MALCOLM PIRNIE

SITE INVESTIGATION / REMEDIAL ALTERNATIVES REPORT

Buffalo Lakeside Commerce Park Parcel 4 Site

ERP Site # E915193

Buffalo, New York

Prepared By:

MALCOLM PIRNIE, INC.

For:

THE BUFFALO URBAN DEVELOPMENT CORPORATION

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Introduction

SECTION 1

The Buffalo Urban Development Corporation (BUDC) and the Erie County Industrial Development Agency (ECIDA) have completed an environmental site investigation (SI) and remedial planning for Parcel 4 (Site) of the Buffalo Lakeside Commerce Park (BLCP) in Buffalo, New York. The project was performed with support from the York State Department of Environmental Conservation (NYSDEC) through the Environmental Restoration Program - Clean Water / Clean Air Bond Act State Assistance Contract (SAC) number C302978. Malcolm Pirnie, Inc. was hired by the BUDC to perform the environmental services related to the project which began in December 2005.

1.1 Project Purpose and Scope

The purpose of the SI was to collect the data necessary to assess environmental risks and develop, if necessary, a feasible remedial program in support of the redevelopment of the site as part of the ongoing redevelopment of the overall BLCP. The project scope included a comprehensive site investigation and characterization, assessment of potential risks to human health and the environment, identification and evaluation of remedial alternatives, and recommendation of a remedial solution that meets the needs and objectives of the project.

1.2 Site Location and Description

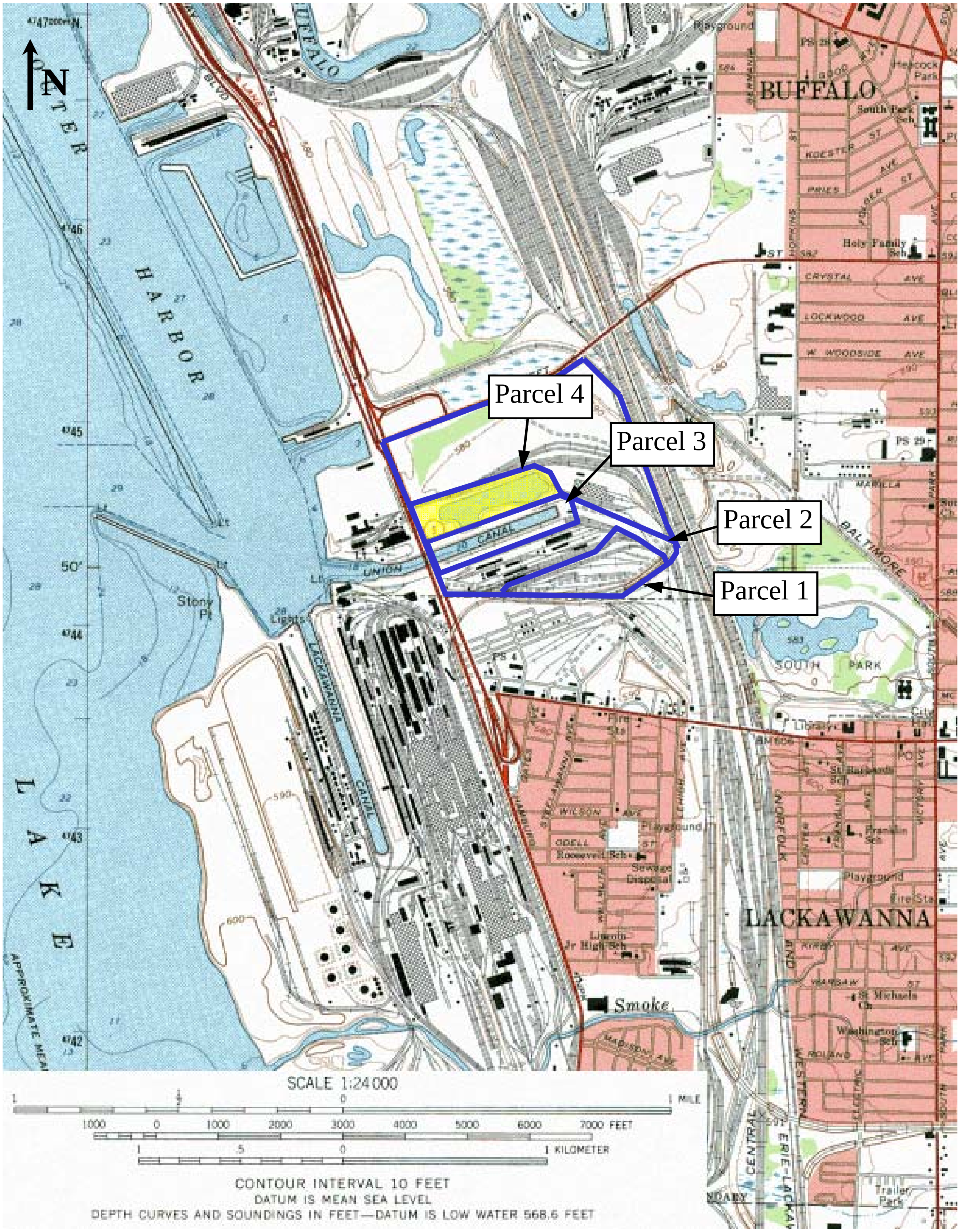
The Buffalo Lakeside Commerce Park occupies over 200 acres at the southern edge of the City of Buffalo. Approximately 113 acres of the BLCP was formerly referred to as the Union Ship Canal or Hanna Furnace Site. The site is bordered to the west by New York State Route 5 (Fuhrman Blvd), to the south by Lackawanna Commerce Park, to the east by several sets of parallel railroad tracks, and to the north by Tifft Street. The BLCP includes the eastern half of the Union Ship Canal. Based on its historic use, the City's current development needs and plans, and the findings of previous investigations, the southern 113 acres (former Hanna Furnace Site) of the BLCP site was informally divided into four Parcels for funding, characterization, and development purposes.

This investigation was limited to Parcel 4 of the BLCP, which is an approximately 20 acre parcel located north of Parcel 3 which encircles and includes the Union Ship Canal, see Figure 1-1. The BUDC intends to redevelop Parcel 4 of the BCLP consistent with the ongoing light industrial/commercial redevelopment activities taking place on Parcels 1, and 2 which will be complemented by passive-use/green space that is planned on Parcel 3 surrounding the canal.

1.3 Site Background and History

The southern portion of what is now the BLCP was purchased in 1902 by what was alternately called the Buffalo and Susquehanna Company, Buffalo and Susquehanna Furnace Company, Buffalo and Susquehanna Iron, and the Buffalo and Susquehanna Iron Company (the precursor to the Hanna Furnace Corporation). In 1903 the Buffalo and Susquehanna Railroad in cooperation with the Pennsylvania Railroad, initiated construction of the Union Ship Canal, originally called the Goodyear Slip. In 1910 the canal was extended to its current 2240 foot length to provide the pig iron manufacturing operations access to barges with raw materials transported via Lake Erie. Historic records indicate that the first two of four blast furnaces were constructed and first blown between 1902 and 1904 and furnaces 3 and 4 built between 1910 and 1912 and first blown in 1912. The corporate history between 1910 and 1930 is somewhat unclear and discrepant however, in April of 1930, the name changed from the Buffalo Union Furnace Corporation to the Hanna Furnace Corporation. During peak production, the Hanna Furnace Site employed over 800 workers and could produce up to 3100 net tons of iron per day.

Beginning in the 1970s, a combination of factors led to the slowdown of iron and steel manufacturing in the United States and Buffalo and on January 29, 1982 Hanna Furnace Corporation shut down all operations at the Plant. In 1983 the plant was purchased by Jordan Foster Scrap Corporation. By 1985 Jordan Foster had dismantled most of the



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BUFFALO LAKESIDE COMMERCE PARK (PARCEL 4)

BUFFALO, NEW YORK

FIGURE 1-1
SITE LOCATION MAP

plant's structures and removed rails from the site rail yard. In 1998 the City of Buffalo took title of the property for non-payment of taxes. In 2001 and 2002 the remainder of site structures was demolished to make way for redevelopment of the site.

The Pennsylvania Railroad first owned the land north of the canal and used the property for unloading ores into train cars. The Hanna Furnace Corporation purchased the property to the north of the canal that is now called Parcel 4, from the Pennsylvania Railroad in 1960. Swampy ponds with depths up to 15 feet occupied much of the property at the time. The swampy area was subsequently filled in with silty sand and gravel, with some black cinders, as described in Recra Environmental, Inc.'s 1988 report. Based on prior reports and review of historic aerial photographs, the area now referred to as Parcel 4 was historically used primarily for landfilling and stockpiling of waste materials generated from the operations of the nearby Hanna Furnace plant. Solid wastes deposited on Parcel 4 primarily include filter cake/flue ash and furnace construction/demolition debris which includes soil, sand, brick, lumber, concrete, and scrap metal. Some portions of parcel 4 were also reportedly used for storage of raw materials including iron ore and limestone, (RECRA, 1988, Panamerican 2002, Engineering Science 1986).Based on a review of Sanborn maps, the area immediately to the south of the canal and north of the manufacturing area was used to unload iron ore and limestone brought in to the site by ship and barge. The limestone and ore were placed on massive concrete pads that occupy the bulk of the southern portion of Parcel 3.

The City of Buffalo acquired 113 acres of this land in the 1990s after the previous owners declared bankruptcy and abandoned the property. The previous owners had removed most of the operating equipment and all of the rolling stock. Many of the buildings on the site were demolished for scrap, but bankruptcies interrupted that process. The remaining ruins (buildings, foundations, vaults and furnaces) were demolished by the City of Buffalo and the Buffalo Urban Development Corporation (BUDC), formerly Development Downtown, Inc. (DDI) between the summer of 2001 and the spring of 2003.

When the City of Buffalo purchased the land, it was informally subdivided into four parcels, which reflected the diverse industrial land usage by the previous owners of the site. Parcel 1 was primarily used as a railroad yard and surface storage area. Parcel 2 was primarily used as the heavy production area and included the furnaces and numerous buildings. Parcel 3 was primarily used for loading and unloading functions and included the ship canal. Parcel 4 was primarily used as a fill area, accepting substantial quantities of flue ash and slag.

Development Downtown, Inc. acquired Parcels 1, 2 and 4 from the City of Buffalo in December of 2002. The acquisition was agreed upon several years ago, and was timed to take place at the point when DDI finalized a Generic Environmental Impact Statement (GEIS) for a 275-acre project area which included the area of the BLCP. The GEIS process was completed during the summer of 2002, with the filing of a Findings Statement on July 1st, 2002. Parcel 3 remains in title to the City of Buffalo.

