Appendix B
Detailed Analytical Results

APPENDIX B – DETAILED ANALYTICAL RESULTS

The following sections provide a detailed analysis of the results of the sampling program carried out under the project entitled "Characterization of Dredged Material Stored in New Jersey Confined Disposal Facilities" for the New Jersey Department of Transportation Office of Maritime Resources' I Boat NJ program. Five CDFs were evaluated as a part of this analysis: Nummy Island in Stone Harbor, Middle Thorofare in Cape May, Site #83 in Ocean City, Corps Cell D in Cape May, and Waackaack Creek in Keansburg. The sampling plan for the CDFs and the methodology for the chemical and physical analyses for the sediments are provided in Appendix A of this report.

The results of the physical and chemical analyses are organized in this Appendix as follows:

- Section B.1 Nummy Island
- Section B.2 Middle Thorofare
- Section B.3 Site #83
- Section B.4 Corps Cell D
- Section B.5 Waackaack Creek
- Section B.6 Summary

B.1 NUMMY ISLAND, STONE HARBOR, NJ

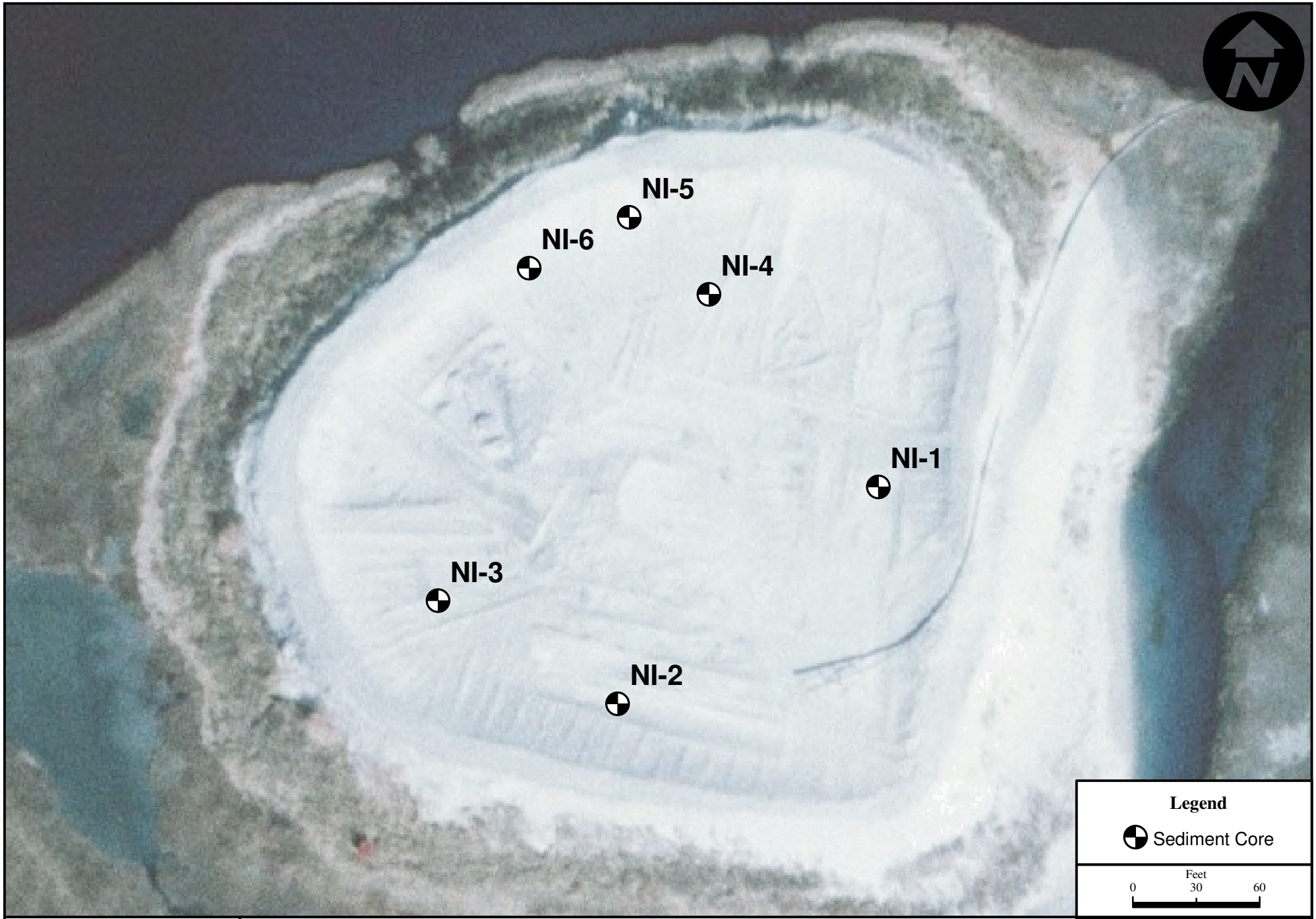
Nummy Island is located in the Borough of Stone Harbor, New Jersey. It is a man-made Island that has been used as a confined disposal facility (CDF) for containing and dewatering material dredged from nearby waterways and marinas. Approximately 90,000 cy of dredged material are currently stored in the CDF. It is estimated that approximately 50,000 cubic yards (cy) of dredged material could be removed from the CDF, leaving 40,000 cy of material to reshape the berm to allow for containment of future dredging projects.

A sampling program was designed to characterize the 50,000 cy of material that could be removed from the CDF. Six sediment cores were collected from the CDF by Aqua Survey, Inc. (ASI) in 2005, and the location of these cores is depicted on Figure B-1. One sample was prepared from each distinct strata of material from each core. The dredged material in the cores was stratified into three distinct layers, and therefore 18 samples were prepared for physical analysis. Physical properties of the sediments were analyzed in the ASI laboratory. These properties included grain size composition, total organic carbon and percent moisture.

- *B.1.1 Physical Characteristics*

The Nummy Island CDF contains three distinct layers of dredged material. An eight foot thick top layer of black silt overlies a seven to eight foot deep layer of fine white sand which overlies a six to seven foot deep layer of fine grey sand.

Table B-1 shows grain size composition of the Nummy Island sediment core subsamples. The top layer (a) of Cores 4, 5, and 6, located near the weir box, contained the greatest amount of fine-grained material. The percent of silt and clay particles in the top layer of these cores ranged from 88% to 92%. Cores 1, 2 and 3 were located on the opposite side of the CDF and the percent of silt and clay particles in the top layer of these cores ranged from 30% to 72%, with the greatest amount of fine-grained material in Core 3.



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Location of Sediment Cores taken from the Nummy Island CDF in Stone Harbor, NJ

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The middle layer (b) of all collected cores had sand content ranging from 91% to 98%. The grain size composition of the bottom layer (c) of the cores varied, but with the exception of Core 1, the subsamples had sand content greater than 50%. The difference in the grain size composition of the bottom section of Core 1 compared to the other cores is likely due to inclusion of peat moss from the underlying marsh in the subsample.

Both the percent moisture and TOC content were highest in the fine-grained sediments from the top layer of the CDF, and lowest in the sandy sediment. The percent moisture ranged from 5% to 53%, and the TOC content ranged from less than one-tenth of a percent to 5% in the subsamples.

The nine subsamples that contained less than 90% sand and gravel were combined to form three composite samples. Material from the top layers of Cores 4, 5, and 6 formed Composite A – Top (A layer), material from the top layers of Cores 1, 2, and 3 formed Composite B – Top (A layer), and the bottom layers of cores 4, 5, and 6 formed the third sample, Composite A - Bottom (C layer). Physical characteristics of the composite samples were not determined.

Table B-1. Physical properties of the sediment cores collected from the Nummy Island CDF.

Core/ Comp ID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Fine Materials	% Coarse Materials
NI-1 Top	20050969a	25.4	8,809	0.9	17.1	13.6	69.3	0.0	30.7	69.3
NI-2 Top	20050946a	30.9	15,017	1.5	24.6	22.3	53.1	0.0	46.9	53.1
NI-3 Top	20050947a	38.3	31,476	3.2	37.2	35.1	27.7	0.0	72.3	27.7
NI-4 Top	20050948a	51.7	35,013	3.5	46.6	45.4	8.0	0.0	92.0	8.0
NI-5 Top	20050949a	47.4	35,539	3.6	45.7	42.5	11.8	0.0	88.2	11.8
NI-6 Top	20050950a	53.2	36,928	3.7	47.1	42.3	10.6	0.0	89.4	10.6
NI-1 Mid	20050969b	13.6	931	0.1	2.9	5.9	91.2	0.0	8.8	91.2
NI-2 Mid	20050946b	9.6	1,038	0.1	4.3	2.0	93.7	0.0	6.3	93.7
NI-3 Mid	20050947b	9.1	1,172	0.1	2.0	1.1	97.0	0.0	3.0	97.0
NI-4 Mid	20050948b	5.6	889	0.1	2.0	0.0	98.0	0.0	2.0	98.0
NI-5 Mid	20050949b	5.8	815	0.1	2.0	0.0	98.0	0.0	2.0	98.0
NI-6 Mid	20050950b	8.7	2,998	0.3	2.7	0.0	97.6	0.0	2.7	97.6
NI-1 Bot*	20050969c	42.3	49,730	5.0	38.3	37.3	24.4	0.0	75.6	24.4

Table B-1 (Cont'd). Physical properties of the sediment cores collected from the Nummy Island CDF.

Core/ Comp ID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Fine Materials	% Coarse Materials
NI-2 Bot	20050946c	28.2	10,881	1.1	17.6	12.4	70.0	0.0	30.0	70.0
NI-3 Bot	20050947c	21.7	4,797	0.5	8.9	4.2	86.9	0.0	13.1	86.9
NI-4 Bot	20050948c	22.6	16,235	1.6	2.0	1.1	97.0	0.0	3.0	97.0
NI-5 Bot	20050949c	19.5	2,480	0.3	11.6	8.7	79.7	0.0	20.3	79.7
NI-6 Bot	20050950c	21.0	5,075	0.5	8.0	0.0	92.0	0.0	8.0	92.0

* NI-1Bot was peat moss from the underlying marsh.

- *B.1.2 Chemical Characteristics*

The composite sediment samples were analyzed for pesticides, PCBs, semivolatile compounds and metals. Of the organic compounds, only 4'4'-DDE, 4'4'-DDD, phthalates and some PAHs were detected in the composite samples (Table B-2). Metals were detected in all three composite samples. For the compounds that were detected, concentrations were generally higher in Composite A-Top (top layer of Cores 4, 5 and 6), followed by Composite B-Top (top layer of Cores 1, 2, and 3) and Composite A-Bottom (bottom layer of Cores 4, 5 and 6). However, none of the detected compounds had concentrations above the NJRDCSCC. Generally, all were below the Criteria by an order of magnitude.

Table B-2. Compounds detected in sediment samples from the Nummy Island CDF.

	NJ RDCSCC	**Comp A-Top (A-layer)**		**Comp A-Bottom (C-layer)**		**Comp B-Top (A-layer)**	
		Cores 4,5,6 (Top)		**Cores 4,5,6 (Bottom)**		**Cores 1,2,3 (Top)**	
	Soil	**Unamended Sediment**		**Unamended Sediment**		**Unamended Sediment**	
Organics	**ug/kg**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**
Di-n-butylphthalate	5700000	190.0	J	110.0	J	130.0	J
Fluoranthene (PAH)	2300000	390.0			ND	290.0	
Pyrene (PAH)	1700000	410.0			ND	300.0	
Butylbenzylphthalate	1100000	140.0	J		ND		ND
Benzo(a)anthracene (PAH)	900	160.0	J		ND	100.0	J
Chrysene (PAH)	9000	250.0			ND	160.0	J
bis(2-Ethylhexyl)phthalate	49000	360.0		77.00	J	120.0	J

Table B-2 (Cont'd). Compounds detected in sediment samples from the Nummy Island CDF.

Organics	ug/kg	ug/kg	Q	ug/kg	Q	ug/kg	Q
Benzo(b)fluoranthene (PAH)	900	230.0	J		ND	130.0	J
Benzo(k)fluoranthene (PAH)	900	72.00	J		ND	53.0	J
Benzo(a)pyrene (PAH)	660	160.0	J		ND	85.0	J
Indeno(1,2,3-cd)pyrene (PAH)	900	130.0	J		ND	59.0	J
4,4'-DDE	2000	12.00		1.700		9.7	
4,4'-DDD	3000	11.00		1.700		11.0	
Metals	**mg/kg**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**
Aluminum	NA	15200		2740		9160	
Arsenic	20	7.98		1.89		4.79	
Barium	700	39.40		9.66		23.40	
Cadmium	39	0.40			ND		ND
Calcium	NA	4360		2360		2720	
Chromium	NA	50.60		11.90		31.80	
Cobalt	NA	18.00		4.83		10.50	
Copper	600	26.60		4.42		16.20	
Lead	400	34.90		5.74		20.50	
Magnesium	NA	8480		1560		4680	
Manganese	NA	254.00		63.50		145.00	
Mercury	14	0.35		0.044		0.19	
Nickel	250	21.00		5.46		12.80	
Potassium	NA	2530		777		1490	
Silver	110	0.52	J		ND		ND
Sodium	NA	8230		891		1310	
Vanadium	370	47.50		11.30		27.90	
Zinc	1500	105.00		24.40		58.80	

Qualifiers (Q):
NA - No criteria
ND - Not detected at the method detection limit (MDL)
J - Estimated concentration, below calibration range and above MDL

In the leachate produced from exposure of the composite samples to artificial rainwater, bis(2-Ethyltexyl)phthalate was the only organic compound detected (Table B-3). This compound was also detected in the analytical blank, and it's presence in the sample may be due to cross-contamination. This compound was found in very low concentrations in the sediments, and Phthalates are widely recognized as ubiquitous compounds that are often found as laboratory contaminants (USEPA 1970). Metals were detected in the leachate from all three sediment composites (Table B-3). Concentrations of five metals in the leachate samples exceeded the NJSGWQC. The metals that exceeded the Criteria in the leachate samples and the composites from which the samples originated include:

manganese and selenium in all three composite samples, aluminum in Composites A-Bottom and B-Top, sodium in Composites A-Top and B-Top and iron in Composite A-Bottom.

