	"	"	U
1,1,2,2-tetrachloroethane	**ND**	2		"	"	"	"	"	"	U
1,3-dichlorobenzene	**ND**	2		"	"	"	"	"	"	U
1,4-dichlorobenzene	**ND**	2		"	"	"	"	"	"	U
1,2-dichlorobenzene	**ND**	2		"	"	"	"	"	"	U
Surrogate: Dibromofluoromethane		*94.4 %*		*90-115*		"	"	"	"	

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Volatile Organic Compounds by EPA Method 8260B

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil	**Sampled: 09/14/15 00:00**			**Received: 09/15/15 09:37**						
Surrogate: 1,2-Dichloroethane-d4		*79.9 %*		*90-120*		*AI51524*	*09/15/15*	*09/24/15*	*8260B***	*S-04*
Surrogate: Toluene-d8		*107 %*		*90-110*		"	"	"	"	
Surrogate: Bromofluorobenzene		*106 %*		*90-120*		"	"	"	"	
Filter Press Filtrate (5I15025-02) Water	**Sampled: 09/14/15 00:00**			**Received: 09/15/15 09:37**						
chloromethane	**ND**	2		ug/l	1	AI51525	09/15/15	09/24/15	8260B**	U
vinyl chloride	**ND**	1		"	"	"	"	"	"	U
bromomethane	**ND**	2		"	"	"	"	"	"	U
chloroethane	**ND**	2		"	"	"	"	"	"	U
1,1-dichloroethene	**ND**	1		"	"	"	"	"	"	U
acetone	**ND**	10		"	"	"	"	"	"	U
carbon disulfide	**ND**	1		"	"	"	"	"	"	U
methylene chloride	**ND**	10		"	"	"	"	"	"	U
trans-1,2-dichloroethene	**ND**	1		"	"	"	"	"	"	U
1,1-dichloroethane	**ND**	1		"	"	"	"	"	"	U
vinyl acetate	**ND**	10		"	"	"	"	"	"	U
2-butanone	**ND**	10		"	"	"	"	"	"	U
cis-1,2-dichloroethene	**ND**	1		"	"	"	"	"	"	U
chloroform	**ND**	1		"	"	"	"	"	"	U
1,1,1-trichloroethane	**ND**	1		"	"	"	"	"	"	U
carbon tetrachloride	**ND**	1		"	"	"	"	"	"	U
benzene	**ND**	1		"	"	"	"	"	"	U
1,2-dichloroethane	**ND**	1		"	"	"	"	"	"	U
trichloroethene	**ND**	1		"	"	"	"	"	"	U
1,2-dichloropropane	**ND**	1		"	"	"	"	"	"	U
bromodichloromethane	**ND**	1		"	"	"	"	"	"	U
2-chloroethylvinyl ether	**ND**	10		"	"	"	"	"	"	U
4-Methyl-2-pentanone (MIBK)	**ND**	10		"	"	"	"	"	"	U
cis-1,3-dichloropropene	**ND**	1		"	"	"	"	"	"	U
toluene	**ND**	1		"	"	"	"	"	"	U
trans-1,3-dichloropropene	**ND**	1		"	"	"	"	"	"	U
1,1,2-trichloroethane	**ND**	1		"	"	"	"	"	"	U
2-hexanone	**ND**	10		"	"	"	"	"	"	U
tetrachloroethene	**ND**	1		"	"	"	"	"	"	U
dibromochloromethane	**ND**	1		"	"	"	"	"	"	U
chlorobenzene	**ND**	1		"	"	"	"	"	"	U
ethylbenzene	**ND**	1		"	"	"	"	"	"	U
m,p-xylene	**ND**	2		"	"	"	"	"	"	U
o-xylene	**ND**	1		"	"	"	"	"	"	U
styrene	**ND**	1		"	"	"	"	"	"	U
bromoform	**ND**	1		"	"	"	"	"	"	U

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Volatile Organic Compounds by EPA Method 8260B

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Filtrate (5I15025-02) Water	**Sampled: 09/14/15 00:00**	**Received: 09/15/15 09:37**								
1,1,2,2-tetrachloroethane	**ND**	1		ug/l	1	AI51525	09/15/15	09/24/15	8260B**	U
1,3-dichlorobenzene	**ND**	1		"	"	"	"	"	"	U
1,4-dichlorobenzene	**ND**	1		"	"	"	"	"	"	U
1,2-dichlorobenzene	**ND**	1		"	"	"	"	"	"	U
Surrogate: Dibromofluoromethane		*101 %*		*90-110*		"	"	"	"	
Surrogate: 1,2-Dichloroethane-d4		*104 %*		*80-120*		"	"	"	"	
Surrogate: Toluene-d8		*98.4 %*		*90-110*		"	"	"	"	
Surrogate: Bromofluorobenzene		*98.3 %*		*85-120*		"	"	"	"	