In late 2006 and early 2007, BUDC acquired the approximately 113 acres of land between Parcel 4 and Tifft Street. Of these 113 acres, 38 were acquired from CSX Transportation. This property was formerly referred to as the Penn 200 Yard. The other 75 acres was purchased from Herbert F. Darling.

The GEIS document included a draft zoning ordinance, designed to set up land use parameters for future development at the site. The three zones established were Office and Light Industrial, Manufacturing and Light Industrial, and Open Space. It is felt that this development program blends the areas environmental features, with the numerous transportation linkages, to produce a modern commerce park with "urban" appeal.

As established previously, the Buffalo Lakeside Commerce Park redevelopment area has a long and varied history of industrial use. Environmental investigations conducted to date in the BLCP area have indicated that industrial contamination resulting from this historic use does exist however BUDC, ECIDA, DDI or the City of Buffalo did not play any role in the contamination of this site. Redevelopment of the BLCP is progressing under multiple applicable and relevant regulatory and funding programs as follows:

- Parcel 1 is covered by a Voluntary Cleanup Program Agreement with the New York State Department of Environmental Conservation, which includes a Soil/Fill Management Plan (S/FMP) that requires a 12-inch cover over undeveloped acreage.
- Parcel 2 is covered by a separate Voluntary Cleanup Agreement with essentially an identical S/FMP.

- Parcel 3 development plans are proceeding under the New York State Environmental Bond Act Program.

- Parcel 4 was investigated in January 2006 under a separate Bond Act agreement, the findings and recommendations of which are presented in this report.

1.4 Previous Investigations and Findings

In the past 25 years, there have been at least 16 separate environmental investigations conducted on the former Hanna Furnace site by 12 different public or private entities. Of these 16 studies, five investigations included the Parcel 4 area. The five studies that included Parcel 4 were performed by; RECRA Environmental, Inc. in 1988, the NYSDEC in 1994, ABB Environmental Services, Inc. in 1995, USEPA during June, 2001, and Malcolm Pirnie, Inc. in 2003.

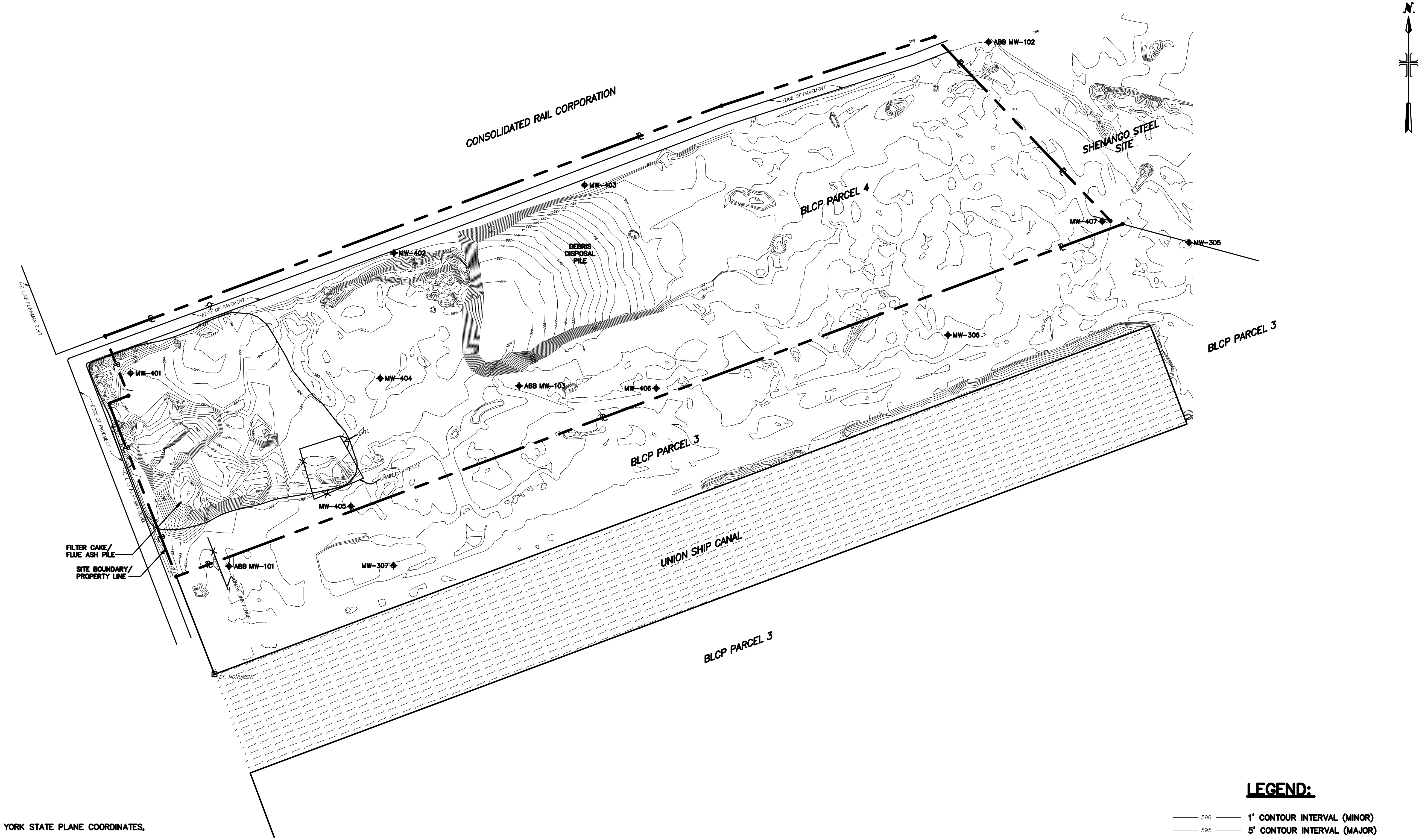
These previous characterization efforts for Parcel 4 focused primarily on two raised fill mounds at the Site, the Filter Cake/Flue Ash (FC/FA) mound and the Debris Disposal Area, see Figure 1-2. A collective summary of the previous investigation work performed in these two areas of Parcel 4 along with a summary of the findings is discussed below in the following subsections. A tabulated summary of historical analytical data is presented on Tables 1-1 through 1-5.

1.4.1 Filter Cake and Flue Ash Pile

A total of 17 surface soil and five subsurface soil samples were collected from the FC/FA Area. All of the samples were analyzed for metals and a limited number were analyzed for organic compounds.

Soil Samples

- Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs) were either not detected or detected at concentrations below the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 Recommended Soil Cleanup Objectives (RSCOs) or Maximum



NOTES:

1. HORIZONTAL DATUM: NAD 27 NEW YORK STATE PLANE COORDINATES, WEST ZONE, US SURVEY FEET
2. VERTICAL DATUM: NGVD29
3. UNDERGROUND UTILITIES AND STRUCTURES ARE SHOWN IN THEIR APPROXIMATE LOCATION AND MAY NOT BE SHOWN IN THEIR ENTIRETY VERIFICATION IS REQUIRED PRIOR TO CONSTRUCTION.
4. TOPOGRAPHIC INFORMATION SHOWN ON THIS MAP WAS SURVEYED AND PREPARED BY WENDEL DUCHSCHERER FROM FIELD DATA GATHERED BETWEEN JANUARY 25 & JANUARY 30, 2006.

LEGEND:

- 596 — 1' CONTOUR INTERVAL (MINOR)
- 595 — 5' CONTOUR INTERVAL (MAJOR)
- PL — PROPERTY LINES
- x — FENCE (TYPE NOTED)
- MW-306 — GROUNDWATER MONITORING WELL LOCATION

50 0 50 100

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BUFFALO LAKESIDE COMMERCE PARK
PARCEL 4

BUFFALO, NEW YORK

FIGURE 1-2

EXISTING SITE PLAN

TABLE 1-1
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - SURFACE SOILS
Hanna Furnace Parcel 4 RECRA 1988 Investigation
Flue Ash/Debris Landfill- Surface Soil Results
Parcel 4 BCLP Site

Sample Location	Restricted Commercial SCO Value	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10
Volatile Organic Compounds - VOCs (ug/kg)											
Oil & Grease		340	400	900	670	640	590	540	21,000	----	2,000
PCBs - (ug/Kg)											
4,4' --DDE	8900										
Aroclor-1254	1000						70		530	170	
Aroclor-1260	1000				230						
TAL Metals (mg/kg)											
Arsenic	16	7.5	5.9	12	9.1	11	7.3	5.6	13	9.8	10
Chromium	400	14	18	25	58	47	60	19	70	75	16
Copper	270	27	25	80	190	120	220	27	260	250	36
Lead	1,000	52	39	230	490	260	400	950	**2,600**	**6,020**	180

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Blank space indicates analyte was not detected.
-- Indicates sample was not analyzed for this parameter.
Bolded concentrations exceed Restricted Commercial SCOs.

*** New York State background concentration.*

NA - Not Applicable or Not Available.

TABLE 1-2
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - SURFACE SOILS
Hanna Furnace Parcel 4 NYSDEC 1994 Investigation
Flue Ash/Debris Landfill- Surface Soil Results
Parcel 4 BCLP Site

Sample Location	Restricted Commercial SCO Value	SS/CD-101	SS/CD-101 Dupl	SS/CD-102	SS/CD-103	SS/CD-104	SS/CD-105	SS/CD-106
TAL Metals (mg/kg)								
Aluminum								
Antimony								
Arsenic	16	**49**		**58**	**62**	**49**	**53**	**48**
Barium	400	**3200**		**3140**	**3070**	**3180**	**3400**	**2300**
Beryllium								
Cadmium	9.3	**24**		**22**	**28**	**21**	**19**	**12**
Calcium								
Chromium	400	25		39	50	25	20	23
Cobalt								
Copper	270	107		150	260	90	99	79
Iron								
Lead	1,000	**1200**		**1540**	**3310**	**1850**	**1200**	**1100**
Magnesium								
Manganese								
Mercury	2.8	0.3			0.3	0.25	0.25	0.3
Nickel	310	35		35	80	37	42	32
Potassium								
Selenium	1,500	180		170	200	160	150	120
Sodium								

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Blank space indicates analyte was not detected.
-- Indicates sample was not analyzed for this parameter.
Bolded concentrations exceed Restricted Commercial SCOs.

*** New York State background concentration.*

NA - Not Applicable or Not Available.