Table B-3. Compounds detected in leachate from Nummy Island CDF sediment samples

	NJSGWQC	Comp A-Top (A-layer) Cores 4,5,6 (Top layer)		Comp A-Bottom (C-layer) Cores 4,5,6 (Bottom layer)		Comp B-Top (A-layer) Cores 1,2,3 (Top layer)	
	Groundwater	Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
bis(2-Ethylhexyl)phthalate	3		ND	7.800	B	7.800	B
Metals	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Cobalt	NA		ND	0.01	J		ND
Copper	1.3	0.01	J	0.01	J	0.03	
Iron	0.3	0.07		7.98		0.18	
Magnesium	NA	27		15		22	
Manganese	0.05	0.06		0.29		0.18	
Nickel	0.1		ND	0.02	J	0.004	J
Potassium	NA	20		8		15	
Selenium	0.04	0.174		0.116		0.090	
Sodium	50	71		39		56	
Vanadium	NA		ND	0.005	J		ND
Zinc	2	0.03		0.3		0.15	

Qualifiers (Q):
NA - No criteria
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
J - Estimated concentration, below calibration range and above MDL
A highlighted value indicates that the concentration was above Groundwater Criteria

Some of the method detection limits for semivolatile compounds, pesticides and metals exceeded the NJSGWQC and whether actual concentrations in the samples exceeded the Criteria is unknown (Table B-4). The method detection limits for these compounds were all equal to or below those required by NJDEP for dredging projects (NJDEP 1997).

Table B-4. Compounds with method detection limits exceeding the NJSGWQC in the analysis of leachate samples from the Nummy Island CDF.

	NJSGWQC	NJ Required MDL	Comp A-Top (A-layer) Cores 4,5,6 (Top)		Comp A-Bottom (C-layer) Cores 4,5,6 (Bottom)		Comp B-Top (A-layer) Cores 1,2,3 (Top)	
	Groundwater	Leachate	Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
bis(2-Chloroethyl)ether	7	10	10	ND	10	ND	10	ND
Hexachloroethane	7	10	10	ND	10	ND	10	ND
Nitrobenzene	6	10	10	ND	10	ND	10	ND
1,2,4-Trichlorobenzene	9	10	10	ND	10	ND	10	ND
Hexachloro-1,3-butadiene	1	10	10	ND	10	ND	10	ND
Hexachlorobenzene	0.02	10	10	ND	10	ND	10	ND
Pentachlorophenol	0.3	50	10	ND	10	ND	10	ND
Benzo(a)anthracene	0.1	10	10	ND	10	ND	10	ND
Chrysene	5	10	10	ND	10	ND	10	ND
bis(2-Ethylhexyl)phthalate	3	10	10	ND	7.8	B	7.80	B
Benzo(b)fluoranthene	0.2	10	10	ND	10	ND	10	ND
Benzo(k)fluoranthene	0.5	10	10	ND	10	ND	10	ND
Benzo(a)pyrene	0.1	10	10	ND	10	ND	10	ND
Indeno(1,2,3-cd)pyrene	0.2	10	10	ND	10	ND	10	ND
Dibenzo(a,h))anthracene	0.3	10	10	ND	10	ND	10	ND
alpha-BHC	0.02	0.05	0.05	ND	0.05	ND	0.05	ND
beta-BHC	0.04	0.05	0.05	ND	0.05	ND	0.05	ND
gamma-BHC (Lindane)	0.03	0.05	0.05	ND	0.05	ND	0.05	ND
Aldrin	0.04	0.05	0.05	ND	0.05	ND	0.05	ND
Dieldrin	0.03	0.10	0.05	ND	0.05	ND	0.05	ND
Metals	**mg/L**	**mg/L**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**
Antimony	0.006	0.06	0.025	ND	0.025	ND	0.025	ND
Arsenic	0.003	0.01	0.010	ND	0.010	ND	0.010	ND
Beryllium	0.001	0.005	0.005	ND	0.005	ND	0.005	ND
Cadmium	0.004	0.005	0.005	ND	0.005	ND	0.005	ND
Thallium	0.002	0.01	0.010	ND	0.010	ND	0.010	ND

Qualifiers (Q):
ND - Not detected at the listed method detection limit (MDL)
B - Compound also detected in the batch blank

B.2 MIDDLE THOROFARE, CAPE MAY, NJ

The Middle Thorofare CDF is a shoreline CDF located in Cape May, NJ. The CDF contains approximately 39,500 cy of dredged material, and it was estimated that approximately 35,000 cy of material can be removed, which would leave a sufficient volume of material to reshape the berm to facilitate future dredging projects.

ASI collected three sediment cores from the Middle Thorofare CDF (Figure B-2). The three collected cores did not have any sediment stratification and each core was homogenized over the entire length. Three samples were prepared for physical and chemical analyses. The following sections describe the physical and chemical properties of the material in the sediment samples.

- *B.2.1 Physical Characteristics*

Table B-4 shows the grain size composition of the Middle Thorofare sediment core subsamples. Core 1 was collected from near the weir structure. The sediment composition in this area was dominated by black silt and clay (80%) with some sand (20%). Core 2 was collected from the approximate center of the CDF. This core had greater sand content (60%) and approximately half of the silt and clay of Core 1. Core 3 was collected in the berm area on the north side of the CDF. Sediment composition at this location was primarily brown sand and gravel (95%), with little silt and clay (5%).

Percent moisture and TOC content of the sediment samples was correlated with the amount of silt and clay. Moisture and TOC content was greatest in Core 1 and least in Core 3. Percent moisture in the individual cores ranged from 4.1% to 44.5% and TOC content ranged from 0.29% to 3.1%.

Composite MT-A was comprised of sediment from Cores 1 and 2 and had grain size composition of 36% sand and 64% silt and clay (Table B-5). Composite MT-A had similar percent moisture and TOC content to Cores 1 and 2.

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Location of Sediment Cores taken from the Middle Thorofare CDF in Cape May, NJ

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Table B-5. Physical properties of the sediment cores collected from the Middle Thorofare CDF.

Core/ Comp ID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Fine Material	% Coarse Material
MT-1	20060009	44.5	30,508	3.1	34.3	45.5	20.1	0.0	79.8	20.1
MT-2	20060010	32.3	14,654	1.5	17.7	23.1	58.7	0.6	40.8	59.3
Comp MT-A	20060015	41.9	28,263	2.8	27.4	37.0	35.3	0.3	64.4	35.6
MT-3	20060003	4.1	2,918	0.3	2.2	3.0	87.6	7.2	5.2	94.8

- *B.2.2 Chemical Characteristics*

Composite MT-A was analyzed for semivolatile compounds, pesticides, PCBs and metals. Phthalates, some PAHs and 4,4'-DDE were the only organic compounds detected in the composite sediment sample (Table B-6). Almost all of the metals for which analyses were conducted were detected in the composite sample (Table B-6). None of the detected compounds had concentrations above the NJRDCSCC.

Table B-6. Compounds detected in the Middle Thorofare CDF composite sediment sample

	NJ RDCSCC	**Composite MT-A**	
		Cores 1 and 2	
	Soil	**Unamended Sediment**	
Organics	**ug/kg**	**ug/kg**	**Q**
Diethylphthalate +	10,000,000	260.0	
Di-n-butylphthalate +	5700000	130.0	J
Fluoranthene (PAH)+	2300000	680.0	
Pyrene (PAH)+	1700000	600.0	
Benzo(a)anthracene (PAH)+	900	170.0	J
Chrysene (PAH)+	9000	200.0	J
bis(2-Ethylhexyl)phthalate +	49000	290.0	
Benzo(b)fluoranthene +	900	160.0	J
4,4'-DDE	2000	8.40	J
Metals	**mg/kg**	**mg/kg**	**Q**
Aluminum	NA	7910	
Arsenic	20	7.8	

Table B-6 (Cont'd). Compounds detected in the Middle Thorofare CDF composite sediment sample

	NJ RDCSCC	Composite MT-A	
		Cores 1 and 2	
	Soil	Unamended Sediment	
Organics	**ug/kg**	**ug/kg**	**Q**
Barium	700	27.3	
Cadmium	39	0.5	
Calcium	NA	3880	
Chromium	NA	28	
Cobalt	NA	9	
Copper	600	29.1	
Iron	NA	15700	
Lead	400	20	
Magnesium	NA	4130	
Manganese	NA	165	
Mercury	14	0.2	
Nickel	250	13.2	
Potassium	NA	3160	
Sodium	NA	4490	
Vanadium	370	26.9	
Zinc	1500	136	
Qualifiers (Q): (+) All sediment semivolatile analysis outside method holding limit NA - No criteria J - Estimated concentration, below calibration range and above MDL			

The leachate produced from exposure of composite MT-A to artificial rainwater did not have detectable concentrations of organic compounds. However, metals were detected in the leachate sample (Table B-7). Concentrations of four metals exceeded the NJSGWQC (last revised 11/07/2005). The metals that exceeded the NJSGWQC in the leachate samples include: antimony, arsenic, manganese and sodium.

Table B-7. Compounds detected in the leachate from the Middle Thorofare CDF sediment sample

	NJSGWQC	Composite MT-A Cores 1 and 2	
	Groundwater	Leachate	
Metals	**mg/L**	**mg/L**	**Q**
Aluminum	0.2	0.026	
Antimony	0.006	0.029	
Arsenic	0.003	0.02	
Barium	2	0.12	
Calcium	NA	45	
Iron	0.3	0.16	
Lead	0.005	0.003	
Magnesium	NA	27	
Manganese	0.05	0.198	
Potassium	NA	29	
Sodium	0.1	120.0	
Zinc	2	0.02	J

NA - No standard
J - Estimated concentration, below calibration range and above MDL
A shaded value indicates that the concentration exceeded groundwater criteria

The detection limits for some semivolatile compounds, pesticides and metals were above the revised Criteria (Table B-8) Although the compounds were not detected in the leachate sample, it is unknown if the actual concentrations exceeded the Criteria. The method detection limits for these compounds were equal to or below those required by NJDEP (1997) for dredging projects.

Table B-8. Compounds with method detection limits greater than the NJSGWQC in the analysis of the Middle Thorofare CDF leachate sample

	NJSGWQC	NJ Required MDL	Composite MT-A Cores 1 and 2	
	Groundwater	Leachate	Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	5.00	ND
Hexachlorobenzene	0.02	10	5.00	ND

Table B-8 (Cont'd). Compounds with method detection limits greater than the NJSGWQC in the analysis of the Middle Thorofare CDF leachate sample

Organics (cont'd)	ug/L	ug/L	ug/L	Q
Pentachlorophenol	0.3	50	5.00	ND
Benzo(a)anthracene	0.1	10	5.00	ND
bis(2-Ethylhexyl)phthalate	3	10	5.00	ND
Benzo(b)fluoranthene	0.2	10	5.00	ND
Benzo(k)fluoranthene	0.5	10	5.00	ND
Benzo(a)pyrene	0.1	10	5.00	ND
Indeno(1,2,3-cd)pyrene	0.2	10	5.00	ND
Dibenzo(a,h))anthracene	0.3	10	5.00	ND
alpha-BHC	0.02	0.05	0.05	ND
beta-BHC	0.04	0.05	0.05	ND
gamma-BHC (Lindane)	0.03	0.05	0.05	ND
Aldrin	0.04	0.05	0.05	ND
Dieldrin	0.03	0.1	0.05	ND
Metals	**mg/L**	**mg/L**	**mg/L**	**Q**
Beryllium	0.001	0.005	0.005	ND
Cadmium	0.004	0.005	0.005	ND
Thallium	0.002	0.01	0.010	ND
Qualifiers (Q): ND - Not detected at the listed method detection limit (MDL)				

B.3. SITE #83, OCEAN CITY, NJ

The Ocean City Site #83 is an island CDF surrounded by marshland that is located adjacent to 32nd Street in Ocean City, NJ. The CDF contains approximately 395,000 cy of dredged material. It was estimated that approximately 375,000 cy could be removed from the CDF, leaving approximately 20,000 cy of material to be recontoured to accommodate future dredging projects.

ASI collected 24 sediment cores from the Site #83 CDF (Figure B-3). No stratification of the material was apparent, so 24 samples were prepared for physical and chemical analyses. The results of these analyses are described below.

- *B.3.1 Physical Characteristics*

All cores collected from the Ocean City Site #83 CDF were predominantly comprised of black silt and clay. With the exception of Cores 16 and 24, all collected cores were approximately 8 feet in length and no stratification was evident. Cores 16 and 24 were approximately 14 feet in length and were also comprised primarily of black silt and clay with no stratification evident throughout.

The sediment composition was greater than 95% silt and clay in of all of the collected cores except Cores 6, 16, 17 and 19. Silt and clay content ranged from 71% to 92% in these cores. These cores are randomly distributed throughout the CDF, suggesting that there are no large areas with predominantly sandy material.

Eight composites were formed from the collected cores (Composites A-H; Table B-9). All of the composites had similar characteristics to the individual component cores except for composite OC-D. This composite had 100% silt and clay, but included Core 6, which had 28.7% sand content.

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Location of Sediment Cores taken from the Ocean City Site #83 CDF in Ocean City, NJ

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Table B-9. Composites formed from the sediment cores collected from the Ocean City Site #83 CDF

Cores	Composite	Cores	Composite
1, 2, 3	OC-A	12, 16, 17	OC-E
4, 5, 8	OC-B	14, 15, 19	OC-F
9, 11, 13	OC-C	18, 22, 24	OC-G
6, 7, 11	OC-D	20, 21, 23	OC-H

Overall, the CDF appears to be filled with fine-grained material. Total organic carbon content was relatively high in all of the collected cores, ranging from 2.61% to 4.76%. Moisture content was between 42% and 57% in all collected cores. The physical properties of the materials in the composite samples are presented in Table B-10.