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil	**Sampled: 09/14/15 00:00 Received: 09/15/15 09:37**									
N-Nitrosodimethylamine	**ND**	134		ug/kg dry	1	AI51701	09/15/15	09/24/15	8270C**	U
bis(2-chloroethyl)ether	**ND**	67		"	"	"	"	"	"	U
Aniline	**ND**	134		"	"	"	"	"	"	U
phenol	**ND**	134		"	"	"	"	"	"	U
2-chlorophenol	**ND**	134		"	"	"	"	"	"	U
benzyl alcohol	**ND**	67		"	"	"	"	"	"	U
bis(2-chloroisopropyl)ether	**ND**	67		"	"	"	"	"	"	U
2-methylphenol	**ND**	67		"	"	"	"	"	"	U
hexachloroethane	**ND**	67		"	"	"	"	"	"	U
N-Nitrosodi-n-propylamine	**ND**	67		"	"	"	"	"	"	U
3 & 4-methylphenol	**ND**	134		"	"	"	"	"	"	U
nitrobenzene	**ND**	67		"	"	"	"	"	"	U
isophorone	**ND**	67		"	"	"	"	"	"	U
2-nitrophenol	**ND**	134		"	"	"	"	"	"	U
2,4-dimethylphenol	**ND**	134		"	"	"	"	"	"	U
Bis(2-chloroethoxy)methane	**ND**	67		"	"	"	"	"	"	U
benzoic acid	**2550**	333		"	"	"	"	"	"	
2,4-dichlorophenol	**ND**	134		"	"	"	"	"	"	U
1,2,4-trichlorobenzene	**ND**	67		"	"	"	"	"	"	U
naphthalene	**ND**	67		"	"	"	"	"	"	U
4-chloroaniline	**ND**	67		"	"	"	"	"	"	U
hexachlorobutadiene	**ND**	67		"	"	"	"	"	"	U
4-chloro-3-methylphenol	**ND**	134		"	"	"	"	"	"	U
2-methylnaphthalene	**ND**	67		"	"	"	"	"	"	U
hexachlorocyclopentadiene	**ND**	130		"	"	"	"	"	"	U
2,4,6-trichlorophenol	**ND**	134		"	"	"	"	"	"	U
2,4,5-trichlorophenol	**ND**	67		"	"	"	"	"	"	U
2-chloronaphthalene	**ND**	67		"	"	"	"	"	"	U
2-nitroaniline	**ND**	67		"	"	"	"	"	"	U
acenaphthylene	**ND**	67		"	"	"	"	"	"	U
Dimethyl phthalate	**ND**	67		"	"	"	"	"	"	U
2,6-dinitrotoluene	**ND**	67		"	"	"	"	"	"	U
acenaphthene	**ND**	67		"	"	"	"	"	"	U
3-nitroaniline	**ND**	67		"	"	"	"	"	"	U
2,4-dinitrophenol	**ND**	333		"	"	"	"	"	"	U
dibenzofuran	**ND**	67		"	"	"	"	"	"	U
2,4-dinitrotoluene	**ND**	67		"	"	"	"	"	"	U
4-nitrophenol	**ND**	134		"	"	"	"	"	"	U
fluorene	**ND**	67		"	"	"	"	"	"	U
4-Chlorophenyl phenyl ether	**ND**	67		"	"	"	"	"	"	U
Diethyl phthalate	**4370**	67		"	"	"	"	"	"	

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil	**Sampled: 09/14/15 00:00**		**Received: 09/15/15 09:37**							
4-nitroaniline	**ND**	67		ug/kg dry	1	AI51701	09/15/15	09/24/15	8270C**	U
4,6-Dinitro-2-methylphenol	**ND**	134		"	"	"	"	"	"	U
n-nitrosodiphenylamine	**ND**	67		"	"	"	"	"	"	U
4-bromophenylphenylether	**ND**	67		"	"	"	"	"	"	U
hexachlorobenzene	**ND**	67		"	"	"	"	"	"	U
pentachlorophenol	**ND**	134		"	"	"	"	"	"	U
phenanthrene	**ND**	67		"	"	"	"	"	"	U
anthracene	**ND**	67		"	"	"	"	"	"	U
carbazole	**ND**	67		"	"	"	"	"	"	U
Di-n-butyl phthalate	**287**	67		"	"	"	"	"	"	
benzidine	**ND**	330		"	"	"	"	"	"	U
fluoranthene	**375**	67		"	"	"	"	"	"	
3,3'-Dichlorobenzidine	**ND**	134		"	"	"	"	"	"	U
pyrene	**396**	67		"	"	"	"	"	"	
Butyl benzyl phthalate	**ND**	67		"	"	"	"	"	"	U
Benzo (a) anthracene	**ND**	67		"	"	"	"	"	"	U
chrysene	**ND**	67		"	"	"	"	"	"	U
bis(2-ethylhexyl)phthalate	**ND**	67		"	"	"	"	"	"	U
Di-n-octyl phthalate	**ND**	67		"	"	"	"	"	"	U
Benzo (b) fluoranthene	**396**	67		"	"	"	"	"	"	
Benzo (k) fluoranthene	**ND**	67		"	"	"	"	"	"	U
Benzo (a) pyrene	**ND**	67		"	"	"	"	"	"	U
Indeno (1,2,3-cd) pyrene	**ND**	67		"	"	"	"	"	"	U
Dibenz (a,h) anthracene	**ND**	67		"	"	"	"	"	"	U
Benzo (g,h,i) perylene	**ND**	67		"	"	"	"	"	"	U
Surrogate: 2-Fluorophenol		*84.5 %*		*40-95*		"	"	"	"	
Surrogate: Phenol-d6		*88.4 %*		*55-95*		"	"	"	"	
Surrogate: Nitrobenzene-d5		*69.1 %*		*40-95*		"	"	"	"	
Surrogate: 2-Fluorobiphenyl		*91.4 %*		*60-100*		"	"	"	"	
Surrogate: 2,4,6-Tribromophenol		*60.9 %*		*60-125*		"	"	"	"	
Surrogate: Terphenyl-d14		*85.8 %*		*50-125*		"	"	"	"	