TABLE 1-3

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - SURFACE SOILS
Hanna Furnace ABB Site Investigation
Flue Ash/Debris Landfill- Surface Soil Results
Parcel 4 BCLP Site

Sample Location	Restricted Commercial SCO Value	SS-101	SS-101 D	SS-102	SS-103	SS-104	SS-105	SS-106	SS-107	SS-108
Volatile Organic Compounds - VOCs (ug/kg)										
Ethyl Benzene	390,000									2 J
Tetrachloroethene	150,000	3 J	3 J	9 J	5 J	9 J	8 J	14		
Semi-Volatile Organic Compounds - SVOCs (ug/kg)										
2-Methylnapthalene	NS		41 J							R
Anthracene	500,000			60 J		49 J	62 J	42 J		R
Benzo(a)anthracene	5,600	110 J	120 J	150 J		110 J	400 J	360 J	190 J	170 J
Benzo(a)pyrene	1,000	52 J	53 J	85 J		60 J	420 J	490 J	270 J	150 J
Benzo(b)fluoranthene	5,600	190 J	290 J	320 J		230 J	540 J	540 J	340 J	230 J
Benzo(g,h,i)perylene	500,000	70 J	70 J	94 J		61 J	240 J	230 J	120 J	82 J
Benzo(k)fluoranthene	56,000	120 J	140 J	120 J		73 J	370 J	450 J	190 J	180 J
Chrysene	56,000	240 J	260 J	300 J		220 J	500 J	490 J	260 J	260 J
Dibenz(a,h,)anthracene	560								40 J	R
Fluoranthene	500,000	190 J	180 J	240 J		170 J	640 J	480 J	290 J	250 J
Indeno(1,2,3-cd)pyrene	5,600	60 J	55 J	66 J		42 J	240 J	220 J	140 J	81 J
Naphthalene	500,000		46 J	66 J						R
Phenanthrene	500,000	160 J	160 J	160 J		200 J	290 J	220 J	130 J	210 J
Pyrene	500,000	210 J	230 J	270 J		210 J	600 J	490 J	240 J	340 J
Pesticides/PCBs - (ug/Kg)										
4,4' --DDE	8,900	5 J								
Aroclor-1260	1,000	250 J	310 J	190 J	28 J	210 J	79 J	50 J	18	71 J
Endosulfan II	200,000	8 J						R		
Methoxychlor	NS	17 J					17 J	16 J		26 J
TAL Metals (mg/kg)										
Aluminum	NS	8500	8670	12600	4010	6450	10100	7330	8440	6590
Antimony	NS	23.3 J	28.8 J	12.1 J	39.5 J	22.9 J	15.8 J	17.4 J	15.1 J	
Arsenic	16	15.4 J	10.4 J	14.4	**20.5**	15.9	15.4	13.7	14.9	**19.1**
Barium	400	112	109	178	52.6	89.5	113	84	77	77.8
Beryllium	590	2.1	1.9	2.9	0.9 J	1.2	1.4	0.9 J	0.9 J	0.9 J
Cadmium	9.3	**14.9**	**16.5**	**12.7**	6.2	**17.6**	5.2	3.9 J	3.1 J	4.3 J
Calcium	NS	42,400	42,100	54,700	27,500	33,400	50,500	34,500	38,900	78,600
Chromium	400	285	164	81.9	251	149	85.1	40.2	22.4	23.2
Cobalt	NS	18.4	19.8	10.2	**33.4**	18.1	16.1	12.2	11.5	11 J
Copper	270	228 J	191 J	79.3 J	**689 J**	**290 J**	178 J	92.9 J	52.1 J	156 J
Cyanide	27	4.1 J	11.4 J	8.7 J		5.8 J				
Iron	NS	156,000 J	181,000 J	114,000 J	343,000 J	186,000 J	159,000 J	124,000 J	124,000 J	116,000 J
Lead	1,000	**4460**	**4460**	**3240**	523	**5880**	500	294	222	337
Magnesium	NS	10,600	10,800	13,200	5,700	7,800	11,800	7670	10,200	11400
Manganese	10,000	4,720	4,860	4,220	7,540	3,670	4,940	4310	4,430	4260
Mercury	2.8	0.1	0.1	0.1		0.3	0.1	0.3	0.3	
Nickel	310	82.7	95.4	37.7	183	87.6	62.4	28.8	15.9	24.5
Potassium	NS	1,220	1,180	3,730	691 J	818 J	4,250	1330	805 J	2650
Selenium	1,500	2.2 J		2.6 J		2.3 J				
Sodium	NS	353 J	542 J	764 J	301 J	272 J	535 J	404 J	916 J	656 J
Thallium	NS	7.3	6.2	8.1		7.7		1.5 J		
Vanadium	NS	62.2	67.2	44.1	85.2	55.5	52.6	45.6	44.4	39.8
Zinc	10,000	4,500	4710	3290	942	4860	1,010	780	457	729
EPTOX Metals (ug/L)										
Arsenic		52 J								
Cadmium		52.4 J	50.4 J	96.6 J		144 J	5 J	2.9 J		
Chromium				6.5 J	6 J	7.7 J	8.4 J		7.9 J	
Lead		410 J	3552 J	752 J	49.8 J	1,630 J	91.2 J		85 J	55.7 J
Silver						6.1 J				

Notes:
Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Blank space indicates analyte was not detected.
-- Indicates sample was not analyzed for this parameter.
Bolded concentrations exceed Restricted Commercial SCOs.

TABLE 1-4
SUMMARY OF HISTORICAL ANALYTICAL RESULTS - SUBSURFACE SOILS
Hanna Furnace ABB 1995 Site Investigation
Debris Landfill- Test Pit Results

Sample Location	Restricted Commercial SCO Value	TP-101 9' bgs	TP-102 5' bgs	TP-103 7' bgs	TP-104 9' bgs	TP-104 D 9' bgs	TP-105 7' bgs	TP-106 11' bgs	TP-107 6' bgs	TP-108 10' bgs
Volatile Organic Compounds - VOCs (ug/kg)										
Acetone	500,000			5 J	5 J		4 J		6 J	
Benzene	44,000				2 J					
Carbon Disulfide	NS			2 J						
Ethyl Benzene	390,000	3 J								
Toluene	500,000	2 J								
Total-xylenes	500,000	2 J								
Semi-Volatile Organic Compounds - SVOCs (ug/kg)										
Acenaphthylene	500,000		110 J							
2-Methylnapthalene	NS	87 J	200 J	220 J			60 J			
Acenaphthene	500,000	340 J	250 J	150 J			72 J	67 J		150 J
Anthracene	500,000	130 J	270 J	140 J			53 J	75 J		49 J
Benzo(a)anthracene	5,600	1,000 J	1,700 J	760 J	**13,000 J**	5,000 J	400 J	3,300	99 J	3,800 J
Benzo(a)pyrene	1,000	**1,200 J**	**1,900 J**	790 J	**16,000 J**	**6,600 J**	450	**4,400**		**3,000 J**
Benzo(b)fluoranthene	5,600	990 J	1,900 J	830 J	**17,000 J**	**6,600 J**	520	5,000	71 J	4,900 J
Benzo(g,h,i)perylene	500,000	420 J	680 J	290 J	6,100 J	2,000 J	190 J	1,200		1,100 J
Benzo(k)fluoranthene	56,000	1,100 J	1,100 J	550 J	11,000 J	4,900 J	350 J	2,200		1,500 J
Carbazole	NS	48 J						87 J		
Chrysene	56,000	1,100 J	2,100 J	1,000 J	**17,000 J**	**6,700 J**	530	5,200	180 J	**6,300 J**
Dibenz(a,h,)anthracene	560	46 J	58 J		540 J			90 J		98 J
Dibenzofuran	NS	70 J	180 J	100 J						
Fluoranthene	500,000	1,200 J	1,400 J	1,100 J	14,000 J	5,400 J	480	4,200	320 J	3,700 J
Fluorene	500,000	83 J	210 J	92 J			49 J			
Indeno(1,2,3-cd)pyrene	5,600	570 J	910 J	350 J	**7,800 J**	2,900 J	240 J	1,600		1,400 J
Naphthalene	500,000	110 J	220 J	140 J			110 J	53 J	67 J	
Phenanthrene	500,000	580 J	1,200 J	700 J	1,800 J	660 J	240 J	610 J	310 J	470 J
Pyrene	500,000	1,300 J	2,500 J	1,400 J	15,000 J	6,000 J	530	3,800	330 J	3,200 J
bis-2-ethylhexyl phthalate	NS	140 J	210 J	74 J			60 J		86 J	
Di-n-butyl phthalate	NS							53 J		
Pesticides/PCBs - (ug/Kg)										
Aroclor-1248	1,000	68 J	88 J	100	R		140	180	85	
Aroclor-1260	1,000	150	120	49 J	R		120	260	120	
Endrin Ketone	8,900			7.8 J	R		6 J			
TAL Metals (mg/kg)										
Aluminum	NS	8310	11300	4100	7560	6110	19600	6500	5010	5290
Antimony	NS	10.3 J	21.8	11.8 J			9.4 J		16.5	
Arsenic	16	11.5	7.7	6.7	2.2 J	2.0 J	10.6	3.9	12.8	4.8
Barium	400	87.8	155	65.4	17.1 J	12.4 J	109	17.5 J	74.1	33.2 J
Beryllium	590	1.3	2.3	0.5 J			1.3		0.9 J	
Cadmium	9.3	4.8 J	3.8 J	3.6 J	R		4.4		5.1 J	1.5 J
Calcium	NS	40,700	68,000	32,500	772 J	473 J	42,100	1,080 J	24,800	4,680
Chromium	400	33.6	84.1	112	7.7	6.1	98.8	6.4	82.7	8
Cobalt	NS	14.3	11.9	12.4			12.3		21.3	2.6 J
Copper	270	210	163	120	2 J		136	2.3 J	214	6.4 J
Iron	NS	63,000	93,300	124,000	9,890	8,350	121,000	8,630	227,000	6,810
Lead	1,000	217	330	669	7.6 J	5.9 J	318	18.6 J	414	11.2 J
Magnesium	NS	9,350	15,300	9,910	725 J	496 J	11,300		5,800	995 J
Manganese	10,000	5,110	4,290	3,720	146	106	3,150	102	5,220	130
Mercury	2.8	0.4	0.4	0.1			0.2			
Nickel	310	23	55.3	39.2			39.4		136	
Potassium	NS	2,920	1,390	1,470	868 J	814 J	13,300	955 J	1,270 J	725 J
Selenium	1,500	550 J	835 J	463 J	324 J	279 J	749 J	431 J	406 J	451 J
Sodium	NS	550 J	835 J	463 J	324 J	279 J	749 J	431 J	406 J	451 J
Total Cyanide	27									
Thallium	NS									
Vanadium	NS	55.2	39.7	50.2	10.8	8.8 J	45.6	10.3 J	64.9	9.8 J
Zinc	10,000	1,440	459	417	6.2	6.4	1,230	13.8	941	23.9

Notes:
Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Blank space indicates analyte was not detected.
-- Indicates sample was not analyzed for this parameter.
Bolded concentrations exceed Restricted Commercial SCOs.

(1) USEPA Region 3 Soil Screening Level.