Table B-10. Physical properties of the sediment cores collected from the Ocean City Site #83 CDF

Core/ Comp ID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Fine Materials	% Coarse Materials
OC-1	20060254	54.6	47,625	4.8	55.3	44.7	0.0	0.0	100.0	0.0
OC-2	20060238	56.0	41,761	4.2	49.7	50.3	0.0	0.0	100.0	0.0
OC-3	20060237	51.4	40,987	4.1	47.6	52.4	0.0	0.0	100.0	0.0
Comp OC-A	20060255	54.3	43,057	4.3	52.8	47.2	0.0	0.0	100.0	0.0
OC-4	20060253	49.8	40,374	4.0	53.9	46.1	0.0	0.0	100.0	0.0
OC-5	20060239	54.1	43,483	4.4	46.7	53.3	0.0	0.0	100.0	0.0
OC-8	20060199	57.5	36,305	3.6	49.9	50.1	0.0	0.0	100.0	0.0
Comp OC-B	20060256	54.5	37,993	3.8	51.9	48.1	0.0	0.0	100.0	0.0
OC-9	20060215	51.8	36,586	3.7	51.5	48.5	0.0	0.0	100.0	0.0
OC-10	20060217	53.6	39,407	3.9	51.3	48.7	0.0	0.0	100.0	0.0
OC-13	20060214	54.8	37,760	3.8	49.2	50.8	0.0	0.0	100.0	0.0
Comp OC-C	20060257	53.4	36,718	3.7	50.5	49.5	0.0	0.0	100.0	0.0
OC-6	20060240	45.0	27,752	2.8	34.3	37.0	28.7	0.0	71.3	28.7
OC-7	20060241	54.1	38,514	3.9	54.6	45.4	0.0	0.0	100.0	0.0
OC-11	20060218	51.8	41,904	4.2	57.1	42.9	0.0	0.0	100.0	0.0

Table B-10 (Cont'd). Physical properties of the sediment cores collected from the Ocean City Site #83 CDF

Core/ Comp ID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Fine Materials	% Coarse Materials
Comp OC-D	20060258	49.9	36,226	3.6	51.0	49.0	0.0	0.0	100.0	0.0
OC-12	20060194	55.7	38,440	3.8	49.6	50.4	0.0	0.0	100.0	0.0
OC-16	20060251	39.8	28,713	2.9	40.6	43.3	16.1	0.0	83.9	12.0
OC-17	20060195	49.3	29,443	2.9	43.5	47.3	9.2	0.0	90.8	9.2
Comp OC-E	20060259	47.7	31,724	3.2	44.7	47.2	8.0	0.0	91.9	8.0
OC-14	20060236	49.2	34,377	3.4	48.1	49.9	2.0	0.0	98.0	2.0
OC-15	20060252	46.6	43,939	4.4	54.0	46.0	0.0	0.0	100.0	0.0
OC-19	20060219	48.0	26,067	2.6	42.2	49.7	8.0	0.0	91.9	8.0
Comp OC-F	20060260	46.9	31,932	3.2	41.7	44.0	14.3	0.0	85.7	14.3
OC-18	20060213	53.7	40,137	4.0	53.8	46.2	0.0	0.0	100.0	0.0
OC-22	20060212	55.5	38,831	3.9	49.6	50.4	0.0	0.0	100.0	0.0
OC-24	20060216	41.8	38,400	3.8	48.5	50.0	1.5	0.0	98.5	1.5
Comp OC-G	20060261	49.6	38,426	3.8	50.1	49.9	0.0	0.0	100.0	0.0
OC-20	20060196	52.0	40,247	4.0	52.0	48.0	0.0	0.0	100.0	0.0
OC-21	20060197	56.6	40,748	4.1	46.8	53.2	0.0	0.0	100.0	0.0
OC-23	20060198	56.0	36,938	3.7	49.0	51.0	0.0	0.0	100.0	0.0
Comp OC-H	20060262	51.3	35,909	3.6	47.7	50.7	1.6	0.0	98.4	1.6

- *B.3.2 Chemical Characteristics*

The eight composite sediment samples were analyzed for semivolatile compounds, pesticides, PCBs and metals. Phthalates and PAHs were detected in all of the composite samples. Phenolic compounds were detected in composites OC-A, OC-B and OC-C (Table B-11). A trace concentration of 4,4'-DDT was measured in composite OC-B and trace levels of alpha- and gamma-chlordane were measured in composite OC-D (Table B-11). No other semivolatiles, pesticides or PCBs were detected in the composite samples. Almost all of the metals for which analyses were conducted were detected in the composite samples (Table B-11). For all compounds, measured concentrations did not exceed the NJRDCSCC.

Table B-11. Compounds detected in the composite sediment samples from Ocean City Site #83 CDF

	NJ RDCSCC	Comp OC-A		Comp OC-B		Comp OC-C		Comp OC-D		Comp OC-E		Comp OC-F		Comp OC-G		Comp OC-H	
		Cores 1,2,3		Cores 4,5,8		Cores 9,10,13		Cores 6,7,11		Cores 12,16,17		Cores 14,15,19		Cores 18,22,24		Cores 20,21,23	
	Soil	Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment	
Organics	**ug/kg**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**
4-Methylphenol	2800000	66.40	Y	52.00	Y	156.00	Y		ND		ND		ND		ND		ND
Naphthalene	230000	30.90	J		ND	26.50	J		ND		ND	21.10	J	21.80	J		ND
4-Nitrophenol	NA	234.0	J		ND		ND		ND		ND		ND		ND		ND
Diethylphthalate	10,000,000	31.80	Y		ND		ND		ND	24.70	Y		ND	28.70	Y	32.40	J
Phenanthrene (PAH)	NA	34.40	Y		ND	42.90	Y	24.70	J	22.00	J	43.20	Y	30.00	Y	34.10	J
Anthracene (PAH)	10000000		ND		ND	26.30	Y		ND		ND	21.30	J	22.40	J		ND
Di-n-butylphthalate	5700000	25.40	J	33.20	J		ND	23.10	J		ND	23.00	J		ND	22.70	J
Fluoranthene (PAH)	2300000	190.0	Y	101.0	Y	229.0	Y	123.0	Y	123.0	Y	184.0	Y	202.0	Y	84.0	Y
Pyrene (PAH)	1700000	152.0	Y	90.80	Y	200.0	Y	137.0	Y	105.0	Y	173.0	Y	208.0	Y	66.7	Y
Benzo(a)anthracene (PAH)	900	50.40	Y	35.20	Y	68.60	Y	50.60	Y	34.90	Y	56.90	Y	62.60	Y	29.90	Y
Chrysene (PAH)	9000	80.90	Y	54.70	Y	118.0	Y	78.30	Y	59.30	Y	75.00	Y	92.10	Y	32.20	J
bis(2-Ethylhexyl)phthalate	49000	144.0	BY	105.0	BY	112.0	BY	119.0	BY	104.0	BY	137.0	BY	139.0	BY	138.0	BY
Benzo(b)fluoranthene (PAH)	900	42.30	Y		ND	57.10	Y	44.70	Y	27.60	Y	46.40	Y	50.70	Y		ND
Benzo(k)fluoranthene (PAH)	900	41.20	J		ND	60.00	Y	42.10	J	27.20	J	42.40	J	49.10	Y		ND
Benzo(a)pyrene (PAH)	660	36.50	Y		ND	45.20	Y	36.00	Y		ND	36.60	Y	38.20	Y	21.30	J
Indeno(1,2,3-cd)pyrene (PAH)	900		ND		ND	25.50	Y		ND		ND		ND	20.50	Y		ND
Benzo(ghi)perylene (PAH)	NA		ND		ND	26.30	Y		ND		ND		ND		ND		ND
4,4'-DDT	2000		ND	1.930			ND		ND		ND		ND		ND		ND
alpha-Chlordane	NA		ND		ND		ND	4.290			ND		ND		ND		ND
gamma-Chlordane	NA		ND		ND		ND	3.440			ND		ND		ND		ND
Metals	**mg/kg**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**
Aluminum	NA	14600		14300		12400		12600		12000		11600		12200		16300	
Antimony	14	0.98		1.17		1.36		1.3		0.94		0.68		0.6		1.36	
Arsenic	20	13.900		12.900		10.800		12.000		10.00		10.1		10.3		15.4	
Barium	700	46.700		46.10		39.500		40.50		38.10		36.4		37.6		51.5	
Cadmium	39		ND		ND		ND	0.051			ND		ND		ND		ND
Calcium	NA	6070		5880		4460		5130		4140		4030		3760		5600	
Chromium	NA	62.600		61.30		52.200		53.40		49.40		47.9		48.9		67.4	
Cobalt	NA	10.8		10.900		9.28		9.780		9.04		9		8.9		12.2	
Copper	600	38.800		38.500		34.200		33.400		30.500		29		31		39.7	
Iron	NA	29900		29700		25500		26100		24700		24900		24600		34300	
Lead	400	50.900		48.300		41.600		45.20		35.1		38.4		36.1		49.7	
Magnesium	NA	8280		8070		6970		7120		6610		6430		6530		9100	
Manganese	NA	338.00		328.0		256.00		319.0		228.0		234		244		323	
Mercury	14	0.75		0.680		0.67		0.67		0.52		0.52		0.56		0.54	
Nickel	250	25.800		25.800		22.200		23.500		21		21		20.9		28.3	
Potassium	NA	5120.0		4950		4470.0		4430		4230.0		4100		4320		6130	
Silver	110		ND		ND	0.51			ND		ND		ND		ND		ND
Sodium	NA	7900		6810.0		7550.0		7240		7930		7790		7390		13500	
Vanadium	370	54.500		52.400		45.800		47.50		43.200		42.9		43.5		60.8	
Zinc	1500	140.00		141.00		122.00		131.00		110.00		111		110		145	
Cyanide, total	1100		ND		ND		ND		ND		ND		ND	0.45	Y		ND

Qualifiers (Q):
NA - No critiera
Y - Estimated concentration, below calibration range and above MDL
B - Compound also detected in the batch blank
J - Estimated concentration, below MDL
ND - Not detected at the method detection limit (MDL)

No pesticides or PCBs were detected in the leachate produced from exposure of the composite sample to artificial rainwater. The semivolatile organic compounds naphthalene, 4-chloro-3-methylphenol, and di-n-butylphthalate were detected in a few of the leachate samples (Table B-12). The compounds diethylphthalate and bis(2-ethylhexyl)phthalate were detected in all of the leachate samples. The concentration of bis(2-ethylhexyl)phthalate in leachate from composite OC-H exceeded the NJSGWQC. However, this compound was also detected in the analytical blank at a level of 1.02 ppb (or 1.02 μg/L) which suggests that its presence in the sample may be due to laboratory contamination. Phthalates are widely recognized as common laboratory contaminants (EPA 1970). The USEPA provides the guidance that when a semivolatile organic compound is detected in the analytical blank, detections in samples at less than ten times the level of the concentrations in the analytical blank should be treated as non-detects (USEPA 2001). The highest concentration of bis(2-ethylhexyl)phthalate found in the composites was 3.07 μg/L, which is less than the 10.2 μg/L required to indicate that the sample has detectable concentrations of this Phthalate.

Metals were detected in all of the leachate samples (Table B-12). Concentrations of six metals exceeded the NJSGWQC in one or more leachate samples. Aluminum and sodium concentrations exceeded the Criteria in all of the leachate samples. Arsenic concentrations exceeded the Criteria in all leachate samples except for leachate produced from composite CD-F. Iron concentrations exceeded the Criteria in all leachate samples except for that produced from composite OC-E. Selenium concentrations exceeded the Criteria in five of the leachate samples (from composites OC-C, OC-D, OC-E, OC-G, and OC-H) and manganese concentrations exceeded the standard in leachate from two of the composite samples (OC-E and OC-G).

For some semivolatile compounds, method detection limits exceeded the NJSGWQC (Table B-13). Although these compounds were not detected in the leachate samples, it is unknown whether actual concentrations in the samples exceeded the NJSGWQC. However, all of the method detection limits were equal to or below those required by the NJDEP for dredging projects (NJDEP 1997).

Table B-12. Compounds detected in the leachate from the Ocean City Site #83 CDF sediment samples

	NJSGWQC	Comp OC-A		Comp OC-B		Comp OC-C		Comp OC-D		Comp OC-E		Comp OC-F		Comp OC-G		Comp OC-H	
		Cores 1,2,3		Cores 4,5,8		Cores 9,10,13		Cores 6,7,11		Cores 12,16,17		Cores 14,15,19		Cores 18,22,24		Cores 20,21,23	
	Groundwater	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Naphthalene	300		ND		ND		ND	0.680	J		ND		ND		ND	0.640	J
4-Chloro-3-methylphenol	NA		ND		ND		ND		ND		ND		ND		ND	1.880	J
2-Methylnaphthalene	NA		ND		ND		ND		ND		ND		ND	0.740	J		ND
Diethylphthalate	6,000	3.370	BY	4.000	BY	2.260	BY	3.230	BY	2.970	BY	1.800	JB	2.200	BY	2.610	BY
Di-n-butylphthalate	900	0.570	J		ND		ND		ND		ND		ND		ND		ND
bis(2-Ethylhexyl)phthalate	3	1.610	JB	1.720	JB	0.910	JB	1.260	JB	0.990	JB	0.630	JB	0.920	JB	3.070	JB
Metals	**mg/L**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**
Aluminum	0.2	0.63		1.43		1.22		0.88		0.73		1.15		0.93		0.82	
Arsenic	0.003	0.0064		0.0069		0.0044		0.0063		0.0057			ND	0.0058		0.0059	
Barium	2	0.17		0.31		0.33		0.24		0.19		0.3		0.25		0.29	
Beryllium	0.001	0.0004		0.0003		0.0004		0.0004		0.0005		0.0003		0.0004		0.0004	
Cadmium	0.004		ND		ND		ND		ND	0.0003			ND		ND		ND
Calcium	NA	10.9		11.1		12.2		11.2		20		12.7		19.4		11.9	
Chromium	0.07	0.0027		0.0035		0.0034		0.0024		0.0025		0.0027		0.0031		0.0024	
Cobalt	NA	0.0006			ND		ND		ND	0.0004	ND		ND		ND		ND
Iron	0.3	0.4		0.87		0.65		0.48		0.26		0.53		0.36		0.37	
Lead	0.005	0.0027		0.0035		0.0023		0.0035		0.0034		0.0034		0.004		0.0024	
Magnesium	NA	13.5		11.3		14.5		12.7		20.2		14.3		22.1		16.8	
Manganese	0.05	0.027		0.022		0.017		0.021		0.14		0.015		0.093		0.02	
Mercury	0.002	0.000064		0.000048		0.000052		0.000052		0.000035		0.000046		0.000027		0.000028	
Nickel	0.1	0.0024		0.0021		0.0019		0.002		0.0018		0.0016		0.0019		0.0012	
Potassium	NA	13.2		12		16		12.5		12.5		14.4		15.6		17.1	
Selenium	0.04	0.04		0.037		0.045		0.041		0.061		0.038		0.068		0.046	
Sodium	50	143		118		174		139		163		169		186		214	
Vanadium	NA	0.012		0.013		0.01		0.013		0.0037		0.0071		0.005		0.0067	
Zinc	2	0.036		0.054		0.078		0.045		0.11		0.056		0.1		0.061	

Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
Y - Estimated concentration, below calibration range and above MDL
B - Compound also detected in the batch blank
J - Estimated concentration, below MDL
A shaded value indicates that the concentration exceeds the groundwater criteria

Table B-13. Compounds with method detection limits greater than the NJSGWQC in the analysis of the Ocean City Site #83 CDF leachate samples