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Filtrate (5I15025-02) Water	**Sampled: 09/14/15 00:00**			**Received: 09/15/15 09:37**						
n-nitrosodimethylamine	**ND**	10		ug/l	1	AI51704	09/16/15	09/24/15	8270C**	U
bis(2-Chloroethyl)ether	**ND**	2		"	"	"	"	"	"	U
Phenol	**ND**	4		"	"	"	"	"	"	U
2-Chlorophenol	**ND**	4		"	"	"	"	"	"	U
Benzyl alcohol	**ND**	2		"	"	"	"	"	"	U
bis(2-chloroisopropyl)ether	**ND**	2		"	"	"	"	"	"	U
2-Methylphenol	**ND**	2		"	"	"	"	"	"	U
Hexachloroethane	**ND**	2		"	"	"	"	"	"	U
N-Nitrosodi-n-propylamine	**ND**	2		"	"	"	"	"	"	U
3 & 4-methylphenol	**ND**	4		"	"	"	"	"	"	U
Nitrobenzene	**ND**	2		"	"	"	"	"	"	U
Isophorone	**ND**	2		"	"	"	"	"	"	U
2-Nitrophenol	**ND**	4		"	"	"	"	"	"	U
2,4-Dimethylphenol	**ND**	4		"	"	"	"	"	"	U
Bis(2-chloroethoxy)methane	**ND**	2		"	"	"	"	"	"	U
Benzoic acid	**7**	10		"	"	"	"	"	"	U
2,4-Dichlorophenol	**ND**	4		"	"	"	"	"	"	U
1,2,4-Trichlorobenzene	**ND**	2		"	"	"	"	"	"	U
Naphthalene	**ND**	2		"	"	"	"	"	"	U
3,3'-Dichlorobenzidine	**ND**	4		"	"	"	"	"	"	U
4-Chloroaniline	**ND**	2		"	"	"	"	"	"	U
Hexachlorobutadiene	**ND**	2		"	"	"	"	"	"	U
4-Chloro-3-methylphenol	**ND**	4		"	"	"	"	"	"	U
2-Methylnaphthalene	**ND**	2		"	"	"	"	"	"	U
Hexachlorocyclopentadiene	**ND**	2		"	"	"	"	"	"	U
2,4,6-Trichlorophenol	**ND**	4		"	"	"	"	"	"	U
2,4,5-Trichlorophenol	**ND**	2		"	"	"	"	"	"	U
2-Chloronaphthalene	**ND**	2		"	"	"	"	"	"	U
2-Nitroaniline	**ND**	2		"	"	"	"	"	"	U
Acenaphthylene	**ND**	2		"	"	"	"	"	"	U
Dimethyl phthalate	**ND**	2		"	"	"	"	"	"	U
2,6-Dinitrotoluene	**ND**	2		"	"	"	"	"	"	U
Acenaphthene	**ND**	2		"	"	"	"	"	"	U
3-Nitroaniline	**ND**	2		"	"	"	"	"	"	U
2,4-Dinitrophenol	**ND**	10		"	"	"	"	"	"	U
Dibenzofuran	**ND**	2		"	"	"	"	"	"	U
2,4-Dinitrotoluene	**ND**	2		"	"	"	"	"	"	U
4-Nitrophenol	**ND**	4		"	"	"	"	"	"	U
Fluorene	**ND**	2		"	"	"	"	"	"	U
4-Chlorophenyl phenyl ether	**ND**	2		"	"	"	"	"	"	U
Diethyl phthalate	**3**	2		"	"	"	"	"	"	

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Filtrate (5I15025-02) Water	**Sampled: 09/14/15 00:00**			**Received: 09/15/15 09:37**						
4-Nitroaniline	**ND**	2		ug/l	1	AI51704	09/16/15	09/24/15	8270C**	U
4,6-Dinitro-2-methylphenol	**ND**	4		"	"	"	"	"	"	U
n-Nitrosodiphenylamine	**ND**	2		"	"	"	"	"	"	U
4-bromophenylphenylether	**ND**	2		"	"	"	"	"	"	U
Hexachlorobenzene	**ND**	2		"	"	"	"	"	"	U
Pentachlorophenol	**ND**	4		"	"	"	"	"	"	U
Phenanthrene	**ND**	2		"	"	"	"	"	"	U
Anthracene	**ND**	2		"	"	"	"	"	"	U
Carbazole	**ND**	2		"	"	"	"	"	"	U
Di-n-butyl phthalate	**ND**	2		"	"	"	"	"	"	U
Benzidine	**ND**	10		"	"	"	"	"	"	U
Fluoranthene	**ND**	2		"	"	"	"	"	"	U
Pyrene	**ND**	2		"	"	"	"	"	"	U
Butyl benzyl phthalate	**ND**	2		"	"	"	"	"	"	U
Benzo (a) anthracene	**ND**	2		"	"	"	"	"	"	U
Chrysene	**ND**	2		"	"	"	"	"	"	U
bis(2-Ethylhexyl)phthalate	**15**	2		"	"	"	"	"	"	
Di-n-octyl phthalate	**ND**	2		"	"	"	"	"	"	U
Benzo (b) fluoranthene	**ND**	2		"	"	"	"	"	"	U
Benzo (k) fluoranthene	**ND**	2		"	"	"	"	"	"	U
Benzo (a) pyrene	**ND**	2		"	"	"	"	"	"	U
Indeno (1,2,3-cd) pyrene	**ND**	2		"	"	"	"	"	"	U
Dibenz (a,h) anthracene	**ND**	2		"	"	"	"	"	"	U
Benzo (g,h,i) perylene	**ND**	2		"	"	"	"	"	"	U
Aniline	**ND**	4		"	"	"	"	"	"	U
Surrogate: 2-Fluorophenol		*73.6 %*		*20-65*		"	"	"	"	*G*
Surrogate: Phenol-d6		*45.6 %*		*10-45*		"	"	"	"	*G*
Surrogate: Nitrobenzene-d5		*104 %*		*45-105*		"	"	"	"	
Surrogate: 2-Fluorobiphenyl		*122 %*		*50-105*		"	"	"	"	*G*
Surrogate: 2,4,6-Tribromophenol		*102 %*		*40-120*		"	"	"	"	
Surrogate: Terphenyl-d14		*117 %*		*50-120*		"	"	"	"	