TABLE 1-5

SUMMARY OF HISTORICAL ANALYTICAL RESULTS - SUBSURFACE SOILS
Hanna Furnace USEPA 2001 Site Invstigation
Flue Ash/Debris Landfill- Subsurface Soil Results
Parcel 4 BCLP Site

Sample Location	40 CFR Part 261	Restricted Commercial SCO Value	FA-01	FA-02	FA-03	FA-04	ML-01	ML-02	ML-03	ML-04
TAL Total Metals (mg/kg)										
Aluminum		NS	10200	---	---	---	6760		7850	
Antimony		NS	1	---	---	---	0.64		1	
Arsenic		16	12.4	---	---	---	15.3		13.8	
Barium		400	128	---	---	---	106		118	
Beryllium		590	1.9	---	---	---	1.2		1.4	
Cadmium		9.3	6.5	---	---	---	4.9		4.6	
Calcium		NS	62400	---	---	---	45000		45600	
Chromium		401	51.4	---	---	---	66.5		104	
Cobalt		NS	2.9	---	---	---	5.1		4.7	
Copper		270	80.3	---	---	---	173		169	
Cyanide		27	11.8	0.0164	0.0096	0.0053	11.8	0.0056	8.7	0.0059
Iron		NS	88000	---	---	---	139000		132000	
Lead		1,000	**1420**	---	---	---	399		396	
Magnesium		NS	9620	---	---	---	10700		9380	
Manganese		10,000	2490	---	---	---	3360		3660	
Mercury		2.8	0.1	---	---	---	0.15		0.14	
Nickel		310	30.6	---	---	---	53.2		56.9	
Potassium		NS	2350	---	---	---	2380		1710	
Selenium		1,500	3.9	---	---	---	3.1		2.6	
Silver		1,500	2.8	---	---	---	0.92		0.72	
Sodium		NS	---	---	---	---	---		56.5	
Thallium		NS	17.6	---	---	---	25		25.8	
Vanadium		NS	18.6	---	---	---	21.4		21.9	
Zinc		10,000	1790	---	---	---	1050		926	
PCBs (mg/kg)										
Aroclor - 1242		1			0.17					
Aroclor - 1254		1		0.14	0.21	0.2				
Aroclor - 1260		1	0.098		0.11	0.14				
TCLP Volatile Organic Compounds - VOCs (ug/L)										
					---	---		---	---	---
TCLP Semi-Volatile Organic Compounds - SVOCs (ug/L)										
					---	---		---	---	---
TCLP Pesticides/PCBs - (ug/L)										
Silvex	1,000				---	---	2.5	---	---	---
TCLP Total Metals (ug/L)										
Arsenic	5000		2.6	2.2	4.6	---	3.9	---	---	3.4
Barium	10,000		581	836	577	274	352	526	468	368
Cadmium	1,000		37.1	107	150	64.9	12.2	13.9	8.8	7.4
Chromium	5,000		1.8	16.5	20.2	6.8	4.9	6.7	7.2	10.5
Lead	5,000		209	1,560	**14,700**	256	28.6	55.1	23.8	22.4
Selenium	1,000		20.9	24.9	26.7	28.2	18.5	16.6	18.1	15.2
Silver	5,000			2.2	2.5	2.7	0.9	---	0.73	0.94
RCRA Characteristics										
Corrosivity	<2 or >12.5		7.77	7.11	7.79	8.13	8.57	8.75	8.52	8.53
Ignitability	< 140$^{o\ F}$		> 140^{o}	> 140^{o}	> 140^{o}	> 140^{o}	> 140^{o}	> 140^{o}	> 140^{o}	> 140^{o}

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Blank space indicates analyte was not detected.
-- Indicates sample was not analyzed for this parameter.
Bolded concentrations exceed Restricted Commercial SCOs or TCLP guidance criteria.

Concentration of Contaminants for the Toxicity Characteristic (MCCTC). These results were consistent with those detected in Parcels 1, 2, and 3.

- Metals - Generally, the concentrations of metals were consistent with those detected during investigation of Parcels 1, 2, and 3. The following items are noteworthy:

- Concentrations of lead detected in the Flue Ash pile were generally higher than the Site-Specific Action Levels (SSALs) approved for Parcels 1 and 2. Additionally, detected lead concentrations were higher than those identified during previous investigation of Parcels 1-3. As shown on Table 1-5, an elevated concentration of lead in one of the USEPA Toxicity Characteristic Leaching Procedure (TCLP) samples (FA-03) exceeded the MCCTC, and, based on this result, the material is considered a hazardous waste. Further delineation of this high-TCLP lead area indicated that it was limited to the sampled location and not more than a 40-foot square area. This area was subsequently fenced to limit access and exposure to the elevated lead concentrations. Analysis of the sample FA-01 for total metals detected an elevated concentration of lead in excess of the RSCO.

- Zinc concentrations were generally higher than those in samples collected from Parcels 1, 2, and 3.

- Barium concentrations were generally below the RSCOs and the SSALs with the exception of the NYSDEC surface soil samples. The concentrations in some of these samples were significantly above the SSALs.

Groundwater Samples

- Although no groundwater samples were collected in the FC/FA Area, groundwater samples were collected from MW-101 and MW-307 in Parcel 3, located between the FC/FA Area and the canal. The information from these downgradient wells may be indicative of the quality of the groundwater in Parcel 4. Analytical results for these samples indicate:

- With the exception of acetone and phenols, VOCs and SVOCs were either not detected or were detected at low concentrations, below the NYSDEC groundwater quality standards.

- Pesticides and PCBs were not detected in the samples.

- Elevated concentrations of arsenic, cyanide, iron, selenium and sodium were detected in at least one of the groundwater samples.

- Lead was not detected in either sample.

- Groundwater pH values were highest in the western portion of Parcel 3, with laboratory measured pH values as high as 12.0 at ABB-MW-101 and 11.0 at MW-307.

1.4.2 Debris Disposal Pile

A total of 16 surface soil, 12 subsurface soil, one surface water, one sediment, and two groundwater samples were collected from on or adjacent to the Debris Disposal Area.

Surface Soil Samples

- VOCs, low concentrations of ethyl benzene and PCE were detected in the surface soil samples collected during the 1995 ABB site investigation. Though qualified as estimated, the concentrations are below the Restricted Commercial SCOs

- As shown on table 1-1 oil and grease was analyzed at surface soil sampling locations SS-1 through SS-10. The greatest oil and grease concentration detected in soil samples collected in the debris disposal area (SS-1 through SS-6) is 900 ug/kg.

- SVOCs - surface soil samples were collected at a total of eight sampling locations designated SS-101 through SS-108 during the ABB investigation. As shown on historic Table 1-3 carcinogenic PAHs were detected at each sampling location Except SS-103.Concentrations for the PAHs did not exceed the Restricted Commercial SCO criteria.

- PCBs, Two PCB analytes were detected in surface soil samples collected during 1988 RECRA and 1995 ABB investigations. Where detected, the PCBs were at concentrations below the Restricted Commercial SCO criteria for each of the PCB analytes (1,000 ug/kg). The highest PCB (Aroclor-1254) concentration of 530 ug/kg was detected at sample location SS-8 collected during the 1988 RECRA site investigation. PCB concentrations were consistent with those detected in Parcels 1, 2, and 3.

- Pesticides – Two pesticides identified as Endosulfan ll and Methoxychlor were detected at concentrations below the respective Restricted Commercial SCOs. A Methoxychlor concentration of 17 ug/kg was detected at sample locations SS-101 and SS-105.

- Metals – Concentrations were consistent with those detected during previous investigations conducted in Parcels 1, 2, and 3. As shown on Tables 1-1 to 1-3, metals concentrations detected greater than the Restricted Commercial SCO included arsenic, cadmium, copper and lead. When compared with concentrations detected in samples collected in the FC/FA pile, the lead concentration was generally lower. Lead concentrations exceeded the SSALs approved for Parcels 1 and 2 in eleven of the 25 soil samples analyzed.

Subsurface Soil Samples

- VOCs - As shown on Table 1-4, very low concentrations of six VOCs were detected in the soil samples collected from test pit excavations during the 1995 ABB site investigation. BTEX compounds were detected at sample locations TP-101 and TP-104 with concentrations that ranged from 2-3 ug/kg. When detected the concentrations were typically 4-5 orders of magnitude below the applicable SCO(s).

- SVOCs - Test pit soil samples were collected at a total of 8 sampling locations designated TP-101 through TP-108 during the 1995 ABB investigation. As shown on Table 1-4, elevated concentrations of carcinogenic PAHs that exceed Restricted Commercial use SCO(s) were detected at all test pit locations except TP-103, TP-105 and TP-107. The highest PAH analyte concentration(s) were identified at test pit location TP-104 where benzo (b) fluoranthene and chrysene were detected at a concentration of 17,000 ug/kg.

- PCBs – Examination of Table 1-4 identified two PCB analytes (Aroclor 1248 and 1260) detected below Restricted Commercial SCO criteria in test pit samples collected during the 1995 ABB investigation. A maximum PCB (Aroclor-1260) concentration of 260 ug/kg was detected at sample location TP-106.

- Pesticides – With the exception of one sample, pesticides were either not detected or were detected at very low concentrations. Silvex was detected below the SCO guidance criteria in one soil sample designated ML-01 collected during the 2001 USEPA investigation. Soils collected during the 2001 EPA investigation were analyzed using the Toxicity Characteristic Leaching Procedure (TCLP).

- Metals – As shown on Table 1-4, detected concentrations of TAL metals did not exceed the Commercial SCO guidance values. Subsurface soils collected by USEPA in 2001 (samples ML-1 through ML-4) were also analyzed using the TCLP method to determine if metals were present at hazardous concentrations. None of the metals came close to exceeding the hazardous limits, see Table 1-5.

Surface Water Sample

- One surface water sample was collected in the vicinity of the debris disposal pile. This sample was collected from a seasonal ponded area south of the pile. VOCs, SVOCs, and pesticides were not detected or were detected at low concentrations, below the Class C Surface Water Quality Standards.

- PCBs were detected in the only pond water sample collected from Parcel 4, sample P-3, by RECRA in 1988. The concentration of Aroclor 1248 in this sample was 1.3 PPM which is three orders of magnitude above the Class C Surface Water Quality Standard of 0.001 PPM.

Sediment Samples

- One sediment sample was collected from the ponded wetland area and analyzed for four metals.

- Metals – The metals, arsenic, chromium, copper and lead were detected at concentrations below the Restricted Commercial SCOs. The concentrations for arsenic and chromium were consistent with concentrations detected in soil samples collected from Parcels 1, 2, and 3. Whereas, concentrations of copper and lead were less than those detected during previous investigations

Groundwater Samples

- In addition to the three groundwater samples collected from MW-103, located near the Debris Disposal Area, a groundwater sample was collected from MW-306 in Subparcel 3, located downgradient of the Debris Disposal Area. Analytical results for these samples indicate:

- VOCs, pesticides and PCBs were not detected in the samples.
- One SVOC (phenol) was detected at concentrations above the NYSDEC groundwater quality standards in the on-site well, and five SVOCs (polycyclic aromatic hydrocarbons) were detected above the Class "GA" standards in well MW-306.
- Metals - Elevated concentrations of cyanide, iron, manganese, and sodium were detected in one or more groundwater samples. Lead was detected in only one sample, and was not detected in the filtered portion of that sample. Therefore, the lead concentration was due to suspended solids in the sample.