	NJ SGWQC	NJ Req'd MDL	Comp OC-A		Comp OC-B		Comp OC-C		Comp OC-D	
			Cores 1,2,3		Cores 4,5,8		Cores 9,10,13		Cores 6,7,11	
	Ground-water	Leachate	Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	1.34	ND	1.34	ND	1.34	ND	1.34	ND
Hexachlorobenzene	0.02	10	1.48	ND	1.48	ND	1.48	ND	1.48	ND
Benzo(a)anthracene	0.1	10	1.88	ND	1.88	ND	1.88	ND	1.88	ND
Benzo(b)fluoranthene	0.2	10	1.98	ND	1.98	ND	1.98	ND	1.98	ND
Benzo(k)fluoranthene	0.5	10	1.88	ND	1.88	ND	1.88	ND	1.88	ND
Benzo(a)pyrene	0.1	10	1.92	ND	1.92	ND	1.92	ND	1.92	ND
Indeno(1,2,3-cd)pyrene	0.2	10	2	ND	2	ND	2	ND	2	ND
Dibenzo(a,h)anthracene	0.3	10	1.82	ND	1.82	ND	1.82	ND	1.82	ND
Qualifiers (Q): ND - Not detected at the listed method detection limit										

	NJ SGWQC	NJ Req'd MDL	Comp OC-E		Comp OC-F		Comp OC-G		Comp OC-H	
			Cores 12,16,17		Cores 14,15,19		Cores 18,22,24		Cores 20,21,23	
	Ground-water	Leachate	Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	1.34	ND	1.34	ND	1.34	ND	1.34	ND
Hexachlorobenzene	0.02	10	1.48	ND	1.48	ND	1.48	ND	1.48	ND
Benzo(a)anthracene	0.1	10	1.88	ND	1.88	ND	1.88	ND	1.88	ND
Benzo(b)fluoranthene	0.2	10	1.98	ND	1.98	ND	1.98	ND	1.98	ND
Benzo(k)fluoranthene	0.5	10	1.88	ND	1.88	ND	1.88	ND	1.88	ND
Benzo(a)pyrene	0.1	10	1.92	ND	1.92	ND	1.92	ND	1.92	ND
Indeno(1,2,3-cd)pyrene	0.2	10	2	ND	2	ND	2	ND	2	ND
Dibenzo(a,h)anthracene	0.3	10	1.82	ND	1.82	ND	1.82	ND	1.82	ND
Qualifiers (Q): ND - Not detected at the listed method detection limit										

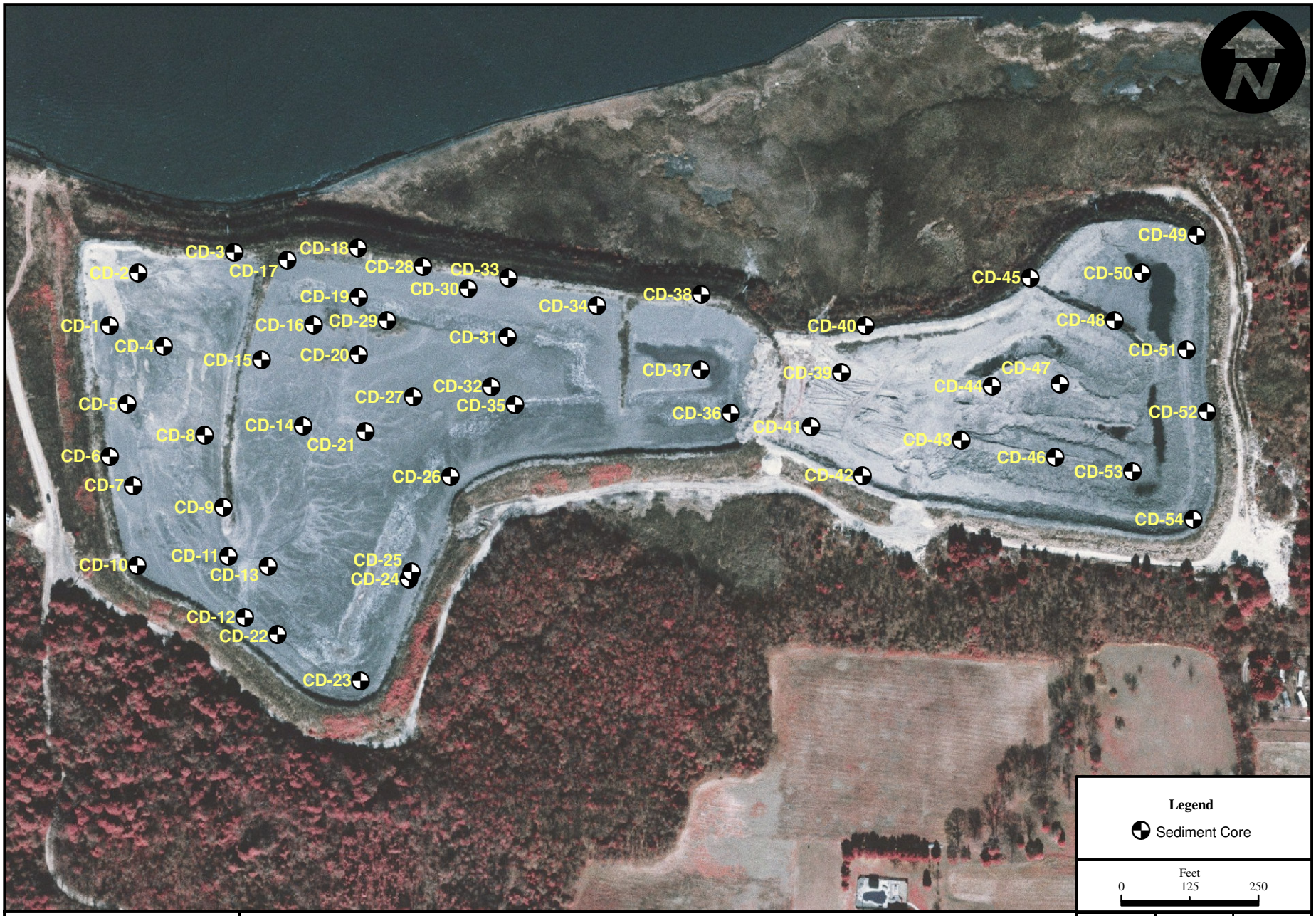
B.4. CORPS CELL D, CAPE MAY, NJ

Corps Cell D is a large CDF in Cape May, NJ that is managed by the U.S. Army Corps of Engineers Philadelphia District. The CDF contains two cells divided by a berm. The estimated volume of dredged material in the entire CDF is 969,500 cy, with three-fourths of the material located in the western cell. Approximately 856,000 cy of material could be removed, leaving sufficient material to recontour the berms and accommodate future dredging projects.

ASI collected 54 sediment cores from the CDF (Figure B-4). Stratification of material was apparent in 10 of these cores where there were layers of both fine and coarse grained materials. A total of 64 samples were prepared for physical and chemical analyses. The following sections describe the results of the analyses.

- *B.4.1 Physical Characteristics*

Table B-14 shows the grain size composition of the Corps Cell D sediment core subsamples. Thirty-eight cores were collected from the western side of the CDF. In general, these cores did not have distinct stratification, but stratification was evident in cores collected near the junction of the eastern and western cells. Sediment cores collected from the far western corner of the CDF (Cores 1-6) were comprised primarily of sand and gravel, with the total amount of coarse-grained material ranging from 67% to 91%. Cores 17, 18, 28 and 10 were also dominated by coarse-grained sediment (74%-83%). These cores were all collected from the berm portion of the western cell. The majority of cores collected from the interior of the western cell were dominated by silt and clay. Total percent silt and clay ranged from 70% to 100% in Cores 7-9, 11, 13, 14, 19-27, 29-31, 35 and 36. A few collected cores contained a mixture of silt and clay in approximately 50/50 proportion. These cores were randomly dispersed throughout the western cell (Cores 12, 15, 16, 32 and 33). Cores 34 and 38 were collected from the western cell near the junction of the eastern and western cells. These cores were stratified, with an eight to twelve foot deep layer of silt and clay (top layer (a), 99-100% fine-grained material) overlying a nine to twelve foot deep layer of sand (bottom layer (b), 93-98% coarse-grained material). Core 37 was collected from an area intermediate to Cores 34 and 38 and was a mixture of sand, silt and clay throughout its length (17 feet).



HDR | LMS

Location of Sediment Cores taken from the Cape May Corps Cell D CDF in Cape May, NJ

Job No.	Date	Figure No.
0904-007	06/05/06	B-4

Sixteen cores were collected from the eastern side of the CDF and approximately half of these cores had distinct sediment stratification. Three of the stratified cores were collected from the berm on the eastern edge of the CDF. These cores (49, 52 and 54) had an eight to twelve foot thick layer of predominantly fine-grained material (top layer (a), 77-88% silt and clay) over an eight to twelve foot thick layer of predominantly coarse-grained material (bottom layer (b), 85-98% sand and gravel). Similar stratification and sediment composition was found in Cores 43 and 48, collected from the interior of the eastern portion of the CDF. Cores collected from the portion of the eastern cell near the junction with the western cell were also stratified. Core 41 had a 12 foot layer of a 50/50 silt and sand mix (top layer (a)) over four feet of sand (bottom layer (b), 89% coarse-grained material). Core 42 had the opposite stratification with a 16 foot layer of fine brown sand (top layer (a), 91% sand content) over 4 feet of 50/50 silt and sand mixture (bottom layer (b)). Core 39 was comprised of predominantly sand, but the top four feet of the core was 97% sand while the bottom 13 feet had some silt and clay (14% fine-grained material). The two cores collected form the northern berm of the eastern cell (Cores 40 and 45) were not stratified and were predominantly comprised of sand (83-93% sand and gravel). Cores collected from the eastern interior of the eastern cell (Cores 46, 47, 50, 51 and 53) were not stratified and were dominated by silt and clay (66-100%). Core 44 was collected from the center of the eastern cell and was comprised of 57% silt and clay and 43% sand and gravel.

For both the eastern and western cells, TOC and moisture content were correlated with the grain size composition of the sediment samples, samples with a greater percentage of fine-grained material had higher TOC and moisture content. For all collected cores, the percent moisture ranged from 6% to 69% and percent TOC ranged from 0.05% to 5.3%.

Table B-14. Grain size composition of the sediment cores collected from the Corps Cell D CDF

Core/ CompID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Coarse Material	% Fine Material
CD-1	20060013	19.8	5,149	0.5	6.5	2.6	90.5	0.4	90.9	93.1
CD-2	20060017	21.6	6,395	0.6	8.5	4.9	86.6	0.0	86.6	91.5
CD-3	20060018	39.0	17,284	1.7	17.5	15.2	67.3	0.0	67.3	82.5
Comp CD-A	20060191	23.5	9,873	1.0	10.0	10.3	79.7	0.0	79.7	20.3
CD-4	20060014	26.2	8,945	0.9	8.6	5.0	86.5	0.0	86.5	91.5
CD-5	20060012	22.1	8,076	0.8	7.4	3.8	88.8	0.0	88.8	92.6
CD-6	20060011	19.5	8,363	0.8	6.1	5.9	88.1	0.0	88.1	94.0

Table B-14 (Cont'd). Grain size composition of the sediment cores collected from the Corps Cell D CDF

Core/ CompID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Coarse Material	% Fine Material
Comp CD-B	20060016	21.4	10,344	1.0	7.6	5.6	86.8	0.0	86.8	13.2
CD-7	20060155	66.3	48,547	4.9	51.8	48.2	0.0	0.0	0.0	48.2
CD-8	20060045	46.6	29,302	2.9	36.0	34.4	29.6	0.0	29.6	64.0
CD-9	20060168	68.8	42,139	4.2	44.0	47.6	8.3	0.0	8.3	55.9
Comp CD-C	20060176	69.7	39,473	4.0	43.8	51.0	5.1	0.0	5.1	94.8
CD-10	20060052	26.1	13,209	1.3	15.3	10.9	73.4	0.4	73.8	84.3
CD-12	20060053	37.5	23,953	2.4	27.2	23.7	49.2	0.0	49.2	72.9
CD-23	20060057	47.2	44,517	4.5	40.4	44.2	15.4	0.0	15.4	59.6
Comp CD-D	20060068	36.5	26,301	2.6	24.8	25.0	50.1	0.0	50.1	49.8
CD-11	20060149	65.4	39,497	4.0	45.7	50.8	3.5	0.0	3.5	54.3
CD-13	20060171	69.4	39,742	4.0	50.3	49.7	0.0	0.0	0.0	49.7
CD-14	20060106	57.3	45,371	4.5	48.3	45.0	6.8	0.0	6.8	51.8
Comp CD-E	20060177	63.9	44,691	4.5	46.8	42.8	10.3	0.0	10.3	89.6
CD-22	20060170	67.1	44,283	4.4	53.5	46.5	0.0	0.0	0.0	46.5
CD-24	20060169	68.7	45,825	4.6	51.7	48.3	0.0	0.0	0.0	48.3
CD-25	20060058	50.8	45,919	4.6	49.2	48.0	2.9	0.0	2.9	50.9
Comp CD-F	20060178	64.0	45,846	4.6	52.0	48.0	0.0	0.0	0.0	100.0
CD-17	20060020	22.6	7,795	0.8	8.9	8.6	81.1	1.5	82.6	89.7
CD-18	20060037	25.0	11,316	1.1	13.9	11.9	72.8	1.4	74.2	84.7
CD-28	20060038	26.0	13,968	1.4	13.4	11.2	75.4	0.0	75.4	86.6
Comp CD-G	20060050	24.5	11,147	1.1	11.3	8.8	77.2	2.8	80.0	20.1
CD-15	20060044	35.3	15,332	1.5	19.8	18.2	62.0	0.0	62.0	80.2
CD-16	20060019	46.7	18,349	1.8	22.9	28.8	48.1	0.3	48.4	76.9
CD-19	20060040	56.8	47,451	4.8	38.5	44.8	16.7	0.0	16.7	61.5
Comp CD-H	20060051	45.6	20,861	2.1	25.4	34.5	40.0	0.1	40.1	59.9
CD-29	20060130	64.5	49,408	4.9	49.0	50.9	0.0	0.1	0.1	50.9
CD-30	20060129	61.7	39,228	3.9	42.6	48.2	9.3	0.0	9.3	57.5
CD-33	20060039	30.9	33,426	3.3	27.4	22.5	49.9	0.2	50.1	72.4
Comp CD-I	20060165	50.4	32,374	3.2	35.0	33.9	31.1	0.0	31.1	68.9

Table B-14 (Cont'd). Grain size composition of the sediment cores collected from the Corps Cell D CDF