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Conventional Chemistry Parameters by EPA Methods

Waste Stream Technology

Analyte	Result	Reporting Limit	MDL	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Filter Press Feed Material (5I15025-01) Soil	**Sampled: 09/14/15 00:00 Received: 09/15/15 09:37**									
% Solids	**9.8**	0.1		%	1	A152401	09/24/15	09/24/15	% calculation	

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Client: Sevenson Environmental Services, Inc.
Project/Site: Sevenson Environmental Services, Inc.

TestAmerica Job ID: 480-85593-1

Client Sample ID: 400 PPM 757 FILTER PRESS
Date Collected: 08/13/15 13:00
Date Received: 08/13/15 16:30

Lab Sample ID: 480-85593-1
Matrix: Water

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia	1.2	B	0.020	0.0090	mg/L			08/15/15 17:27	1
Sulfide	ND		1.0	0.67	mg/L			08/18/15 05:35	1

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Metals by EPA 6000/7000 Series Methods - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51526 - EPA 3015										
Blank (AI51526-BLK1)				Prepared & Analyzed: 09/15/15						
Silver	ND	0.005	mg/L							
Arsenic	ND	0.010	"							
Barium	ND	0.005	"							
Cadmium	ND	0.001	"							
Chromium	ND	0.005	"							
Lead	ND	0.010	"							
Selenium	ND	0.020	"							
LCS (AI51526-BS1)				Prepared & Analyzed: 09/15/15						
Silver	0.564	0.005	mg/L	0.556		101	80-120			
Arsenic	1.14	0.010	"	1.11		103	80-120			
Barium	1.21	0.005	"	1.11		109	80-120			
Cadmium	1.13	0.001	"	1.11		102	80-120			
Chromium	1.13	0.005	"	1.11		102	80-120			
Lead	1.14	0.010	"	1.11		103	80-120			
Selenium	1.18	0.020	"	1.11		107	80-120			
Batch AI51629 - EPA 3051										
Blank (AI51629-BLK1)				Prepared: 09/16/15 Analyzed: 09/17/15						
Silver	ND	0.500	mg/kg wet							
Arsenic	ND	2.00	"							
Barium	ND	1.00	"							
Cadmium	ND	0.500	"							
Chromium	ND	1.00	"							
Lead	ND	2.00	"							
Selenium	ND	2.00	"							

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Metals by EPA 6000/7000 Series Methods - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51629 - EPA 3051										
LCS (AI51629-BS1)				Prepared: 09/16/15 Analyzed: 09/17/15						
Silver	50.5	0.500	mg/kg wet	50.0		101	75-120			
Arsenic	104	2.00	"	100		104	80-120			
Barium	113	1.00	"	100		113	80-120			
Cadmium	109	0.500	"	100		109	80-120			
Chromium	108	1.00	"	100		108	80-120			
Lead	110	2.00	"	100		110	80-120			
Selenium	107	2.00	"	100		107	80-120			
Batch AI51706 - EPA 7471A										
Blank (AI51706-BLK1)				Prepared & Analyzed: 09/17/15						
Mercury	ND	0.017	mg/kg wet							
LCS (AI51706-BS1)				Prepared & Analyzed: 09/17/15						
Mercury	0.1667	0.017	mg/kg wet	0.167		100	80-120			
Batch AI52235 - EPA 7470A										
Blank (AI52235-BLK1)				Prepared & Analyzed: 09/22/15						
Mercury	ND	0.0002	mg/L							
LCS (AI52235-BS1)				Prepared & Analyzed: 09/22/15						
Mercury	0.002	0.0002	mg/L	0.00250		100	80-120			

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

TCLP Metals by 1311/6000/7000 Series Methods - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51634 - EPA 3015 Leachate										
Blank (AI51634-BLK1)				Prepared: 09/16/15 Analyzed: 09/17/15						
Silver	ND	0.025	mg/L							U
Arsenic	ND	0.050	"							U
Barium	ND	0.025	"							U
Cadmium	ND	0.005	"							U
Chromium	ND	0.025	"							U
Lead	ND	0.050	"							U
Selenium	ND	0.100	"							U
LCS (AI51634-BS1)				Prepared: 09/16/15 Analyzed: 09/17/15						
Silver	0.602	0.025	mg/L	0.556		108	80-120			
Arsenic	1.20	0.050	"	1.11		108	80-120			
Barium	1.24	0.025	"	1.11		111	80-120			
Cadmium	1.24	0.005	"	1.11		111	80-120			
Chromium	1.16	0.025	"	1.11		105	80-120			
Lead	1.23	0.050	"	1.11		111	80-120			
Selenium	1.22	0.100	"	1.11		110	80-120			
Batch AI52236 - EPA 7470A Leachate										
Blank (AI52236-BLK1)				Prepared & Analyzed: 09/22/15						
Mercury	ND	0.0002	mg/L							U
LCS (AI52236-BS1)				Prepared & Analyzed: 09/22/15						
Mercury	0.00247	0.0002	mg/L	0.00250		98.8	80-120			