Comparison of data collected from the Debris Disposal Pile and data collected from the other areas of Parcel 4 indicates that soil/fill materials are generally similar in physical character and chemical composition. However, it should be noted that localized areas of physical and chemical anomaly within Parcel 4 (i.e. the filter cake/flue ash pile, blue fill, and Hot Spots") were identified and are discussed within the report.

1.5 Physical Setting

1.5.1 Land Use and Demography

Most of Parcel 4 is former marsh lands that were covered with standing water prior to use of the property for industrial purposes. Review of previous environmental reports and historic aerial photographs indicates that Parcel 4 never contained buildings. The marsh areas were filled in with sediment and shale rock dredge spoils from the building of the Union Ship Canal and fill material related to the steel making industry. The site was used to stock-pile and transport raw materials including iron ore, limestone, and to store solid waste including filter cake/flue ash and general soil/fill. Evidence of some of these materials and partial rail spurs remain on the Site.

1.5.2 Topography and Drainage

The Site is generally flat with two areas of pronounced fill material in raised fill mounds, the largest of the two primary fill mounds is located in the approximate center of the Site, this mound is referred to as the “Debris Disposal Pile”. This mound is a ramp-like feature that gradually rises toward the west to a maximum relief of approximately 20 feet and having a steep scarp facing the west. The footprint area of this mound is nearly 3 acres, see (oversize) Figure 2-1. The Debris Disposal Pile is composed of soil/fill including sand, gravel, cobbles and boulders with fill materials including black sand, ash, slag, red brick, yellow fire brick, concrete, wire rope, tires, crushed stone, metal debris, and various other construction and demolition debris (C&D).

The second raised fill area is along the western end of the Site and is called the “Filter Cake/Flue Ash Pile”. This mound of fill is composed entirely of black fine-grained filter cake and flue ash, a by-product from the steel making process. The surface of the FC/FA Pile is hummocky and reaches a maximum height of approximately 15 feet. The estimated area of this fill mound is approximately 3.7 acres. The remainder of the Site is generally flat and varies in elevation between 580 and 585 feet above mean sea level (AMSL).

Precipitation and snow-melt waters generally do not flow across the Site but rather infiltrate into the thick fill mounds and subsurface soil/fill materials present along the western and central portion of the site or stands in the wetlands that are present at the eastern and east central portions of the site. No direct surface water connection between the site and the nearby ship canal to the south was observed.

1.5.3 Soils

The Erie County Survey classifies the Site soils as Urban land (Ud) where 80 percent or more of the native soil is covered by structures, pavement or landfills. An extensive program of soil borings and test pits was completed as part of this Site Investigation and a more detailed understanding of subsurface conditions was formulated. In general, native soils at the Site have been covered with fill material throughout the entire Site. The fill material varies from natural soil materials including clay to boulders, dredged sediments and shale rock, raw materials and by-products of the steel industry including filter cake, flue ash, limestone, iron ore, slag and C&D. Thickness of these fill materials varies from as little as four feet to over 25 feet. Natural soils observed beneath the fill materials include; mostly clay, with some silt, sand, peat, and till.

1.5.4 Regional Geology and Hydrogeology

The Site is located in the Eastern Lake Section of the Central Lowlands physiographic province (Pirkle and Yoho 1977). This area is characterized as being covered by a blanket of relatively young till deposits from the Pleistocene Epoch approximately 12,000 years before present. A thin (<1 foot) layer of till was observed in samples collected from on-site soil borings directly above the bedrock. The till consisted of a tight mixture of clay, silt, sand and gravel. Above bedrock and till deposits, where present, the natural overburden consists of lacustrine silt and clay deposits from former glacial lakes, (Cadwell, 1988). Clay was present throughout the Site at thicknesses ranging up to 23 feet.

Beneath approximately 25 feet of overburden cover of fill, clay, and till, the bedrock at the Site is known to be the Levanna Shale Member of the Middle Devonian Age Skaneateles Formation (Buehler and Tesmer 1963). The Levanna shall is described as a fissile shale dark gray or black near the bottom and lighter gray near the top. Some calcareous (limey) beds and some pyrite concretions are present within this shale member. The Levanna is reportedly 45 feet thick at Lake Erie and outcrops along the Lake Erie shore at Bayview and Hamburg town park.

The underlying shale typically produces relatively low quantities of groundwater in the range of 10 to 15 gallons per minute. Being located near the shore of Lake Erie, surface water is the source of water for all uses in the area.

Site Investigation Methods and Results

SECTION 2

2.1 Introduction

Field activities of the Site investigation were completed between January 9 and March 3, 2006. Tasks were conducted in accordance with the NYSDEC-approved Investigation Work Plan (Malcolm Pirnie, November 2005).

The Site investigation included the following field tasks:

- Site survey for creation of a to-scale Site base map with Site features, topography, and well and sample locations.
- Drilling and sampling of 20 soil borings.
- Installation, development, and sampling of seven groundwater monitoring wells.
- Excavation and sampling of 11 test pits.
- Groundwater Infiltration Testing.
- Collection and analysis of surface soil, subsurface soil/fill, solid waste, and groundwater samples for laboratory analysis.
- Completion of an XRF/analytical pilot study of the filter cake/flue ash pile.
- Hydraulic conductivity testing of the seven new groundwater monitoring wells.
- Water level measurement and mapping.

Detailed discussions of the purpose, methodologies, and results of each of the investigative activities completed are presented in the following subsections. Analytical results are presented and discussed in Section 5.0. Photographs of the Site were taken during the Site investigation field tasks, some of which are presented in Appendix A.

2.2 Site Survey and Base Map Preparation

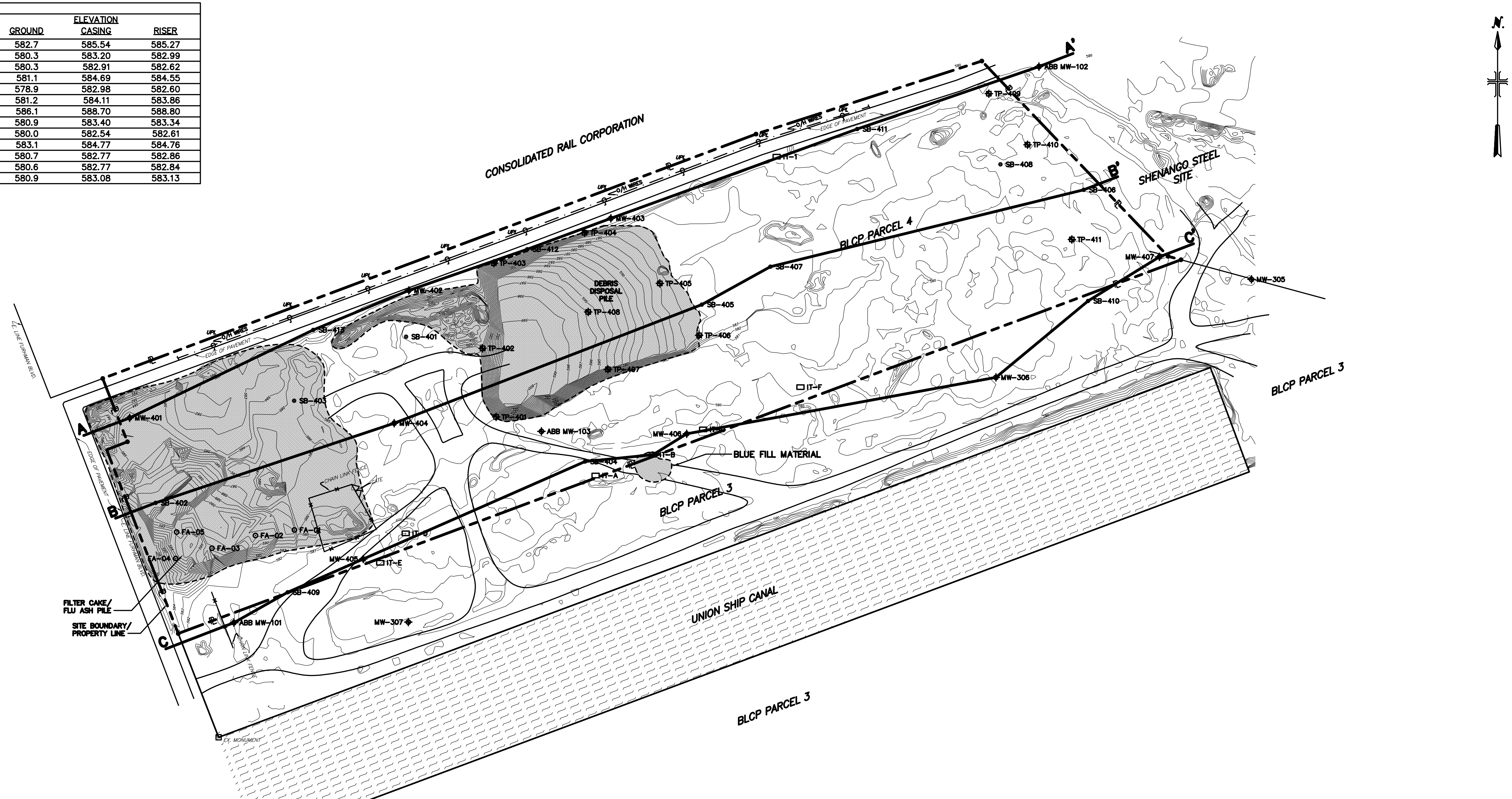
Wendel Duchscherer of Lockport, New York, performed a survey of the Site that included Site property boundaries, relevant Site features, and topography. This information was used to generate a Site base map that was used during the Site investigation. Ground control was established on Site that includes USGS vertical control and NY State Plane Coordinates for horizontal control. The base map developed for the Site, Figure 1-2, covers an area of approximately 20 acres. After completion of all investigation tasks, a second survey of the Site was completed to add well and sample locations to the base map.

2.3 Soil Boring Program

A soil boring program was conducted to establish the thickness and physical and chemical composition of the fill material present at the Site. Also investigated as part of the soil boring program were the type, distribution, and thickness of the various natural overburden materials present beneath the Site and the depth and composition of bedrock at the Site.