Core/ CompID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Coarse Material	% Fine Material
CD-26	20060059	50.1	45,076	4.5	47.1	48.7	4.2	0.0	4.2	52.9
CD-31	20060150	66.2	41,975	4.2	43.2	54.7	2.1	0.0	2.1	56.8
CD-32	20060060	35.5	18,138	1.8	24.4	20.9	54.7	0.0	54.7	75.6
Comp CD-J	20060166	51.0	37,814	3.8	38.8	39.3	21.9	0.0	21.9	78.1
CD-34 Top	20060064a	49.4	52,717	5.3	48.5	51.5	0.0	0.0	0.0	51.5
CD-35	20060063	55.5	51,989	5.2	48.9	51.1	0.0	0.0	0.0	51.1
CD-37	20060066	33.8	16,241	1.6	16.5	15.9	67.6	0.0	67.6	83.5
Comp CD-K	20060077	45.2	36,438	3.6	33.3	37.3	29.4	0.0	29.4	70.6
CD-36	20060067	50.6	43,476	4.4	38.3	43.7	18.0	0.0	18.0	61.7
CD-38 Top	20060065a	44.2	47,771	4.8	47.1	51.8	1.2	0.0	1.2	53.0
CD-41 Top	20060070a	32.3	18,519	1.9	18.9	22.0	58.9	0.2	59.1	80.9
Comp CD-L	20060078	41.5	33	3.3	35.1	36.8	28.1	0.0	28.1	71.9
CD-20	20060043	50.8	45,076	4.5	36.4	35.4	28.2	0.0	28.2	63.6
CD-21	20060107	56.9	50,113	5.0	50.5	49.1	0.0	0.3	0.3	49.1
CD-27	20060131	65.3	49,536	5.0	47.9	52.1	0.0	0.0	0.0	52.1
Comp CD-M	20060167	57.5	44,673	4.5	42.4	44.3	13.3	0.0	13.3	86.7
CD-39 Bot	20060072b	21.2	5,135	0.5	7.2	7.0	85.8	0.0	85.8	92.8
CD-42 Bot	20060071b	32.7	18,279	1.8	24.2	22.7	52.4	0.6	53.0	75.1
Comp CD-N	20060079	27.3	15,861	1.6	15.4	14.2	70.4	0.0	70.4	84.6
CD-43 Top	20060074a	41.4	35,135	3.5	31.0	40.2	28.8	0.0	28.8	69.0
CD-44	20060081	42.8	29	2.9	27.1	30.3	42.3	0.3	42.6	72.6
CD-46	20060075	46.3	39,303	3.9	32.1	40.5	23.0	4.4	27.4	63.5
Comp CD-O	20060111	43.5	35,827	3.6	23.5	51.6	22.1	2.9	25.0	75.1
CD-47	20060080	47.7	45,076	4.5	37.5	43.8	18.5	0.2	18.7	62.3
CD-48 Top	20060097a	45.7	45,435	4.5	41.0	45.0	14.0	0.0	14.0	59.0

Table B-14 (Cont'd). Grain size composition of the sediment cores collected from the Corps Cell D CDF

Core/ CompID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Coarse Material	% Fine Material
Comp CD-P	20060112	47.4	43,852	4.4	43.0	44.7	12.4	0.0	12.4	57.1
CD-45	20060096	16.9	12,095	1.2	9.3	8.1	81.7	0.8	82.5	89.8
CD-48 Bot	20060097b	16.1	14,248	1.4	14.5	8.4	76.0	1.1	77.1	84.4
Comp CD-P(b)	20060267	15.1	14,996	1.5	12.4	9.3	76.2	2.1	78.3	85.5
CD-49 Top	20060095a	41.8	42,625	4.3	39.8	41.2	19.0	0.0	19.0	60.2
CD-50	20060082	49.8	46,187	4.6	49.4	50.6	0.0	0.0	0.0	50.6
CD-51	20060098	40.2	26,659	2.7	32.4	33.9	33.7	0.0	33.7	67.6
Comp CD-Q	20060113	42.6	45,881	4.6	39.8	40.3	19.9	0.0	19.9	80.1
CD-52 Top	20060094a	39.8	40,238	4.0	40.6	47.1	11.7	0.6	12.3	58.8
CD-53	20060076	55.9	45,366	4.5	43.5	56.5	0.0	0.0	0.0	56.5
CD-54 Top	20060093a	41.1	37,634	3.8	38.8	37.8	23.3	0.2	23.5	61.1
Comp CD-R	20060114	46.7	43,254	4.3	40.8	44.5	14.5	0.2	14.7	85.3
CD-34 Bot	20060064b	17.2	1,099	0.1	3.6	0.0	90.2	7.3	97.5	90.2
CD-38 Bot	20060065b	21.2	3,454	0.4	5.8	1.4	91.2	1.7	92.9	92.6
CD-39 Top	20060072a	8.8	1,245	0.1	3.2	0.2	96.2	0.4	96.6	96.4
CD-40	20060073	7.6	2,400	0.2	4.7	2.1	91.3	1.8	93.1	6.9
CD-41 Bot	20060070b	18.3	5,788	0.6	7.0	3.9	87.3	1.8	89.1	91.2
CD-42 Top	20060071a	10.9	2,505	0.3	5.9	3.6	89.6	1.0	90.6	93.2
CD-43 Bot	20060074b	15.5	4,266	0.4	5.4	2.6	89.4	2.6	92.0	92.0
CD-49 Bot	20060095b	14.3	1,995	0.2	3.2	3.9	92.9	0.0	92.9	96.8
CD-52 Bot	20060094b	6.0	502	0.1	1.9	0.0	95.2	2.8	98.0	95.2
CD-54 Bot	20060093b	11.1	11,065	1.1	7.9	7.5	81.6	3.0	84.6	89.1

A total of 19 composite samples were formed from the 54 cores collected at Corps Cell D (Table B-15). Thirteen composite samples were formed from cores collected in the western cell. In general, these composites had similar grain size composition and TOC content to their component cores (Table B-14). However, Composites CD-D, CD-H, CD-I, CD-J, and CD-K were comprised of cores with different grain size composition. Therefore, these composites have sediment characteristics that represent the average between the three cores. Six composite samples were formed from cores collected in the eastern cell. One composite sample, CD-N, included two cores with different grain size composition and the characteristics of the composite are an average of the two component cores. Entire cores or portions of cores with greater than 90% sand and gravel content were not included in the composites and these samples are shown in Table 3-16. Most of these cores were collected in the eastern cell of the Corps Cell D CDF.

Table B-15. Composites (Comp) of the sediment cores collected from the Corps Cell D CDF

Western Cell				Eastern Cell			
Cores	Comp	Cores	Comp	Cores	Comp	Cores	Comp
1, 2, 3	CD-A	29, 30, 33	CD-I	43a, 44, 46	CD-O	41b	--
4, 5, 6	CD-B	26, 31, 32	CD-J	47, 48a	CD-P(a)	42a	--
7, 8, 9	CD-C	34a, 35, 37	CD-K	45, 48b	CD-P(b)	43b	--
10, 12, 23	CD-D	36, 38a, 41a	CD-L	49a, 50, 51	CD-Q	49b	--
11, 13, 14	CD-E	20, 21, 27	CD-M	52a, 53, 54a	CD-R	52b	--
22, 24, 25	CD-F	39b, 42b	CD-N	39a	--	54b	--
17, 18, 28	CD-G	34b	--	40	--		
15, 16, 19	CD-H	38b	--				

- *3.4.4 Chemical Characteristics*

The 19 composite sediment samples and two individual core sections that had less than 90% sand content (bottom sections (b) of Cores 41 and 54) were analyzed for semivolatile compounds, pesticides, PCBs and metals. No pesticides or PCBs were detected in any of the sediment samples. Phthalates and PAHs were detected in all of the composite samples and phenolic compounds were detected in eight of the composite samples (Table B-16).

The semivolatile compounds carbazole and dibenzofuran were only detected in composites CD-C and CD-N. Metals were detected in all of the composite samples (Table B-16). For all composite samples, with the exception of composite CD-C, measured concentrations of all compounds did not exceed the NJRDCSCC. In composite

CD-C, concentrations of six PAHs exceeded the NJRDCSCC. These PAHs include: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. Concentrations of all of these PAHs except indeno(1,2,3-cd)pyrene also exceeded the Non-Residential Direct Contact Soil Cleanup Criteria (NJNRDCSCC; last revised 5/12/99). These Non-Residential Criteria increase to 4,000 ug/kg for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene and are the same as the NJRDCSCC for benzo(a)pyrene and dibenzo(a,h)anthracene. Composite CD-C was comprised of Cores 7, 8 and 9, located on the western edge of the western cell of the Corps Cell D CDF (Figure B-5).

Table B-16. Compounds detected in the composite sediment samples from Corps Cell D CDF

	NJRDCSCC	Comp CD-O		Comp CD-P (a)		Comp CD-Q		Comp CD-R		Comp CD-I		Comp CD-J		Comp CD-M	
		Cores 43a ,44, 46		Cores 47 and 48a		Cores 49a, 50, 51		Cores 52a, 53, 54a		Cores 29, 30, 33		Cores 26, 31, 32		Cores 20, 21, 27	
	Soil	Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment	
Organics	**ug/kg**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**
Phenol	10,000,000	48.30	Y		ND		ND		ND	66.10	Y	103.0	Y	191.0	Y
4-Methylphenol	2800000	50.60	Y		ND		ND	94.00	Y	73.60	Y	56.10	Y	152.0	Y
Acenaphthene (PAH)	3400000		ND		ND	27.90	Y		ND		ND		ND		ND
Diethylphthalate	10,000,000	723.0	B	750.0	B	563.0	B	741.0	B	932.0	B	729.0	B	935.0	B
Pentachlorophenol	6000	162.0	Y		ND		ND		ND		ND		ND		ND
Phenanthrene (PAH)	NA	39.20	Y	37.40	Y	42.10	Y	36.20	Y		ND		ND	37.10	Y
Anthracene (PAH)	10000000	26.50	Y		ND	25.40	Y		ND		ND		ND		ND
Di-n-butylphthalate	5700000		ND	109.00	Y		ND		ND		ND		ND		ND
Fluoranthene (PAH)	2300000	291.0	Y	129.0	Y	132.0	Y	147.0	Y	50.90	Y	70.30	Y	85.80	Y
Pyrene (PAH)	1700000	227.0	Y	104.0	Y	96.40	Y	106.0	Y	41.10	Y	56.30	Y	68.80	Y
Benzo(a)anthracene (PAH)	900	129.0	Y	50.20	Y	73.40	Y	40.20	Y	22.30	Y	29.90	Y	26.90	Y
Chrysene (PAH)	9000	174.0	Y	55.10	Y	73.20	Y	50.30	Y	31.70	Y	33.80	Y	35.40	Y
bis(2-Ethylhexyl)phthalate	49000	183.0	BY	206.0	BY	142.0	BY	160.0	BY	226.0	BY	180.0	BY	225.0	BY
Benzo(b)fluoranthene (PAH)	900	98.50	Y	34.90	Y	54.30	Y	32.20	Y		ND	25.50	Y		ND
Benzo(k)fluoranthene (PAH)	900	105.0	Y	34.00	Y	52.40	Y		ND		ND		ND		ND
Benzo(a)pyrene (PAH)	660	80.10	Y		ND	33.50	Y	27.40	Y		ND	24.80	Y		ND
Indeno(1,2,3-cd)pyrene (PAH)	900	38.00	Y		ND	21.50	Y		ND		ND		ND		ND
Benzo(g,h,i)perylene (PAH)	NA	32.70	Y		ND	18.10	Y		ND		ND		ND		ND
Metals	**mg/kg**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**
Aluminum	NA	8280		10400		10200		10800		8950		10100		11100	
Antimony	14	0.670		0.750		1.210		0.820		0.600		0.820		0.920	
Arsenic	20	10.40		12.10		10.50		11.20		9.81		11.60		12.60	
Barium	700	24.60		29.20		28.50		29.70		26.60		29.10		32.00	
Cadmium	39	0.130		0.120		0.076			ND		ND	0.091		0.120	
Calcium	NA	3350		3390		3020		3130		5190		3840		4440	
Chromium	NA	30.40		38.50		37.80		40.10		32.30		36.30		40.40	
Cobalt	NA	6.440		8.080		7.870		8.040		6.900		7.800		8.580	
Copper	600	14.40		18.20		17.30		18.30		14.40		16.80		18.90	
Iron	NA	17900		21400		20400		22000		18900		21300		23200	
Lead	400	21.60		28.90		27.40		28.00		21.60		25.40		28.00	
Magnesium	NA	4490		5230		4970		5200		5270		5630		6520	
Manganese	NA	423.0		486.0		498.0		507.0		490.0		442.0		536.0	
Mercury	14	0.240		0.310		0.330		0.320		0.250		0.210		0.300	
Nickel	250	13.90		17.10		16.90		17.10		14.70		16.60		18.30	
Potassium	NA	2690		3480		3350		3550		3120		3550		4010	
Sodium	NA	7850		7910		6800		7840		11100		12700		15200	
Vanadium	370	32.70		41.40		39.70		43.50		34.10		39.20		43.70	
Zinc	1500	83.60		109.0		102.0		99.90		87.20		99.90		116.0	
Cyanide, total	1100	0.370			ND		ND	0.400	Y	0.510	Y		ND	0.680	Y
% Moisture	NA	NA		NA		NA		NA		NA		NA		NA	
%Solids	NA	58.20		55.50		59.50		55.60		46.80		49.00		40.80	