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Polychlorinated Biphenyls by EPA Method 8082 - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51702 - EPA 3550B										
Blank (AI51702-BLK1)				Prepared: 09/15/15 Analyzed: 09/22/15						
Aroclor 1016	ND	6.60	ug/kg wet							U
Aroclor 1221	ND	6.60	"							U
Aroclor 1232	ND	6.60	"							U
Aroclor 1242	ND	6.60	"							U
Aroclor 1248	ND	6.60	"							U
Aroclor 1254	ND	6.60	"							U
Aroclor 1260	ND	6.60	"							U
Aroclor 1262	ND	6.60	"							U
Aroclor 1268	ND	6.60	"							U
Surrogate: Tetrachloro-meta-xylene	*29.5*		"	*33.3*		*88.6*	*80-125*			
Surrogate: Decachlorobiphenyl	*39.5*		"	*33.3*		*118*	*60-130*			
Batch AI51703 - EPA 3510C										
Blank (AI51703-BLK1)				Prepared: 09/16/15 Analyzed: 09/22/15						
Aroclor 1016	ND	0.050	ug/l							U
Aroclor 1221	ND	0.050	"							U
Aroclor 1232	ND	0.050	"							U
Aroclor 1242	ND	0.050	"							U
Aroclor 1248	ND	0.050	"							U
Aroclor 1254	ND	0.050	"							U
Aroclor 1260	ND	0.050	"							U
Aroclor 1262	ND	0.050	"							U
Aroclor 1268	ND	0.050	"							U
Surrogate: Tetrachloro-meta-xylene	*0.467*		"	*0.500*		*93.4*	*45-135*			
Surrogate: Decachlorobiphenyl	*0.541*		"	*0.500*		*108*	*55-120*			

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51524 - EPA 5030/5035 Soil MS										
Blank (AI51524-BLK1)			Prepared: 09/15/15 Analyzed: 09/24/15							
chloromethane	ND	10	ug/kg wet							U
vinyl chloride	ND	10	"							U
bromomethane	ND	10	"							U
chloroethane	ND	10	"							U
1,1-dichloroethene	ND	2	"							U
acetone	ND	10	"							U
carbon disulfide	ND	2	"							U
methylene chloride	ND	10	"							U
trans-1,2-dichloroethene	ND	2	"							U
1,1-dichloroethane	ND	2	"							U
vinyl acetate	ND	10	"							U
2-butanone	ND	10	"							U
cis-1,2-dichloroethene	ND	2	"							U
chloroform	ND	2	"							U
1,1,1-trichloroethane	ND	2	"							U
carbon tetrachloride	ND	2	"							U
benzene	ND	2	"							U
1,2-dichloroethane	ND	2	"							U
trichloroethene	ND	2	"							U
1,2-dichloropropane	ND	2	"							U
bromodichloromethane	ND	2	"							U
4-Methyl-2-pentanone (MIBK)	ND	10	"							U
cis-1,3-dichloropropene	ND	2	"							U
toluene	ND	2	"							U
trans-1,3-dichloropropene	ND	2	"							U
1,1,2-trichloroethane	ND	2	"							U
2-hexanone	ND	10	"							U
tetrachloroethene	ND	2	"							U
1,3-dichloropropane	ND	2	"							U
dibromochloromethane	ND	2	"							U
chlorobenzene	ND	2	"							U
ethylbenzene	ND	2	"							U
m,p-xylene	ND	4	"							U
o-xylene	ND	2	"							U
styrene	ND	2	"							U
bromoform	ND	2	"							U
1,1,2,2-tetrachloroethane	ND	2	"							U
1,3-dichlorobenzene	ND	2	"							U