Twenty soil borings were advanced through unconsolidated overburden fill and soils using 4-¼-inch inside diameter (ID) hollow stem augers. Locations of the test borings are shown on Figure 2-1. The drilling rig used to complete the other test borings was provided and operated by a subcontractor to Malcolm Pirnie. At each test boring location, continuous two-inch outer diameter (OD) split-spoon samplers were used to collect soil cores which were screened with a photo ionization detector (PID) to obtain a qualitative estimate of total volatile organic compounds (VOCs) emitted from the subsurface soil/fill. The on-site Malcolm Pirnie geologist recorded the PID measurements, physical characteristics of the soil, depth to groundwater, and other notable conditions on Field Boring Log forms at each test boring location. The split spoon samplers were decontaminated prior to each use using a solution of Alconox and

LOCATIONS/ELEVATIONS: MONITORING WELLS:					
WELL NUMBER	LOCATION		ELEVATION		
	NORTHING	EASTING	GROUND	CASING	RISER
ABB-MW101	1033018.1	427533.9	582.7	585.54	585.27
ABB-MW102	1034017.1	428981.1	580.3	583.20	582.99
ABB-MW103	1033361.8	428086.7	580.3	582.91	582.62
MW-305	1033634.9	429363.1	581.1	584.69	584.55
MW-306	1033458.7	428903.8	578.9	582.98	582.60
MW-307	1033019.1	427847.4	581.2	584.11	583.86
MW-401	1033386.0	427346.5	586.1	588.70	588.80
MW-402	1033615.0	427848.4	580.9	583.40	583.34
MW-403	1033744.5	428211.5	580.0	582.54	582.61
MW-404	1033376.4	427822.1	583.1	584.77	584.76
MW-405	1033132.3	427766.4	580.7	582.77	582.86
MW-406	1033357.3	428347.9	580.6	582.77	582.84
MW-407	1033675.3	429197.6	580.9	583.08	583.13



LEGEND:

596	1' CONTOUR INTERVAL (MINOR)
595	5' CONTOUR INTERVAL (MAJOR)
PL	PROPERTY LINES
x	FENCE (TYPE NOTED)
A — A'	LINE OF GEOLOGICAL CROSS SECTION
	SITE ROADS (APPROXIMATE LOCATIONS)
	DISTINCT FILL AREAS
FA-05	FLU ASH SAMPLE LOCATION (5)
SB-413	SOIL BORING LOCATION (13)
MW-306	GROUNDWATER MONITORING WELL LOCATION (13)
IT-1	IFILTRATION TEST TRENCH (4)
TP-410	TEST PIT LOCATION (11)
IP	IRON PIN/PIPE

50 0 50 100
SCALE: 1" = 100'

NOTES:

1. HORIZONTAL DATUM: NAD 27 NEW YORK STATE PLANE COORDINATES, WEST ZONE, US SURVEY FEET
2. VERTICAL DATUM: NGVD29
3. UNDERGROUND UTILITIES AND STRUCTURES ARE SHOWN IN THEIR APPROXIMATE LOCATION AND MAY NOT BE SHOWN IN THEIR ENTIRETY VERIFICATION IS REQUIRED PRIOR TO CONSTRUCTION.
4. TOPOGRAPHIC INFORMATION SHOWN ON THIS MAP WAS SURVEYED AND PREPARED BY WENDEL DUCHSCHERER FROM FIELD DATA GATHERED BETWEEN JANUARY 25 & JANUARY 30, 2006.

FIGURE 2-1

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REVISIONS			
NO.	BY	DATE	REMARKS

DES
DWN
CKD

BUFFALO LAKESIDE COMMERCE PARK PARCEL 4 SITE

BUFFALO, NEW YORK

SAMPLE LOCATION MAP

DATE MARCH, 2006

G SHEET 2 OF X

CAD REF. NO. 4080G102

XREFS:F:\Projects\4080004\CADD\Xref\Wendel\4080BOR.dwg F:\Projects\4080004\CADD\Xref\Wendel\Union-Ship-BASE.dwg IMAGES:None
User:WELSHANS Spec:PIRNIE STANDARD File:F:\Projects\4080004\CADD\4080G102.DWG Scale:1:1 Date:05/12/2006 Time:10:40 Layout:Layout1

water followed by a clean potable water rinse. All soil borings not converted to monitoring wells were backfilled with the drill cuttings.

Borehole depths ranged from 14.0 feet to 29.3 feet below ground surface (bgs). A description of the geologic conditions encountered during the drilling program is provided in Section 3, and borehole logs with detailed overburden descriptions and other observations are provided in Appendix B. A summary of the total depths of each soil boring, as well as the fill thickness and intervals selected for analytical sampling are presented in Table 2-1.

2.4 Monitoring Well Installation and Development

Seven groundwater monitoring wells were installed during the Site investigation to provide hydrogeologic and water quality data at the Site. Groundwater samples and elevation data were collected from these seven new and five pre-existing wells on and near the Site.

Well installation activities were completed using standard well installation techniques. All monitoring wells were constructed of 2-inch ID, flush joint, Schedule 40 PVC, with 0.010-inch slotted screen a maximum of 10 feet in length. A silica sand filter pack was placed to approximately two feet above the top of the screened interval. A two-foot thick layer of bentonite chips was placed above the sand pack as a seal to prevent the downward infiltration of surface water. Approximately six inches of fine sand was placed on top of the bentonite seal and the remainder of the boring annulus was filled with cement/bentonite grout to grade. Monitoring wells were completed at the surface with three foot steel pro-casings, and a two-foot diameter round concrete drainage pad.

All monitoring wells were installed at the base of fill material. Total well depths range from 10 and 25 feet bgs. A summary of well construction details is presented in Table 2-2. Detailed well construction diagrams and borehole logs with geologic descriptions for the wells are presented in Appendix B.

The newly installed wells were developed to flush the well and sand pack of fine sediments, create wells that will yield water samples that are representative of the groundwater quality at that location, and to provide accurate measurement points for groundwater elevations. All wells were developed using a pre-cleaned centrifugal pump

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TABLE 2-1
SOIL BORING SUMMARY
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4 SITE
BUFFALO, NEW YORK

Boring No.	Date Drilled	Total Depth	Depth to Water	Maximum PID Reading/Depth Interval	Depth to Native Material	Depth the Bedrock	Sampled Interval (1)	Analyses	Comments
		(feet bgs)	*(feet bgs)*	*(ppm/feet bgs)*	*(feet bgs)*	*(feet bgs)*	*(feet bgs)*		
MW-401	01/09/06	20.0	16.0	0.0 ppm throughout	16.6	NA	8-10	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Peat at 17.5 feet.
MW-402	01/09/06	14.0	8.0	0.0 ppm throughout	8.0	NA	8-10'	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Peat at 10.5 feet
MW-403	01/10/06	14.0	2.0	0.7 at 12' -14'	12.6	NA	12.5-13	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Peat at 12.6'
MW-404	01/11/06	14.0	5.0	0.0 ppm throughout	10.0	NA	14-14.5	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
MW-405	01/11/06	25.0	2.0	0.0 ppm throughout	24.5	24.8	24.0 - 25.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, CN, and amenable CN	Till at 24.5' to 24.8'
MW-406	01/10/06	26.0	7.5	1.7 at 22.0 to 24.o'	24.5	26.0	24.5 - 25.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
MW-407	01/10/06	14.0	4.0	31.6 @ 12.0-12.5'	9.0	NA	2-2.5	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-401	01/12/06	16.0	4.0	0.0 ppm throughout	14.0	NA	14.14.5	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-402	01/12/06	24.0	11.5	0.0 ppm throughout	22.0	NA	11.5 - 12	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-403	01/12/06	18.0	12.0	0.0 ppm throughout	17.0	NA	11.0 - 12.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-404	01/16/06	25.0	4.0	0.0 ppm throughout	NA	25.0	8.0-10.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, CN, and amenable CN	
SB-405	01/17/06	16.0	6.0	0.0 ppm throughout	13.9	NA	8.0-9.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-406	01/13/06	12.0	5.0	21 ppm at 3.5 to 4.0'	9.7	NA	3.5 - 4.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-407	01/13/06	14.0	3.0	0.0 ppm throughout	13.7	NA	3.0-4.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Peat at 13.7'
SB-408	01/17/06	14.0	4.0	0.0 ppm throughout	10.0	NA	5.0-6.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Peat at 10.0
SB-409	01/16/06	25.4	10.0	0.0 ppm throughout	NA	25.2	10.0-11.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, CN, and amenable CN	
SB-410	01/17/06	29.1	18.0	0.0 ppm throughout	4.0	27.9	3.0-4.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Till at 27.1'
SB-411	01/19/06	29.3	16.0	0.0 ppm throughout	10.0	26.7	6.0-7.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Till @ 25.6'
SB-412	01/18/06	24.9	4.0	0.0 ppm throughout	13.0	24.9	2.0-4.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	
SB-413	1/18/2006	24.4	2	0.0 ppm throughout	12.0	24.0	12.0-13.0	VOCs, SVOCs, Pesticides, PCBs, TAL Metals, and CN	Till at 23.8'

Notes:

-1 In addition to a subsurface soil/fill sample, a surface soil sample was collected at each boring locatin from the 0-0.5' depth and analyzed for Pahs, PCBs, metals, and cyanide.

bgs - below ground surface

ppm - parts per million

VOCs = Volatile Organic Compounds

SVOCs = Semivolatile Organic Compounds

TAL = Target Analyte List

CN = Cyanide

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TABLE 2-2
SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS
SITE INVESTIGATION REPORT
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4 SITE
BUFFALO, NEW YORK

Well No.	Screen Diam. *(in)*	Slot Size *(in)*	Well Material	Borehole Diameter *(in)*	Borehole Depth *(ft bgs)*	Screened Interval *(ft bgs)*	Date Installed
MW-401	2	0.010	PVC	8.5	20.0	8.0 - 18.0	1/9/2006
MW-402	2	0.010	PVC	8.5	14.0	7.0 - 12.0	1/9/2006
MW-403	2	0.010	PVC	8.5	14.0	3.5 - 13.5	1/10/2006
MW-404	2	0.010	PVC	8.5	14.0	7.0 - 12.0	1/11/2006
MW-405	2	0.010	PVC	8.5	25.0	15.0 - 25.0	1/11/2006
MW-406	2	0.010	PVC	8.5	26.0	15.0 25.0	1/10/2006
MW-407	2	0.010	PVC	8.5	14.0	4.5 - 9.5	1/10/2006

Notes:
bgs - below ground surface.

Created by: JR Date: 04/03/2006
Checked by: Date:

attached to dedicated polyethylene tubing. Groundwater evacuated from each well during development was monitored for pH, specific conductivity, temperature, dissolved oxygen, Eh, and turbidity. Development water was discharged at the ground surface. Well Development/Purging Logs are included in Appendix C.

2.5 Test Pit Excavation and Sampling

Two areas of the Site were investigated with a backhoe to obtain visual observations of the fill material and to test specific chemical contents of the fill.