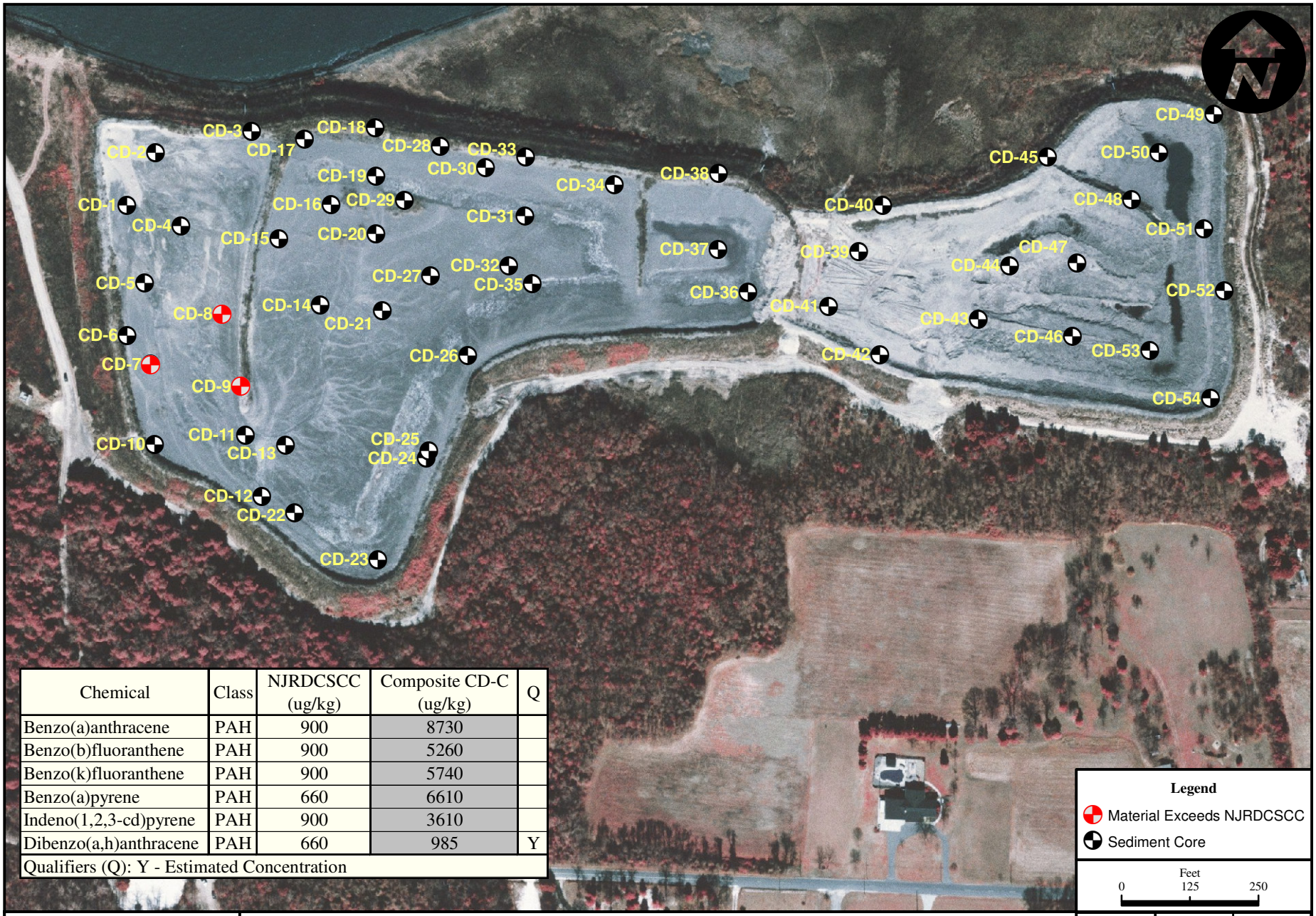
Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
Y - Estimated concentration, below calibration range and above MDL
J - Estimated concentration, below MDL
A shaded value indicates that the concentration exceeds the soil criteria

	NJRDCSCC	Comp CD-K		Comp CD-L		Comp CD-N		Site 54		Comp CD-E		Comp CD-F		Comp CD-A2	
		Cores 34a, 35, 37		Cores 36, 38a, 41a		Cores 39b and 42b		Core 54 - Bottom		Cores 11, 13, 14		Cores 22, 24, 25		Cores 1, 2, 3	
	Soil	Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment	
Organics	**ug/kg**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**
4-Methylphenol	2800000		ND	32.70	Y		ND		ND		ND		ND		ND
Naphthalene (PAH)	230000		ND		ND	30.40	Y		ND		ND		ND		ND
Acenaphthene (PAH)	3400000		ND		ND	106.0	Y		ND		ND		ND		ND
Dibenzofuran	NA		ND		ND	20.20	Y		ND		ND		ND		ND
Diethylphthalate	10,000,000	608.0	B	786.0	B	28.30	BY	18.70	BY	51.60	BY	89.70	BY	24.10	BY
Fluorene	2300000		ND		ND	28.90	Y		ND		ND		ND		ND
Phenanthrene (PAH)	NA	40.50	Y	44.10	Y	57.50	Y		ND	34.60	Y		ND	18.60	Y
Anthracene (PAH)	10000000	20.60	Y	20.30	Y	49.30	Y		ND		ND		ND		ND
Carbazole	NA		ND		ND	18.70	Y		ND		ND		ND		ND
Di-n-butylphthalate	5700000		ND		ND	41.90	Y		ND		ND		ND		ND
Fluoranthene (PAH)	2300000	92.90	Y	137.0	Y	758.0		34.50	Y	64.40	Y	38.70	Y	51.10	Y
Pyrene (PAH)	1700000	74.90	Y	107.0	Y	580.0		24.60	Y	57.20	Y	29.80	Y	44.30	Y
Benzo(a)anthracene (PAH)	900	38.90	Y	52.70	Y	152.0	Y	12.20	Y	27.20	Y		ND	25.20	Y
Chrysene (PAH)	9000	48.80	Y	62.20	Y	270.0	Y	14.40	Y		ND		ND	33.30	Y
bis(2-Ethylhexyl)phthalate	49000	233.0	BY	373.0	BY	85.00	BY	62.00	BY	199.0	BY	140.0	BY	76.30	BY
Benzo(b)fluoranthene (PAH)	900		ND	41.70	Y	121.0	Y		ND		ND		ND	15.70	Y
Benzo(k)fluoranthene (PAH)	900	26.60	Y	46.80	Y	172.0	Y		ND		ND		ND		ND
Benzo(a)pyrene (PAH)	660	26.10	Y	41.50	Y	80.10	Y		ND		ND		ND		ND
Indeno(1,2,3-cd)pyrene (PAH)	900		ND	19.60	Y	34.00	Y		ND		ND		ND		ND
Benzo(g,h,i)perylene (PAH)	NA		ND		ND	33.00	Y		ND		ND		ND		ND
	mg/kg	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**
Aluminum	NA	8830		9040		3580		1820		12200		14200		3030	
Antimony	14	0.600		0.680		0.330		0.420		0.880		1.040		0.340	
Arsenic	20	11.20		10.90		3.890		1.760		11.60		15.30		3.390	
Barium	700	26.70		25.20		9.950		4.510		35.00		41.00		8.680	
Cadmium	39	0.065			ND		ND		ND		ND		ND		ND
Calcium	NA	3600		3260		1880		236.0		5150		5320		2140	
Chromium	NA	33.20		34.10		13.00		16.00		43.30		51.20		11.40	
Cobalt	NA	6.970		7.040		2.890		1.850		9.350		10.90		2.450	
Copper	600	16.90		16.30		5.890		2.330		19.50		23.10		4.750	
Iron	NA	18600		19000		7810		4020		25400		29700		6460	
Lead	400	24.40		24.20		10.50		4.720		28.40		34.50		8.340	
Magnesium	NA	4590		4670		1810		640.0		7200		7990		1440	
Manganese	NA	414.0		434.0		238.0		132.0		558.0		663.0		198.0	
Mercury	14	0.310		0.250		0.081		0.026		0.260		0.350		0.071	
Nickel	250	14.80		15.00		6.000		7.600		20.00		23.20		5.170	
Potassium	NA	2960		3040		973.0		371.0		4450		5090		789.0	
Sodium	NA	7590		6440		1980		804.0		16800		16600		1990	
Vanadium	370	36.00		36.30		13.20		5.900		46.40		55.00		11.20	
Zinc	1500	89.40		90.00		39.10		20.20		115.0		134.0		30.80	
% Moisture	NA	NA		NA		NA		NA		NA		NA		NA	
%Solids	NA	58.40		59.30		76.80		91.30		38.60		35.10		75.90	

Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
Y - Estimated concentration, below calibration range and above MDL
J - Estimated concentration, below MDL
A shaded value indicates that the concentration exceeds the soil criteria

	NJRDCSCC	Comp CD-P (b) Cores 45 and 48b		Comp CD-C Cores 7, 8, 9		Comp CD-B Cores 4, 5, 6		Comp CD-G Cores 17, 18, 28		Comp CD-H Cores 15, 16, 19		Comp CD-D Cores 10, 12, 23		Site 41 (12-16') Core 41 - Bottom	
	Soil	Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment		Unamended Sediment	
Organics	**ug/kg**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**	**ug/kg**	**Q**
Phenol	10,000,000		ND		ND	99.30	Y		ND		ND		ND		ND
4-Methylphenol	2800000		ND		ND	147.0	Y		ND	126.0	Y		ND		ND
Naphthalene (PAH)	230000		ND	1120	Y		ND		ND		ND		ND		ND
2-Methylnaphthalene	NA		ND	798.0	Y		ND		ND		ND		ND		ND
Acenaphthylene (PAH)	NA		ND	483.0	Y		ND		ND		ND		ND		ND
Acenaphthene (PAH)	3400000		ND	2730	Y		ND		ND		ND		ND		ND
Dibenzofuran	NA		ND	2610	Y		ND		ND		ND		ND		ND
Diethylphthalate	10,000,000	568.0	B		ND	135.0	BY	1380	B	1620	BY	1690	B	294.0	BY
Fluorene (PAH)	2300000		ND	2940	Y		ND		ND	24.00	ND		ND		ND
Phenanthrene (PAH)	NA		ND	29900			ND	20.30	Y	53.80	Y	32.30	Y	25.30	Y
Anthracene (PAH)	10000000		ND	7250			ND		ND		ND		ND	14.20	Y
Carbazole	NA		ND	3680			ND		ND		ND		ND		ND
Di-n-butylphthalate	5700000		ND		ND		ND	42.40	Y	105.0	Y	66.20	Y		ND
Fluoranthene (PAH)	2300000	36.30	Y	21300		30.40	Y	45.50	Y	106.0	Y	82.20	Y	71.00	Y
Pyrene (PAH)	1700000	24.60	Y	18200		26.50	Y	46.50	Y	79.70	Y	63.80	Y	52.30	Y
Benzo(a)anthracene (PAH)	900	16.10	Y	8730			ND	15.00	Y	40.30	Y	30.30	Y	36.60	Y
Chrysene (PAH)	9000	21.70	Y	8380		15.10	Y		ND	59.80	Y	45.40	Y	48.60	Y
bis(2-Ethylhexyl)phthalate	49000	135.0	BY	207.0	BY	66.90	BY	284.0	BY	411.0	BY	349.0	BY	130.0	BY
Benzo(b)fluoranthene (PAH)	900		ND	5260			ND		ND		ND	21.70	Y		ND
Benzo(k)fluoranthene (PAH)	900		ND	5740			ND		ND	27.50	Y		ND	26.10	Y
Benzo(a)pyrene (PAH)	660		ND	6610			ND		ND	25.50	Y	18.10	Y	15.20	Y
Indeno(1,2,3-cd)pyrene (PAH)	900		ND	3610			ND		ND		ND		ND		ND
Dibenzo(a,h)anthracene (PAH)	660		ND	985.0	Y		ND		ND		ND		ND		ND
Benzo(g,h,i)perylene (PAH)	NA		ND	2960	Y		ND		ND		ND		ND		ND
Metals	**mg/kg**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**	**mg/kg**	**Q**
Aluminum	NA	3110		11700		2900		3370		7490		6410		2240	
Antimony	14	0.220		0.760		0.310		0.370		0.640		0.860		0.250	
Arsenic	20	2.850		13.20		2.710		3.450		8.400		7.020		2.670	
Barium	700	8.080		33.70		8.860		10.30		21.10		19.00		5.640	
Beryllium	1		ND		ND		ND		ND		ND		ND	0.036	
Cadmium	39		ND	0.110			ND		ND		ND	0.055		0.089	
Calcium	NA	862.0		5130		1850		3270		4460		4190		1140	
Chromium	NA	12.00		41.80		11.60		13.00		27.10		24.00		6.880	
Cobalt	NA	2.380		9.080		2.320		2.760		5.860		5.030		1.760	
Copper	600	5.170		18.50		4.350		5.590		12.70		11.50		3.300	
Iron	NA	5970		24800		6120		7120		16100		13300		4610	
Lead	400	8.910		28.00		7.770		9.210		20.00		17.70		5.780	
Magnesium	NA	1280		6520		1540		1700		4710		3340		1030	
Manganese	NA	111.0		620.0		149.0		188.0		427.0		305.0		99.20	
Mercury	14	0.071		0.280		0.048		0.069		0.210		0.180		0.040	
Nickel	250	5.460		19.10		5.350		5.780		12.40		10.70		3.490	
Potassium	NA	808.0		4020		786.0		961.0		2480		2050		528.0	
Sodium	NA	959.0		11800		2620		2480		9390		4980		1880	
Vanadium	370	11.90		44.30		10.50		13.20		28.90		24.90		7.280	
Zinc	1500	29.50		118.0		28.50		33.80		75.20		68.70		23.40	

Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
Y - Estimated concentration, below calibration range and above MDL
J - Estimated concentration, below MDL
A shaded value indicates that the concentration exceeds the soil criteria



Chemical	Class	NJRDCSCC (ug/kg)	Composite CD-C (ug/kg)	Q
Benzo(a)anthracene	PAH	900	8730	
Benzo(b)fluoranthene	PAH	900	5260	
Benzo(k)fluoranthene	PAH	900	5740	
Benzo(a)pyrene	PAH	660	6610	
Indeno(1,2,3-cd)pyrene	PAH	900	3610	
Dibenzo(a,h)anthracene	PAH	660	985	Y
Qualifiers (Q): Y - Estimated Concentration				

Legend

Material Exceeds NJRDCSCC

Sediment Core

Feet

0 125 250

HDR | LMS

Location of the composite materials exceeding the New Jersey Residential Direct Contact Soil Cleanup Criteria and the measured chemical concentrations in Corps Cell D, Cape May, NJ

Job No.	Date	Figure No.
0904-007	06/05/06	B-5

The semivolatile compounds diethylphthalate, 2-methylnapthalene, and napthalane were detected in the leachate produced from some of the composite samples, but concentrations did not exceed the NJSGWQC (Table B-17). The compound bis(2-ethylhexyl)phthalate was detected in the leachate produced from all of the composite samples and concentrations exceeded the NJSGWQC in the leachate produced from three samples, CD-P(a), CD-R and CD-M. However, bis(2-ethylhexyl)phthalate was also detected in the analytical blank at a level of 1.10 ppb (1.10 μg/L) and its presence in the samples may be due to laboratory contamination. Based on the USEPA guidelines for treatment of results where the analytical blank is contaminated with semivolatile compounds, concentrations of less than 11 μg/L should be considered non-detects (USEPA 2001). The highest concentration of bis(2-ethylhexyl)phthalate in the Corps Cell D composite samples was 6.94, and thus should be considered a non-detect. No pesticides or PCBs were detected in any of the leachate samples. Metals were detected in all of the leachate samples (Table B-17). Concentrations of six metals exceeded the NJSGWQC in one or more leachate samples. The Criteria for the following metals were exceeded: sodium (19 leachate samples), arsenic (15 leachate samples), aluminum (12 leachate samples), selenium (11 leachate samples), iron (6 leachate samples), and manganese (6 leachate samples).

For some semivolatile compounds, method detection limits exceeded the NJSGWQC (Table B-18). Although these compounds were not detected in the leachate samples, it is unknown whether actual concentrations in the samples exceeded the Criteria. However, all of the method detection limits were equal to or below those required by the NJDEP for dredging projects (NJDEP 1997).