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51524 - EPA 5030/5035 Soil MS										
Blank (AI51524-BLK1)				Prepared: 09/15/15 Analyzed: 09/24/15						
1,4-dichlorobenzene	ND	2	ug/kg wet							U
1,2-dichlorobenzene	ND	2	"							U
Surrogate: Dibromofluoromethane	*29.7*		*ng/ml*	*30.0*		*98.9*	*90-115*			
Surrogate: 1,2-Dichloroethane-d4	*30.6*		*"*	*30.0*		*102*	*90-120*			
Surrogate: Toluene-d8	*29.6*		*"*	*30.0*		*98.6*	*90-110*			
Surrogate: Bromofluorobenzene	*30.2*		*"*	*30.0*		*101*	*90-120*			
LCS (AI51524-BS1)				Prepared: 09/15/15 Analyzed: 09/24/15						
chloromethane	29.8	10	ug/kg wet	30.0		99.4	60-125			
vinyl chloride	29.9	10	"	30.0		99.5	65-115			
bromomethane	29.4	10	"	30.0		97.9	55-145			
chloroethane	28.5	10	"	30.0		95.1	65-130			
1,1-dichloroethene	31.4	2	"	30.0		105	80-115			
acetone	40.8	10	"				70-135			
carbon disulfide	28.8	2	"				65-110			
methylene chloride	27.9	10	"	30.0		93.0	75-135			
trans-1,2-dichloroethene	30.2	2	"	30.0		100	85-110			
1,1-dichloroethane	30.2	2	"	30.0		101	80-115			
vinyl acetate	26.9	10	"				65-115			
2-butanone	30.7	10	"				65-115			
cis-1,2-dichloroethene	30.7	2	"	30.0		102	80-115			
chloroform	30.9	2	"	30.0		103	85-115			
1,1,1-trichloroethane	28.9	2	"	30.0		96.4	85-115			
carbon tetrachloride	29.6	2	"	30.0		98.6	75-125			
benzene	31.4	2	"	30.0		105	90-110			
1,2-dichloroethane	32.3	2	"	30.0		108	85-115			
trichloroethene	31.5	2	"	30.0		105	85-115			
1,2-dichloropropane	31.4	2	"	30.0		105	85-110			
bromodichloromethane	31.4	2	"	30.0		105	85-110			
4-Methyl-2-pentanone (MIBK)	30.5	10	"				75-115			
cis-1,3-dichloropropene	31.2	2	"	30.0		104	85-115			
toluene	30.1	2	"	30.0		100	90-105			
trans-1,3-dichloropropene	30.5	2	"	30.0		102	85-110			
1,1,2-trichloroethane	30.6	2	"	30.0		102	85-105			
2-hexanone	30.2	10	"				75-120			
tetrachloroethene	31.6	2	"	30.0		105	85-115			
1,3-dichloropropane	31.4	2	"	30.0		105	85-105			
dibromochloromethane	31.0	2	"	30.0		103	85-115			

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Volatile Organic Compounds by EPA Method 8260B - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51524 - EPA 5030/5035 Soil MS										
LCS (AI51524-BS1)				Prepared: 09/15/15 Analyzed: 09/24/15						
chlorobenzene	31.1	2	ug/kg wet	30.0		104	90-105			
ethylbenzene	30.0	2	"	30.0		100	90-110			
m,p-xylene	61.0	4	"	60.0		102	90-110			
o-xylene	30.3	2	"	30.0		101	85-110			
styrene	30.2	2	"	30.0		101	90-110			
bromoform	31.1	2	"	30.0		104	85-105			
1,1,2,2-tetrachloroethane	29.0	2	"	30.0		96.8	85-105			
1,3-dichlorobenzene	31.4	2	"	30.0		105	90-110			
1,4-dichlorobenzene	32.6	2	"	30.0		109	90-110			
1,2-dichlorobenzene	31.1	2	"	30.0		104	90-110			
Surrogate: Dibromofluoromethane	*29.5*		*ng/ml*	*30.0*		*98.3*	*90-115*			
Surrogate: 1,2-Dichloroethane-d4	*29.7*		"	*30.0*		*99.0*	*90-120*			
Surrogate: Toluene-d8	*29.6*		"	*30.0*		*98.8*	*90-110*			
Surrogate: Bromofluorobenzene	*30.1*		"	*30.0*		*100*	*90-120*			

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51701 - EPA 3550B										
Blank (AI51701-BLK1)				Prepared: 09/15/15 Analyzed: 09/24/15						
N-Nitrosodimethylamine	ND	134	ug/kg wet							U
bis(2-chloroethyl)ether	ND	67	"							U
Aniline	ND	134	"							U
phenol	ND	134	"							U
2-chlorophenol	ND	134	"							U
benzyl alcohol	ND	67	"							U
bis(2-chloroisopropyl)ether	ND	67	"							U
2-methylphenol	ND	67	"							U
hexachloroethane	ND	67	"							U
N-Nitrosodi-n-propylamine	ND	67	"							U
3 & 4-methylphenol	ND	134	"							U
nitrobenzene	ND	67	"							U
isophorone	ND	67	"							U
2-nitrophenol	ND	134	"							U
2,4-dimethylphenol	ND	134	"							U
Bis(2-chloroethoxy)methane	ND	67	"							U
benzoic acid	ND	333	"							U
2,4-dichlorophenol	ND	134	"							U
1,2,4-trichlorobenzene	ND	67	"							U
naphthalene	ND	67	"							U
4-chloroaniline	ND	67	"							U
hexachlorobutadiene	ND	67	"							U
4-chloro-3-methylphenol	ND	134	"							U
2-methylnaphthalene	ND	67	"							U
hexachlorocyclopentadiene	ND	130	"							U
2,4,6-trichlorophenol	ND	134	"							U
2,4,5-trichlorophenol	ND	67	"							U
2-chloronaphthalene	ND	67	"							U
2-nitroaniline	ND	67	"							U
acenaphthylene	ND	67	"							U
Dimethyl phthalate	ND	67	"							U
2,6-dinitrotoluene	ND	67	"							U
acenaphthene	ND	67	"							U
3-nitroaniline	ND	67	"							U
2,4-dinitrophenol	ND	333	"							U
dibenzofuran	ND	67	"							U
2,4-dinitrotoluene	ND	67	"							U
4-nitrophenol	ND	134	"							U