Debris Disposal Pile

The Debris Disposal Pile was tested for pesticides at eight test pit locations. A backhoe was used to excavate into the face of this raised fill mound at six perimeter locations of the pile. Two additional locations were excavated through the top surface of this large ramp-like feature. Contents of the soil/fill mound were logged and one sample per test pit was collected and submitted for Toxicity Characteristic Leaching Procedure (TCLP) pesticides analysis. No pesticides were detected in any of these samples.

Eastern Site Perimeter

The Shenango Steel site, located adjacent and to the east of the Parcel 4, is a known source of PCB contamination. To determine of PCBs from the Shenango Steel site were impacting the Parcel 4 Site, three test pits (TP-409 through TP-411) were excavated along the eastern end of the Site and sampled for total PCBs. PCBs were not detected in any of the samples collected at these eastern locations.

Test pit logs are provided in Appendix B.

2.6 Groundwater Infiltration Testing

A groundwater infiltration test was performed using a trench located near the eastern end of the northern Site road (IT-1). A second test was planned along the western end of the southern Site boundary but hard fill conditions prevented excavation to sufficient depth at six test location attempts (IT-A through IT-F), see Figure 2-1.

The objective of the groundwater infiltration test was to estimate the rate at which groundwater would need to be pumped during future construction activities that require subsurface excavation.

The trench used was excavated to a depth of 10 feet, a width of 7 feet and a length of 12 feet. Water naturally filled the trench to a depth of 2.0 feet below grade (8 feet of standing water). A 4" diameter water hose connected to a pump was lowered to the bottom of the trench. The pump removed the water from the trench at a measured rate of 300 gallons per minute (GPM) while the water level was recorded at regular time intervals. This pumping and measurement continued for two hours at which time the water in the trench had been lowered by 3.4 feet (4.6 feet of standing water). Using the data collected during the test the groundwater infiltration rate is calculated at 23.54 gallons per minute per foot of (7-feet wide) trench length. Results will vary across the Site because of the high degree of heterogeneity of the subsurface soil/fill. See Appendix D for field data and calculations.

2.7 Environmental Sampling Program

The environmental sampling program for Parcel 4 included the collection and analysis of samples from surface soil, subsurface soils/fill, solid waste, and groundwater.

Samples were collected and handled in accordance with the NYSDEC- approved Site Investigation Work Plan. Samples were submitted under chain-of-custody to Chemtech Laboratories, Inc. in Mountainside, New Jersey for analysis. Third-party validation of the analytical results was performed by Data Validation Services, Inc. of North Creek, New York. Data validation and usability is discussed in Section 4.0 and the validation report is presented in Appendix E along with the analytical data forms for each sample analyzed. Post-validation analytical results are presented and discussed in Section 5. Information pertaining to the sample collection methods used and the number of samples collected for each media is provided in the following sections.

2.7.1 Surface Soil/Fill Samples

One surface soil sample was collected at each of the 20 soil boring locations. Each surface soil sample was collected from the uppermost portion of the first (0-2') split spoon sample and submitted under chain of custody to the off-site laboratory for analysis of PAHs, PCBs, metals, and cyanide. Section 5.2 provides a discussion of the analytical results of the surface soil samples.

2.7.2 Subsurface Soil/Fill Samples

One subsurface soil/fill sample was collected from each of the 20 soil borings at the depth exhibiting the greatest evidence of potential contamination, or directly above the saturated zone where no evidence of contamination was observed.

Analytical results for the subsurface soil/fill samples are discussed in detail in Section 5.3, Site Contaminant Characterization.

2.7.3 Solid Waste Samples

A blue colored fill material was encountered at the central area of the southern Site boundary during the excavation of an infiltration test trench. This material appeared to consist of wood chips and was not found anywhere else on Site during the SI. A backhoe was used to further delineate the lateral and vertical extent of the material. The blue fill material was found to be continuous over an area of approximately 60 feet in diameter and of generally uniform thickness of 6 to 12 inches located one foot below grade. A sample of the blue fill material was submitted for analysis of SVOCs, pesticides, PCBs, Metals, cyanide, and amenable cyanide. Analytical results for this sample are discussed in detail in Section 5.3, Site Contaminant Characterization.

2.7.4 Groundwater Samples

The seven new and five pre-existing groundwater monitoring wells were sampled to characterize the groundwater quality at the Site. Groundwater samples were collected from the monitoring wells one week following well development. A water level indicator was used to measure the water table elevation at each monitoring well. Each well was then purged using a centrifugal pump with new and dedicated polyethylene tubing. The evacuated groundwater was periodically measured for the pH, conductivity, temperature, turbidity, dissolved oxygen, and redox potential. Upon stabilization of these parameters, groundwater samples were collected using the dedicated polyethylene bailers. Samples were collected for TCL VOCs, SVOCs, PCBs, and pesticides, and TAL metals plus total cyanide analyses.

A total of 12 groundwater samples plus a field duplicate, a rinsate blank, and a matrix spike (MS), and matrix spike duplicate (MSD) were collected. Well Purging and Sampling Logs are included in Appendix C. Analytical results for the groundwater samples are discussed in detail in Section 5.4, Site Contaminant Characterization. Based on the analytical results of the groundwater samples, two wells that yielded water with elevated total cyanide were resampled on January 4, 2007 for total cyanide and free cyanide.

2.8 Pilot Test for Field Analysis of Lead

A pilot test was performed on ash material collected from the filter cake/flue ash pile to determine the accuracy of a field measurement tool that can be used to measure the content of total lead in soils or other solids. Specifically, the pilot test was to determine if X-ray fluorescence (XRF) would produce reasonably accurate quantification of total lead in the ash during possible removal actions.

Five near-surface samples of the flue ash (FA-01 through FA-05) were collected from the 0.5 to 1.0 foot depth interval. Each sample was brought to an indoor location and allowed to equilibrate to room temperature. Each sample was placed in a zip-sealed plastic bag and was measured using the XRF gun five times for a period of 1 minute each. The five readings were recorded and averaged. A portion of each of the five samples was then placed into new glass sample jars and sent off-site for laboratory measurement of total lead. Results of the XRF and laboratory measurements of total lead in the flue ash samples are presented in Table 2-3. As seen on Table 2-3 and Figure 2-2, the correlation between the field screening results and the results from the analytical laboratory indicates that the field screening method would likely not provide the level of accuracy needed during remedial action thus requiring alternative on-site or off Site analysis of all samples.

2.9 Hydraulic Conductivity Testing

In-situ hydraulic conductivity tests were conducted to determine the hydraulic conductivity of the fill overburden in which the monitoring wells were completed.

Tests were conducted in all seven newly installed groundwater-monitoring wells. Hydraulic conductivity testing consisted of performing rising-head slug tests with the

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TABLE 2-3
XRF PILOT STUDY ANALYTICAL RESULTS
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Sample Location / Sampling Depth (ft. bgs)(1) / Collection Date	UNITS	NYSDEC TAGM 4046 (2) TCLP Limit (3)	Urban Background Concentrations(4)	FA-01 (0.5 - 1.5) 1/27/2006		FA-02 (0.5 - 1.5) 1/27/2006		FA-03 (0.5 - 1.5) 1/27/2006		FA-04 (0.5 - 1.5) 1/27/2006		FA-05 (0.5 - 1.5) 1/27/2006	
Inorganics / TAL Metals (mg/kg)													
Total Lead	mg/Kg	400	200 - 500	***4440***		***11000***		***1940***		***1470***		***2490***	
TCLP Lead (mg/L)													
TCLP Lead		5		0.86		11.7		1.51		0.61		0.85	
Lead - XRF Pilot Study													
Lead		400 (6)	200 - 500	2,998	65	4,924	90	1,508	39	1,731	45	1,862	46
		400 (6)	200 - 500	3,102	69	4,718	87	1,443	38	1,487	41	1,640	43
		400 (6)	200 - 500	2,955	66	4,578	83	1,496	39	1,428	43	1,775	45
		400 (6)	200 - 500	3,018	Avg	4,740	Avg	1,482	Avg	1,549	Avg	1,759	Avg

Shaded and framed concentrations exceed TAGM values.
Bold/Italic values exceed upper limits of background concentrations.

(1) Sample depths in parentheseis ( ) represent depths of grab sample for VOC analysis.
(2) New York State Dept. of Environmental Conservation TAGM 4046, Recommended Soil Cleanup Objectives, Dec. 2000.
(3) Target Compound Leaching Procedure limit, above which is considered hazardous.

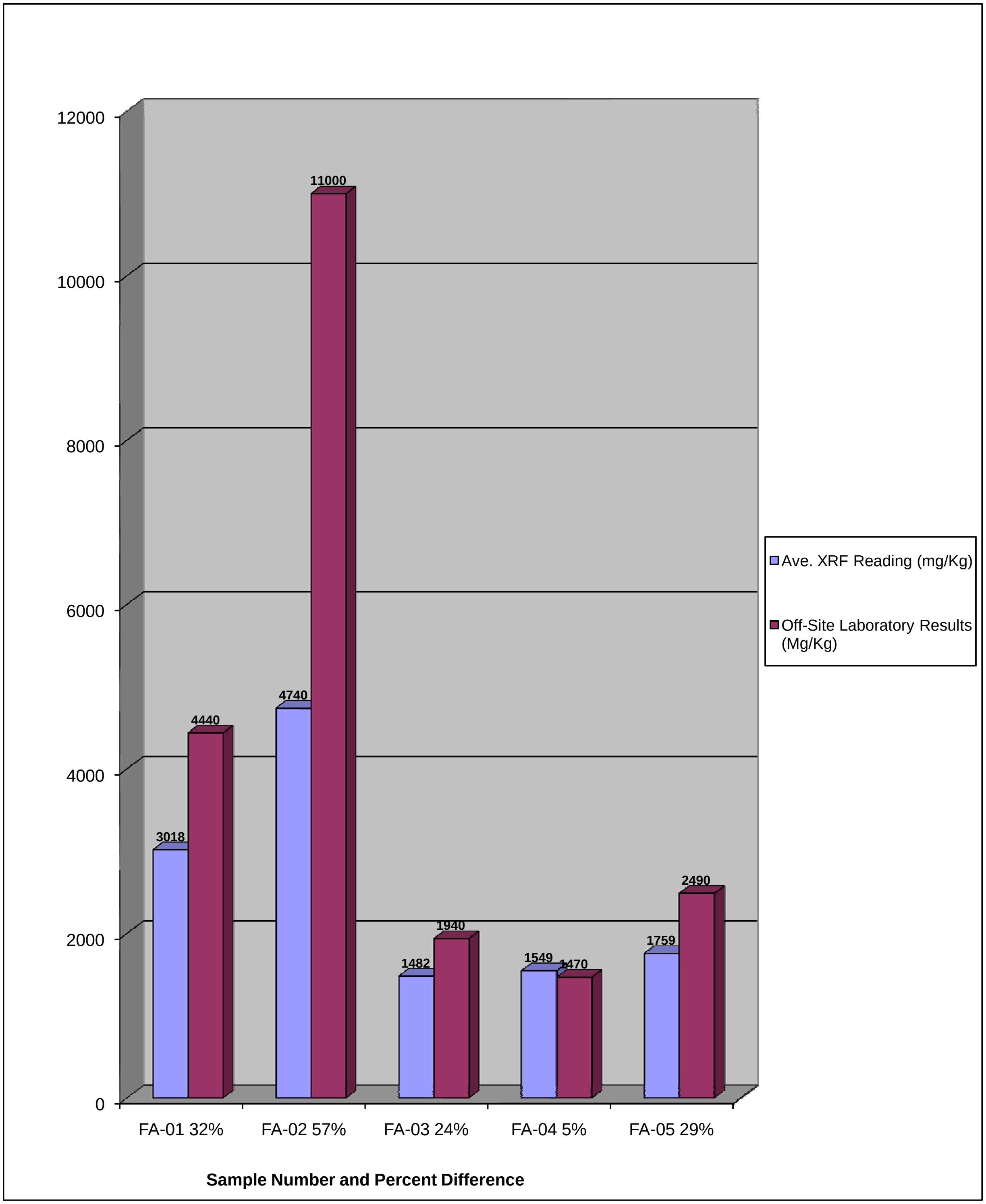
(4) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000.