Table B-17. Compounds detected in the leachate from the Corps Cell D CDF sediment samples

	NJSGWQC	Comp CD-O		Comp CD-P (a)		Comp CD-Q		Comp CD-R		Comp CD-I		Comp CD-J		Comp CD-M	
		Cores 43a ,44, 46		Cores 47 and 48a		Cores 49a, 50, 51		Cores 52a, 53, 54a		Cores 29, 30, 33		Cores 26, 31, 32		Cores 20, 21, 27	
	Groundwater	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Naphthalene	300	12.00			ND		ND		ND		ND		ND		ND
2-Methylnaphthalene	NA	7.200	Y		ND		ND		ND		ND		ND	2.200	Y
Diethylphthalate	6,000	0.970	JB	0.670	JB	0.500	JB	28.00	BY	0.650	JB	0.530	JB	0.520	JB
bis(2-Ethylhexyl)phthalate	3	2.100	JB	2.700	JB	1.900	JB	6.900	BY	3.000	JB	2.600	JB	3.500	JB
Metals	**mg/L**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**
Aluminum	0.2	0.490		0.600		0.480		0.290		0.044		0.014		0.160	
Antimony	0.006	0.003			ND	0.003		0.003		0.004		0.002		0.002	
Arsenic	0.003	0.008		0.006			ND	0.004		0.005		0.006			ND
Barium	2	0.270		0.210		0.200		0.160		0.069		0.067		0.140	
Beryllium	0.001	0.0005		0.0005		0.0004		0.0005		0.0006		0.0006		0.0005	
Calcium	NA	9.160		13.60		16.40		24.60		14.20		10.50		8.920	
Chromium	0.07	0.002		0.002		0.002		0.002		0.002			ND	0.002	
Copper	1.3		ND		ND		ND	0.003			ND		ND		ND
Iron	0.3	0.360		0.400		0.350		0.180		0.024			ND	0.110	
Lead	0.005	0.003		0.003		0.004		0.005			ND	0.002			ND
Magnesium	NA	11.40		14.70		16.20		21.20		19.90		18.00		20.20	
Manganese	0.05	0.005		0.009		0.072		0.023		0.055		0.078		0.120	
Mercury	0.002	0.00003		0.00006		0.00004			ND		ND	0.00003		0.00004	
Nickel	0.1	0.003		0.002		0.003		0.003		0.002		0.002		0.002	
Potassium	NA	15.20		18.30		17.20		17.20		17.80		18.00		20.40	
Selenium	0.04	0.037		0.041		0.046		0.060		0.062		0.048		0.051	
Sodium	50	192.0		197.0		183.0		198.0		246.0		249.0		291.0	
Vanadium	NA	0.007		0.006		0.004		0.002		0.005		0.005		0.006	
Zinc	2	0.052		0.056		0.066		0.069		0.022		0.016		0.019	

Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
Y - Laboratory defined
J - Estimated concentration, below calibration range and above MDL
A shaded value indicates that the concentration exceeded applicable criteria

Table B-17 (Cont'd). Compounds detected in the leachate from the Corps Cell D CDF sediment samples

	NJSGWQC	Comp CD-P (b)		Comp CD-C		Comp CD-B		Comp CD-G		Comp CD-H		Comp CD-D		Site 41 (12-16')	
		Cores 45 and 48b		Cores 7, 8, 9		Cores 4, 5, 6		Cores 17, 18, 28		Cores 15, 16, 19		Cores 10, 12, 23		Core 41 - Bottom	
	Groundwater	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Naphthalene	300		ND		ND		ND		ND	16.00		6.650	Y		ND
2-Methylnaphthalene	NA		ND		ND	3.700	Y		ND	7.800	Y	3.100	Y	2.670	Y
Diethylphthalate	6,000	0.890	JB	0.410	JB	0.440	JB		ND	0.500	JB	2.360	BY	8.300	BY
bis(2-Ethylhexyl)phthalate	3	4.300	BY	1.500	JB	1.800	JB	2.000	JB	3.200	JB	2.090	JB	1.730	JB
Metals	**mg/L**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**
Aluminum	0.2	1.640		0.310		0.320		0.310		0.017		0.380		0.230	
Arsenic	0.003		ND	0.005		0.008			ND	0.008		0.005		0.008	
Barium	2	0.190		0.170		0.180		0.150		0.120		0.210		0.097	
Beryllium	0.001		ND	0.001		0.0004		0.0003		0.0006		0.0004		0.0003	
Cadmium	0.004		ND		ND		ND		ND	0.0003			ND		ND
Calcium	NA	10.50		7.900		12.10		14.50		11.10		7.200		13.40	
Chromium	0.07	0.006		0.002			ND		ND	0.002			ND		ND
Cobalt	NA	0.0005			ND		ND		ND		ND		ND		ND
Iron	0.3	1.650		0.240		0.230		0.250			ND	0.310		0.160	
Lead	0.005	0.005		0.002		0.002		0.002			ND	0.003			ND
Magnesium	NA	7.060		13.70		8.720		7.940		20.00		8.930		8.570	
Manganese	0.05	0.079		0.076		0.004		0.004		0.031		0.005		0.002	
Mercury	0.002	0.00006			ND	0.00003		0.00003		0.00003		0.00004		0.00003	
Nickel	0.1	0.006		0.002		0.002		0.002		0.002		0.002		0.001	
Potassium	NA	6.720		16.20		6.710		6.980		17.50		13.10		6.030	
Selenium	0.04	0.012		0.041		0.027		0.032		0.059		0.029		0.030	
Sodium	50	42.20		213.0		94.30		77.40		246.0		152.0		73.80	
Vanadium	NA	0.005		0.007		0.007		0.004		0.007		0.007		0.003	
Zinc	2	0.058		0.031		0.035		0.040		0.019		0.030		0.029	

Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
Y - Laboratory defined
J - Estimated concentration, below calibration range and above MDL
A shaded value indicates that the concentration exceeded applicable criteria

Table B-17 (Cont'd). Compounds detected in the leachate from the Corps Cell D CDF sediment samples

	NJSGWQC	Comp CD-K		Comp CD-L		Comp CD-N		Site 54		Comp CD-E		Comp CD-F		Comp CD-A2	
		Cores 34a, 35, 37		Cores 36, 38a, 41a		Cores 39b and 42b		Core 54 - Bottom		Cores 11, 13, 14		Cores 22, 24, 25		Cores 1, 2, 3	
	Groundwater	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Naphthalene	300	1.700	Y		ND		ND		ND		ND		ND		ND
2-Methylnaphthalene	NA	4.410	Y		ND		ND		ND		ND		ND		ND
Diethylphthalate	6,000	1.030	JB	7.940	BY	1.100	JB	0.940	JB	0.900	JB	0.750	JB	2.140	BY
bis(2-Ethylhexyl)phthalate	3	0.570	JB	1.460	JB	0.630	JB	0.690	JB	1.000	JB	0.540	JB	0.860	JB
Metals	**mg/L**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**	**mg/L**	**Q**
Aluminum	0.2	0.017		0.160		0.300		0.110		0.091		0.039		1.450	
Antimony	0.006		ND		ND		ND		ND	0.003			ND		ND
Arsenic	0.003	0.008		0.007		0.004			ND	0.010		0.004		0.005	
Barium	2	0.100		0.120		0.110		0.075		0.110		0.160		0.240	
Beryllium	0.001	0.0005		0.0004			ND		ND	0.0007		0.0006			ND
Cadmium	0.004		ND		ND		ND		ND	0.0003			ND		ND
Calcium	NA	7.320		13.50		5.820		2.130		9.940		8.600		16.60	
Chromium	0.07		ND		ND		ND		ND	0.002		0.002		0.003	
Iron	0.3		ND	0.110		0.240		0.093		0.055		0.026		1.240	
Lead	0.005		ND	0.002		0.002			ND	0.002		0.002		0.005	
Magnesium	NA	11.10		13.00		5.860		3.340		20.10		17.40		7.940	
Manganese	0.05		ND	0.002		0.005		0.003		0.011		0.040		0.015	
Mercury	0.002	0.00006		0.00004		0.00004		0.00002		0.00003		0.00004		0.00004	
Nickel	0.1	0.002		0.002		0.001		0.001		0.002		0.003		0.002	
Potassium	NA	15.50		15.20		7.670		2.980		19.90		19.80		6.790	
Selenium	0.04	0.029		0.048		0.023		0.006		0.060		0.049		0.016	
Sodium	50	189.0		161.0		72.90		36.20		284.0		267.0		71.10	
Vanadium	NA	0.005		0.005		0.006			ND	0.006		0.006		0.005	
Zinc	2	0.024		0.031		0.021		0.026		0.025		0.026		0.056	

Qualifiers (Q):
NA - No critiera
ND - Not detected at the method detection limit (MDL)
B - Compound also detected in the batch blank
Y - Laboratory defined
J - Estimated concentration, below calibration range and above MDL
A shaded value indicates that the concentration exceeded applicable criteria

Table B-18. Compounds with method detection limits greater than the NJSGWQC in the analysis of the Corps Cell D CDF leachate samples

	NJSGWQC	NJ Required MDL	Comp CD-O		Comp CD-P (a)		Comp CD-Q		Comp CD-R		Comp CD-I		Comp CD-J		Comp CD-M	
			Cores 43a ,44, 46		Cores 47 and 48a		Cores 49a, 50, 51		Cores 52a, 53, 54a		Cores 29, 30, 33		Cores 26, 31, 32		Cores 20, 21, 27	
	Groundwater	Leachate	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	1.300	ND	1.300	ND	1.300	ND	1.300	ND	1.300	ND	1.300	ND	1.300	ND
Hexachlorobenzene	0.02	10	1.500	ND	1.500	ND	1.500	ND	1.500	ND	1.500	ND	1.500	ND	1.500	ND
Benzo(a)anthracene	0.1	10	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND
Benzo(b)fluoranthene	0.2	10	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND
Benzo(k)fluoranthene	0.5	10	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND
Benzo(a)pyrene	0.1	10	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND
Indeno(1,2,3-cd)pyrene	0.2	10	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND
Dibenzo(a,h)anthracene	0.3	10	1.800	ND	1.800	ND	1.800	ND	1.800	ND	1.800	ND	1.800	ND	1.800	ND

Qualifiers (Q):
ND - Not detected at the listed method detection limit (MDL)

	NJSGWQC	NJ Required MDL	Comp CD-P (b)		Comp CD-C		Comp CD-B		Comp CD-G		Comp CD-H		Comp CD-D		Site 41 (12-16')	
			Cores 45 and 48b		Cores 7, 8, 9		Cores 4, 5, 6		Cores 17, 18, 28		Cores 15, 16, 19		Cores 10, 12, 23		Core 41 - Bottom	
	Groundwater	Leachate	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	1.300	ND	1.300	ND	1.300	ND	1.300	ND	1.300	ND	0.660	ND	0.660	ND
Hexachlorobenzene	0.02	10	1.500	ND	1.500	ND	1.500	ND	1.500	ND	1.500	ND	1.500	ND	1.500	ND
Benzo(a)anthracene	0.1	10	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.840	ND	1.840	ND
Benzo(b)fluoranthene	0.2	10	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND	1.700	ND	1.700	ND
Benzo(k)fluoranthene	0.5	10	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	2.300	ND	2.300	ND
Benzo(a)pyrene	0.1	10	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.900	ND	1.740	ND	1.740	ND
Indeno(1,2,3-cd)pyrene	0.2	10	2.000	ND	2.000	ND	2.000	ND	2.000	ND	2.000	ND	1.780	ND	1.780	ND
Dibenzo(a,h)anthracene	0.3	10	1.800	ND	1.800	ND	1.800	ND	1.800	ND	1.800	ND	1.700	ND	1.700	ND

Qualifiers (Q):
ND - Not detected at the listed method detection limit (MDL)

	NJSGWQC	NJ Required MDL	Comp CD-K		Comp CD-L		Comp CD-N		Site 54		Comp CD-E		Comp CD-F		Comp CD-A2	
			Cores 34a, 35, 37		Cores 36, 38a, 41a		Cores 39b and 42b		Core 54 - Bottom		Cores 11, 13, 14		Cores 22, 24, 25		Cores 1, 2, 3	
	Groundwater	Leachate	Leachate		Leachate		Leachate		Leachate		Leachate		Leachate		Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	0.660	ND	0.660	ND	0.660	ND	0.660	ND	3.200	ND	0.660	ND	0.660	ND
Hexachlorobenzene	0.02	10	1.500	ND	1.500	ND	1.500	ND	1.500	ND	3.760	ND	1.500	ND	1.500	ND
Benzo(a)anthracene	0.1	10	1.840	ND	1.840	ND	1.840	ND	1.840	ND	3.800	ND	1.840	ND	1.840	ND
Benzo(b)fluoranthene	0.2	10	1.700	ND	1.700	ND	1.700	ND	1.700	ND	3.560	ND	1.700	ND	1.700	ND
Benzo(k)fluoranthene	0.5	10	2.300	ND	2.300	ND	2.300	ND	2.300	ND	4.640	ND	2.300	ND	2.300	ND
Benzo(a)pyrene	0.1	10	1.740	ND	1.740	ND	1.740	ND	1.740	ND	3.920	ND	1.740	ND	1.740	ND
Indeno(1,2,3-cd)pyrene	0.2	10	1.780	ND	1.780	ND	1.780	ND	1.780	ND	3.680	ND	1.780	ND	1.780	ND
Dibenzo(a,h)anthracene	0.3	10	1.700	ND	1.700	ND	1.700	ND	1.700	ND	3.720	ND	1.700	ND	1.700	ND

Qualifiers (Q):
ND - Not detected at the listed method detection limit (MDL)

WAACKAACK CREEK CDF, KEANSBURG, NJ

The Waackaack Creek CDF is a shoreline CDF located in Keansburg, NJ. The site has a flood control berm that appears to have been constructed with dredged material. The estimated volume of dredged material in the Waackaack Creek CDF is 132,000 cy. Approximately 47,000 cy of material could be removed from the Waackaack Creek CDF. The remaining 85,000 cy of material would be contoured to reestablish the flood control dune and establish a containment berm for future dredging projects.

ASI collected 12 sediment cores from the Waackaack Creek CDF (Figure B-6). Stratification was found in the materials from two of the cores in the eastern portion of the CDF where sand is overlying finer grained materials. Fourteen samples were prepared from the sediment cores for physical and chemical analyses. The results of the analyses are provided below.