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Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51701 - EPA 3550B										
Blank (AI51701-BLK1)			Prepared: 09/15/15 Analyzed: 09/24/15							
fluorene	ND	67	ug/kg wet							U
4-Chlorophenyl phenyl ether	ND	67	"							U
Diethyl phthalate	202	67	"							
4-nitroaniline	ND	67	"							U
4,6-Dinitro-2-methylphenol	ND	134	"							U
n-nitrosodiphenylamine	ND	67	"							U
4-bromophenylphenylether	ND	67	"							U
hexachlorobenzene	ND	67	"							U
pentachlorophenol	ND	134	"							U
phenanthrene	ND	67	"							U
anthracene	ND	67	"							U
carbazole	ND	67	"							U
Di-n-butyl phthalate	ND	67	"							U
benzidine	ND	330	"							U
fluoranthene	ND	67	"							U
3,3'-Dichlorobenzidine	ND	134	"							U
pyrene	ND	67	"							U
Butyl benzyl phthalate	ND	67	"							U
Benzo (a) anthracene	ND	67	"							U
chrysene	ND	67	"							U
bis(2-ethylhexyl)phthalate	ND	67	"							U
Di-n-octyl phthalate	ND	67	"							U
Benzo (b) fluoranthene	ND	67	"							U
Benzo (k) fluoranthene	ND	67	"							U
Benzo (a) pyrene	ND	67	"							U
Indeno (1,2,3-cd) pyrene	ND	67	"							U
Dibenz (a,h) anthracene	ND	67	"							U
Benzo (g,h,i) perylene	ND	67	"							U
Surrogate: 2-Fluorophenol	*5400*		"	*6670*		*81.1*	*40-95*			
Surrogate: Phenol-d6	*6420*		"	*6670*		*96.3*	*55-95*			*G*
Surrogate: Nitrobenzene-d5	*3190*		"	*3330*		*95.8*	*40-95*			*G*
Surrogate: 2-Fluorobiphenyl	*4030*		"	*3330*		*121*	*60-100*			*G*
Surrogate: 2,4,6-Tribromophenol	*1350*		"	*6670*		*20.2*	*60-125*			*L*
Surrogate: Terphenyl-d14	*3990*		"	*3330*		*120*	*50-125*			

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51704 - EPA 3510C										
Blank (AI51704-BLK1)				Prepared: 09/16/15 Analyzed: 09/24/15						
n-nitrosodimethylamine	ND	10	ug/l							U
bis(2-Chloroethyl)ether	ND	2	"							U
Phenol	ND	4	"							U
2-Chlorophenol	ND	4	"							U
Benzyl alcohol	ND	2	"							U
bis(2-chloroisopropyl)ether	ND	2	"							U
2-Methylphenol	ND	2	"							U
Hexachloroethane	ND	2	"							U
N-Nitrosodi-n-propylamine	ND	2	"							U
3 & 4-methylphenol	ND	4	"							U
Nitrobenzene	ND	2	"							U
Isophorone	ND	2	"							U
2-Nitrophenol	ND	4	"							U
2,4-Dimethylphenol	ND	4	"							U
Bis(2-chloroethoxy)methane	ND	2	"							U
Benzoic acid	ND	10	"							U
2,4-Dichlorophenol	ND	4	"							U
1,2,4-Trichlorobenzene	ND	2	"							U
Naphthalene	ND	2	"							U
3,3'-Dichlorobenzidine	ND	4	"							U
4-Chloroaniline	ND	2	"							U
Hexachlorobutadiene	ND	2	"							U
4-Chloro-3-methylphenol	ND	4	"							U
2-Methylnaphthalene	ND	2	"							U
Hexachlorocyclopentadiene	ND	2	"							U
2,4,6-Trichlorophenol	ND	4	"							U
2,4,5-Trichlorophenol	ND	2	"							U
2-Chloronaphthalene	ND	2	"							U
2-Nitroaniline	ND	2	"							U
Acenaphthylene	ND	2	"							U
Dimethyl phthalate	ND	2	"							U
2,6-Dinitrotoluene	ND	2	"							U
Acenaphthene	ND	2	"							U
3-Nitroaniline	ND	2	"							U
2,4-Dinitrophenol	ND	10	"							U
Dibenzofuran	ND	2	"							U
2,4-Dinitrotoluene	ND	2	"							U
4-Nitrophenol	ND	4	"							U

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

Waste Stream Technology

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51704 - EPA 3510C										
Blank (AI51704-BLK1)				Prepared: 09/16/15 Analyzed: 09/24/15						
Fluorene	ND	2	ug/l							U
4-Chlorophenyl phenyl ether	ND	2	"							U
Diethyl phthalate	3.9	2	"							
4-Nitroaniline	ND	2	"							U
4,6-Dinitro-2-methylphenol	ND	4	"							U
n-Nitrosodiphenylamine	ND	2	"							U
4-bromophenylphenylether	ND	2	"							U
Hexachlorobenzene	ND	2	"							U
Pentachlorophenol	ND	4	"							U
Phenanthrene	ND	2	"							U
Anthracene	ND	2	"							U
Carbazole	ND	2	"							U
Di-n-butyl phthalate	ND	2	"							U
Benzidine	ND	10	"							U
Fluoranthene	ND	2	"							U
Pyrene	ND	2	"							U
Butyl benzyl phthalate	ND	2	"							U
Benzo (a) anthracene	ND	2	"							U
Chrysene	ND	2	"							U
bis(2-Ethylhexyl)phthalate	ND	2	"							U
Di-n-octyl phthalate	ND	2	"							U
Benzo (b) fluoranthene	ND	2	"							U
Benzo (k) fluoranthene	ND	2	"							U
Benzo (a) pyrene	ND	2	"							U
Indeno (1,2,3-cd) pyrene	ND	2	"							U
Dibenz (a,h) anthracene	ND	2	"							U
Benzo (g,h,i) perylene	ND	2	"							U
Aniline	ND	4	"							U
Surrogate: 2-Fluorophenol	*151*		"	*200*		*75.6*	*20-65*			*G*
Surrogate: Phenol-d6	*83.7*		"	*200*		*41.9*	*10-45*			
Surrogate: Nitrobenzene-d5	*114*		"	*100*		*114*	*45-105*			*G*
Surrogate: 2-Fluorobiphenyl	*119*		"	*100*		*119*	*50-105*			*G*
Surrogate: 2,4,6-Tribromophenol	*208*		"	*200*		*104*	*40-120*			
Surrogate: Terphenyl-d14	*118*		"	*100*		*118*	*50-120*			