- *B.5.1 Physical Characteristics*

Cores 1 through 5 and core 8a were collected from plateau area C, Cores 6 and 7 were collected from plateau area B, and Cores 9 through 12 were collected from plateau area A. Table B-19 shows the grain size composition of the Waackaack Creek sediment core subsamples. The material in all sampled portions of areas C and B was comprised of brown sand. The brown sand was present throughout the length of the cores, there was no stratification in sediment type. Grain size analysis showed that the sediment in these cores had a total percent silt and clay less than or equal to 4%, with total percent sand and gravel greater than 96%. Moisture and TOC content were very low in these sediment samples. In the western portion of Area A (Cores 9 and 10), the cores were also comprised of mostly brown sand. Total percent sand and gravel was between 93% and 96% and percent moisture and TOC of the sediment were similar to what was measured in cores from areas C and B. In the eastern portion of area A (Cores 11 and 12), a layer of brown sand was present to a depth of five feet, followed by a six to 10 foot deep layer of black silt with fine sand, with a one to two foot deep layer of brown sand with peat at the bottom of the core. These cores were split into top and bottom portions for analysis. Grain size analysis showed that the top portions of the cores were comprised primarily of sand (93-97% coarse-grained sediment), with low moisture and TOC. The sediment from the bottom portions of the cores was primarily comprised of silt and clay (39-55% fine-grained material), with moisture content ranging from 30% to 40% and TOC content ranging from 2.7% to 3.1%.

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Location of Sediment Cores taken from the Waackaack Creek CDF in Keansburg, NJ

Job No.	Date	Figure No.
0904-007	06/05/06	B-6

Table B-19. Physical properties of the sediment cores collected from the Waackaack Creek CDF

Core/ Comp ID	ASI #	Moisture (%)	TOC (ppm)	TOC (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	% Coarse Material	% Fine Material
WK-11 Bot	20051286b	40.2	30,956	3.1	26.0	29.1	43.8	1.2	45.0	55.1
WK-12 Bot	20051284b	30.1	27,358	2.7	20.9	17.9	59.0	2.1	61.1	38.8
Comp WK-D	20060005	34.3	28,966	2.9	21.2	22.0	49.9	6.9	56.8	43.2
WK-1	20051310	5.8	1,421	0.1	1.6	0.0	84.6	13.8	98.4	1.6
WK-2	20051309	4.2	597	0.1	1.5	0.5	88.2	9.7	97.9	2.1
WK-3	20051311	5.6	622	0.1	0.9	0.0	98.3	2.0	100.3	0.9
WK-4	20051312	4.3	493	0.1	1.0	0.0	97.6	2.3	99.9	1.0
WK-5	20051313	5.6	748	0.1	2.1	2.1	85.7	10.1	95.8	4.2
WK-6	20051308	5.3	574	0.1	3.2	0.6	82.1	14.2	96.3	3.7
WK-7	20051307	5.4	524	0.1	2.9	0.9	93.3	2.9	96.2	3.8
WK-8a	20051314	6.0	788	0.1	2.1	0.0	89.8	8.5	98.3	2.1
WK-9	20051306	6.4	478	0.1	5.3	1.8	85.6	7.3	92.9	7.1
WK-10	20051285	7.1	703	0.1	3.9	0.0	95.1	1.7	96.8	3.9
WK-11 Top	20051286a	11.9	1,006	0.1	5.0	0.0	83.2	12.8	96.0	5.0
WK-12 Top	20051284a	7.0	1,350	0.1	4.8	1.7	84.3	9.2	93.5	6.5

Composite WK-D was formed from the bottom portions of Cores 11 and 12. Only one composite sample was formed, since all other cores or core sections were comprised of greater than 90% sand. Composite WK-D had silt, clay and sand content intermediate between those measured in the bottom portions of Cores 11 and 12, but had greater gravel content (7% compared to 1-2%) (Table B-19). The composite sample also had intermediate percent moisture and TOC content relative to the bottom portions of Cores 11 and 12.

- *B.5.2 Chemical Characteristics*

Composite WK-D was analyzed for semivolatile compounds, pesticides, PCBs, metals, and dioxin/furan congeners. Of the organic compounds, only hexachloro-1,3-butadiene, pthalates and some PAHs were detected in the sediment sample (Table B-20) and no pesticides or PCBs were detected. Almost all of the metals for which analyses were conducted were detected in the composite sample (Table B-20). None of the detected compounds had concentrations above the NJRDCSCC, except for arsenic which was

measured at 20.10 mg/kg, slightly exceeding the criterion of 20 mg/kg. Composite WK-D was comprised of the bottom portions of Cores WK-11 and WK-12 located on the eastern edge of the Waackaack Creek D CDF (Figure B-7). Dioxin/furan congeners were detected in the composite sample, but the total TEQ value was very low, only 3.1 ng/kg (parts-per-trillion) (Table B-21).

Table B-20. Compounds detected in the composite sediment sample from Waackaack Creek CDF

	NJ RDCSCC	Composite WK-D	
		Cores 11 and 12 - Bottom	
	Soil	Unamended Sediment	
Organics	**ug/kg**	**ug/kg**	**Q**
Hexachloro-1,3-butadiene	NA	200.0	
Diethylphthalate	10,000,000	110.0	J
Phenanthrene (PAH)	NA	120.0	J
Di-n-butylphthalate	5700000	170.0	J
Fluoranthene (PAH)	2300000	460.0	
Pyrene (PAH)	1700000	480.0	
Butylbenzylphthalate	1100000	200.0	
Benzo(a)anthracene (PAH)	900	180.0	J
Chrysene (PAH)	9000	230.0	
bis(2-Ethylhexyl)phthalate	49000	1400	
Benzo(b)fluoranthene (PAH)	900	330.0	
Benzo(k)fluoranthene (PAH)	900	100.0	J
Benzo(a)pyrene (PAH)	660	220.0	
Indeno(1,2,3-cd)pyrene (PAH)	900	160.0	J
Metals	**mg/kg**	**mg/kg**	**Q**
Aluminum	NA	5800	
Arsenic	20	20.10	
Barium	700	23.90	
Cadmium	39	0.751	
Calcium	NA	2470	
Chromium	NA	33.80	
Cobalt	NA	13.00	
Copper	600	55.80	
Iron	NA	23900	
Lead	400	51.40	
Magnesium	NA	2200	
Manganese	NA	164.0	
Mercury	14	0.553	
Nickel	250	13.60	

Table B-20. (Cont'd). Compounds detected in the composite sediment sample from Waackaack Creek CDF

Potassium	NA	2400	
Silver	110	0.809	
Sodium	NA	2330	
Vanadium	370	36.20	
Zinc	1500	132.0	
Qualifiers (Q): NA - No standard J - Estimated concentration, below calibration range and above MDL			

Table B-21. Dioxin/Furan congeners detected in the composite sediment sample from Waackaack Creek CDF and their calculated toxicity equivalents (TEQs)

		Composite WK-D **Cores 11 and 12 - Bottom** **Unamended Sediment**		
Dioxin/Furan Congeners	**I-TEF**	**ng/kg**	**Q**	**TEQ**
2,3,7,8-TCDD	1	0.501	A	0.501
1,2,3,7,8-PeCDD	0.5	0.526	A	0.263
1,2,3,4,7,8-HxCDD	0.1	0.503	AI	0.050
1,2,3,6,7,8-HxCDD	0.1	2.650	A	0.265
1,2,3,7,8,9-HxCDD	0.1	1.360	A	0.136
1,2,3,4,6,7,8-HpCDD	0.01	26.60		0.266
OCDD	0.001	574.0		0.574
2,3,7,8-TCDF	0.1	1.460		0.146
1,2,3,7,8-PeCDF	0.05	0.573	A	0.029
2,3,4,7,8-PeCDF	0.5	0.915	A	0.458
1,2,3,4,7,8-HxCDF	0.1	0.997	A	0.100
1,2,3,6,7,8-HxCDF	0.1	0.748	A	0.075
2,3,4,6,7,8-HxCDF	0.1	0.783	A	0.078
1,2,3,7,8,9-HxCDF	0.1	0.623	ND	0.062
1,2,3,4,6,7,8-HpCDF	0.01	6.460		0.065
1,2,3,4,7,8,9-HpCDF	0.01	0.434	A	0.004
OCDF	0.001	13.60		0.014
Sum TEQ (pptr)				**3.085**
Qualifiers (Q): ND - Not detected at the listed method detection limit (MDL) A - Amount detected is less than the lower calibration limit I - Indicates the presence of a qualitative interference that could cause a false positive or overestimation of the affected analytes				

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Location of the composite materials exceeding the New Jersey Residential Direct Contact Soil Cleanup Criteria and the measured chemical concentrations at Waackaack Creek CDF in Keansburg, NJ

Job No.	Date	Figure No.
0904-007	06/05/06	B-7

No pesticides, PCBs or semivolatile compounds were detected in the leachate produced from exposure of the composite sample to artificial rainwater. However, metals and dioxin/furan congeners were detected in the leachate (Tables B-22 and B-23). Concentrations of four metals in the leachate samples exceeded the NJSGWQC (last revised 11/07/2005). The metals that exceeded the Criteria the leachate sample include: iron, lead, manganese and sodium. The total TEQ for dioxin/furan congeners in the leachate sample was 0.012 ng/L which slightly exceeds the NJSGWQC for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (0.01 ng/L).

Table B-22. Compounds detected in the leachate from the Waackaack Creek CDF sediment sample

	NJSGWQC	Composite WK-D Cores 11 and 12 Bottom	
	Groundwater	Leachate	
Metals	**mg/L**	**mg/L**	**Q**
Aluminum	0.2	0.124	
Barium	2	0.070	
Calcium	NA	33.50	
Cobalt	NA	0.021	
Iron	0.3	47.50	
Lead	0.005	0.007	
Magnesium	NA	20.50	
Manganese	0.05	0.974	
Nickel	0.1	0.008	J
Potassium	NA	17.10	
Sodium	50	74.90	
Zinc	2	0.045	

Qualifiers (Q):
NA - No standard
J - Estimated concentration, below calibration range and above MDL

A shaded value indicates that the concentration was above applicable criteria

Table B-23. Dioxin/furan congeners detected in the leachate from the Waackaack Creek CDF sediment sample and their calculated toxicity equivalents (TEQs)

Dioxin/Furan Congeners	I-TEF	Composite WK-D Cores 11 and 12 - Bottom Leachate		
		ng/L	Q	TEQ
2,3,7,8-TCDD	1	0.00235	A	0.00235
1,2,3,7,8-PeCDD	0.5	0.00588	A	0.00294
1,2,3,4,7,8-HxCDD	0.1	0.00424	A	0.000424
1,2,3,6,7,8-HxCDD	0.1	0.00432	AI	0.000432
1,2,3,7,8,9-HxCDD	0.1	0.00514	AI	0.000514
1,2,3,4,6,7,8-HpCDD	0.01	0.00461	A	0.0000461
OCDD	0.001	0.04660	A	0.0000466
2,3,7,8-TCDF	0.1	0.00681	A	0.000681
1,2,3,7,8-PeCDF	0.05	0.00656	A	0.000328
2,3,4,7,8-PeCDF	0.5	0.00484	A	0.00242
1,2,3,4,7,8-HxCDF	0.1	0.00475	A	0.000475
1,2,3,6,7,8-HxCDF	0.1	0.00467	A	0.000467
2,3,4,6,7,8-HxCDF	0.1	0.00364	A	0.000364
1,2,3,7,8,9-HxCDF	0.1	0.00374	A	0.000374
1,2,3,4,6,7,8-HpCDF	0.01	0.00436	A	0.0000436
1,2,3,4,7,8,9-HpCDF	0.01	0.00407	ND	0.0000407
OCDF	0.001	0.00683	A	0.00000683
Sum TEQ (pptr)				**0.012**

Qualifiers (Q):
ND - Not detected at the listed method detection limit (MDL)
A - Amount detected is less than the lower calibration limit
I - Indicates the presence of a qualitative interference that could cause a false positive or overestimation of the affected analytes

Some of the method detection limits for the semivolatile compounds, pesticides and metals exceeded the revised NJSGWQC (Table B-24). Although these compounds were not detected in the leachate samples, it is unknown whether actual concentrations in the samples exceeded the Groundwater Standards. All of the detection limits met the NJDEP requirements for dredging projects (NJDEP 1997).

Table B-24. Compounds with method detection limits greater than the NJSGWQC in the analysis of the Waackaack Creek CDF leachate samples

	NJSGWQC	NJ Req'd MDL	Composite WK-D Cores 11 and 12 Bottom	
	Groundwater	Leachate	Leachate	
Organics	**ug/L**	**ug/L**	**ug/L**	**Q**
Hexachloro-1,3-butadiene	1	10	5.600	ND
Hexachlorobenzene	0.02	10	5.600	ND
Pentachlorophenol	0.3	50	5.600	ND
Benzo(a)anthracene	0.1	10	5.600	ND
bis(2-Ethylhexyl)phthalate	3	10	5.600	ND
Benzo(b)fluoranthene	0.2	10	5.600	ND
Benzo(k)fluoranthene	0.5	10	5.600	ND
Benzo(a)pyrene	0.1	10	5.600	ND
Indeno(1,2,3-cd)pyrene	0.2	10	5.600	ND
Dibenzo(a,h))anthracene	0.3	10	5.600	ND
alpha-BHC	0.02	0.05	0.050	ND
beta-BHC	0.04	0.05	0.050	ND
gamma-BHC (Lindane)	0.03	0.05	0.050	ND
Aldrin	0.04	0.05	0.050	ND
Dieldrin	0.03	0.10	0.050	ND
Metals	**mg/L**	**mg/L**	**mg/L**	**Q**
Antimony	0.006	0.06	0.025	ND
Arsenic	0.003	0.01	0.010	ND
Beryllium	0.001	0.005	0.005	ND
Cadmium	0.004	0.005	0.005	ND
Thallium	0.002	0.01	0.010	ND
Qualifiers (Q): ND - Not detected at the listed method detection limit (MDL)				

B.6 CONCLUSIONS

The physical properties of the dredged materials stored in the five CDFs evaluated during this analysis vary by geographic region, and by location within the CDF. While the Waackaack Creek CDF contains mostly sand, the materials in the Site #83 CDF have virtually no sand. The Corps Cell D and Nummy Island CDFs contain pockets of fine grained materials and pockets of coarse materials. This is likely the result of the reuse of the CDFs for separate dredging projects that excavated different types of material.

The materials in all of the CDFs appear to be relatively clean and free of contaminants at concentrations of concern. With the exception of one sample from the Corps Cell D CDF, none of the materials exceeded the NJDEP's Direct Contact Residential Soil Cleanup Criteria. The leachates produced with the SPLP procedures had concentrations of some metals that may result in slight restrictions for their use in areas where there is a drinking water aquifer.