Notes and Definitions

U	Analyte included in the analysis, but not detected at or above the reporting limit.
S-04	The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.
L	L denotes analyte recovery is less than the lower quality control limit.
G	G denotes analyte recovery is greater than the upper quality control limit.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
**	Denotes a promulgated method, but not the most updated version.

SEVENSON ENVIRONMENTAL SERVICES, INC.
2701 Lockport Road
Niagara Falls, NY 14305
(716) 282-2469

Analytical Data Report
Report Date: 09/24/15
Work Order Number: 5I15025

Prepared For
Jim Hyzy
Sevenson Treatability Studies
2749 Lockport Road
Niagara Falls, NY 14305
Fax: (716) 284-1796

Site: Pompton Lakes

Enclosed are the results of analyses for samples received by the laboratory on 09/15/15. If you have any questions concerning this report, please feel free to contact me.

DISCLAIMER: The Sevenson Laboratory is not certified by any State or Federal agency - these results are for informational purposes **only**.

Sincerely,

James B. Hyzy, Ph.D., Director of Operations

Sevenson Environmental Services, Inc.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception
	Metals RCRA TCLP ICP	(Soil)	U-Flags used
			Default Report (not modified)
5I15025-02	8270C	2-Fluorobiphenyl	G: G denotes analyte recovery is greater than the upper quality control limit.
5I15025-01	8260 TCL	1,2-Dichloroethane-d4	S-04: The surrogate recovery for this sample is outside of established control limits due to a sampl
AI51524-BS1	8260 TCL	vinyl acetate	No spike level
AI51524-BS1	8260 TCL	carbon disulfide	No spike level
AI51524-BS1	8260 TCL	acetone	No spike level
AI51524-BS1	8260 TCL	4-Methyl-2-pentanone (MIBK)	No spike level
5I15025-02	8270C	Phenol-d6	G: G denotes analyte recovery is greater than the upper quality control limit.
AI51524-BS1	8260 TCL	2-butanone	No spike level
AI51701-BLK1	8270C	2,4,6-Tribromophenol	L: L denotes analyte recovery is less than the lower quality control limit.
	Hg TCLP CVAA	(Soil)	U-Flags used
	8270C	(Water)	U-Flags used
	8270C	(Soil)	U-Flags used
	8260 TCL	(Water)	U-Flags used
	8260 TCL	(Soil)	U-Flags used
	PCBs by 8082	(Water)	U-Flags used
	PCBs by 8082	(Soil)	U-Flags used
			VERSION 6.14:2004
AI51524-BS1	8260 TCL	2-hexanone	No spike level
5I15025-02	8270C	2-Fluorophenol	Exceeds upper control limit
AI51701-BLK1	8270C	Diethyl phthalate	Blank >1 x MRL
AI51704-BLK1	8270C	Nitrobenzene-d5	Exceeds upper control limit
AI51704-BLK1	8270C	2-Fluorophenol	Exceeds upper control limit
AI51704-BLK1	8270C	2-Fluorobiphenyl	Exceeds upper control limit
AI51701-BLK1	8270C	Phenol-d6	Exceeds upper control limit
AI51701-BLK1	8270C	Nitrobenzene-d5	Exceeds upper control limit
AI51701-BLK1	8270C	2-Fluorobiphenyl	Exceeds upper control limit
5I15025-02	8270C	2-Fluorophenol	G: G denotes analyte recovery is greater than the upper quality control limit.
5I15025-02	8270C	Phenol-d6	Exceeds upper control limit
AI51704-BLK1	8270C	Diethyl phthalate	Blank >1 x MRL
5I15025-02	8270C	2-Fluorobiphenyl	Exceeds upper control limit
5I15025-01	8260 TCL	1,2-Dichloroethane-d4	Exceeds lower control limit
AI51704-BLK1	8270C	Nitrobenzene-d5	G: G denotes analyte recovery is greater than the upper quality control limit.
AI51704-BLK1	8270C	2-Fluorophenol	G: G denotes analyte recovery is greater than the upper quality control limit.
AI51704-BLK1	8270C	2-Fluorobiphenyl	G: G denotes analyte recovery is greater than the upper quality control limit.

Sevenson Treatability Studies	Project: Pompton Lakes	
2749 Lockport Road	Project Number: Pompton Lakes	**Reported:**
Niagara Falls NY, 14305	Project Manager: Jim Hyzy	09/24/15 10:43

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception
AI51701-BLK1	8270C	Phenol-d6	G: G denotes analyte recovery is greater than the upper quality control limit.
AI51701-BLK1	8270C	Nitrobenzene-d5	G: G denotes analyte recovery is greater than the upper quality control limit.
AI51701-BLK1	8270C	2-Fluorobiphenyl	G: G denotes analyte recovery is greater than the upper quality control limit.
AI51701-BLK1	8270C	2,4,6-Tribromophenol	Exceeds lower control limit