NR - Not analyzed

Created by: BW Date: 05/16/2005
Checked by: MM Date: 07/07/2005

FIGURE 2-2

XRF PILOT STUDY RESULTS



resultant change in water levels recorded with a pressure transducer and data logger. The rising-head data for all wells monitoring unconfined groundwater conditions were analyzed using the methods of Hvorslev (Hvorslev, M.J., 1951).

Hydraulic conductivity measurements determined for the monitoring wells are presented and summarized in Appendix D.

All seven of the new wells are completed in heterogeneous fill material and, thus, are not representative of the natural overburden soils on Site and composition and hydraulic conductivity can change over a short distance. Slug test data indicate that hydraulic conductivity of the fill material is generally high with a geometric mean hydraulic conductivity of 3.39×10^{-3} cm/s. See Table 2-4 and Appendix D for backup data.

2.10 Groundwater Elevation Measurement and Mapping

Groundwater levels were measured as part of the groundwater sampling task on February 7 and 8, 2006. Depth-to-water measurements were determined to the nearest 0.01 foot from the top of the PVC well riser using an electronic water level indicator. Following the completion of the Site survey, all water levels were converted to elevation measurements in units of feet above mean sea level.

An equipotential map of the shallow overburden water table was prepared using these data. A discussion of groundwater flow directions and water levels is presented in Section 3.3, Site Hydrogeology. A tabulated summary of the water level data is provided in Table 2-5.

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TABLE 2-4

SUMMARY OF HYDRAULIC CONDUCTIVITY VALUES
SITE INVESTIGATION REPORT
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4 SITE
BUFFALO, NEW YORK

Monitoring Well Number	Lithology Monitored	Well Screen Interval (Depth Below Grade)	Hydraulic Conductivity (cm/s)	
MW-401	Fill Overburden	8.0 - 18.0		4.40E-03
MW-402	Fill Overburden	7.0 - 12.0		4.90E-04
MW-403*	Fill Overburden	3.5 - 13.5		
MW-404 *	Fill Overburden	7.0 - 12.0		
MW-405	Fill Overburden	15.0 - 25.0		7.10E-03
MW-406	Fill Overburden	15.0 - 25.0		7.10E-04
MW-407	Fill Overburden	4.5 - 9.5		4.10E-02
			Geometric Mean (Overburden)	**3.39E-03**

Notes:

Depths are in units of feet below ground surface (bgs).
** - No data available due to nearly instant recovery.*
All wells are completed in heterogeneous fill material.

TABLE 2-5
GROUNDWATER ELEVATIONS - FEBRUARY 7 and 8, 2006
SITE INVESTIGATION REPORT
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4 SITE
BUFFALO, NEW YORK

Well No.	PVC Riser Elev. (ft AMSL)	Water Level (ft BTOR)	Groundwater Elev. (ft AMSL)
ABB-MW-101	585.54	5.75	579.79
ABB-MW-103	582.91	3.01	579.90
MW-305	584.69	8.60	576.09
MW-306	582.98	4.94	578.04
MW-307	584.11	4.50	579.61
MW-401	588.70	9.12	579.58
MW-402	583.40	3.42	579.98
MW-403	582.54	3.00	579.54
MW-404	584.77	4.75	580.02
MW-405	582.77	3.68	579.09
MW-406	582.77	5.64	577.13
MW-407	583.08	5.00	578.08

Notes:
AMSL - Above Mean Sea Level
BTOR - Below Top of Riser

Hydrogeologic Evaluation

SECTION 3

3.1 Introduction

This hydrogeologic evaluation was prepared based on information obtained from published geologic reports, previous environmental Site investigation reports, and field data collected as part of the 2006 Site Investigation (SI).

Although several investigations have been performed that included Parcel 4, these investigations encompassed the entire Hanna Furnace Site and only limited work was performed on Parcel 4. The 2006 SI is the first investigation to focus solely on Parcel 4.

The SI included the following tasks that provided useful hydrogeologic information pertaining to the Site:

- Drilling and sampling of 20 soil borings
- Excavation and sampling of 11 test pits.
- Installation of seven new overburden groundwater monitoring wells.
- Measurement and mapping of groundwater elevations collected from the seven new and five existing monitoring wells on and near the Site.
- Hydrogeologic (Slug) testing of the seven new monitoring wells.
- Surveying and mapping of topographic contours of the Site.

Monitoring well and sample locations are illustrated on Figure 2-1.

3.2 Site Geology

Overall the Site can be characterized as having a 25 to 30 feet thick cover of natural and man-made overburden materials over a relatively flat shale bedrock surface.

Overburden

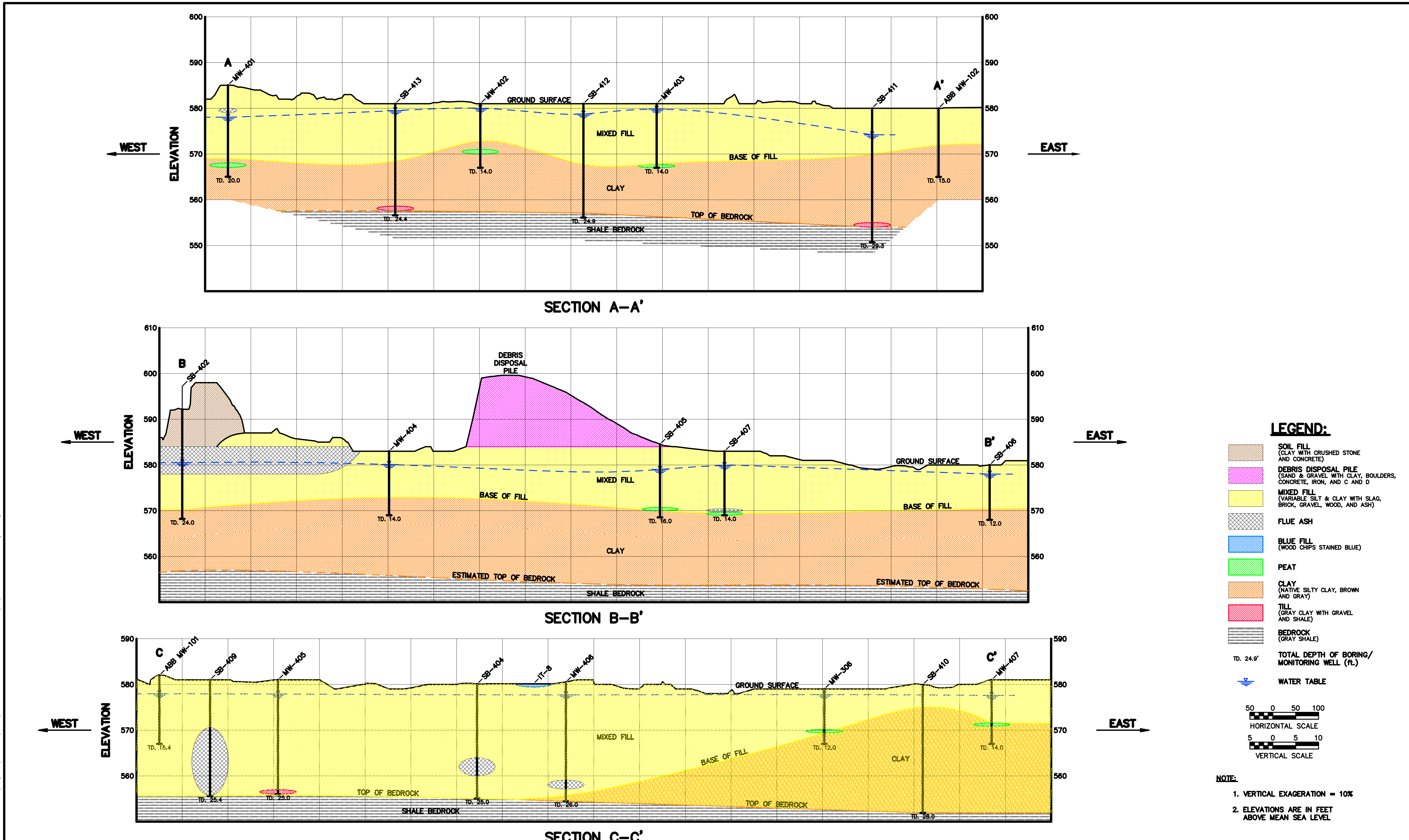
A variety of natural and man-made overburden materials cover the entire Parcel 4 Site. Natural overburden materials encountered include, in ascending order, till, clay, and peat. Man-made fill materials encountered include; mixed soil/fill, the debris disposal pile, flue ash, and blue fill. The composition and distribution of each overburden unit is variable as described below and depicted on three geologic cross sections, presented on Figure 3-1.

The natural overburden units are described in ascending order as follows:

Till – glacial till was encountered directly above the bedrock at three boring locations (MW-405, SB-411, and SB-413). Five other borings were drilled to bedrock and did not encounter till. Where present, the till unit was composed of gray clay with sand, gravel, and shale rock fragments. Thickness of the till ranged from 0.2 to 1.1 feet.

Clay – brown and gray native, silty-clay was encountered in all soil borings except those where no native material was encountered from surface to bedrock, (in the southwestern portion of the Site), see Figure 3-1. The elevation of the top of the clay unit was approximately at or slightly above 570’ above mean sea level (AMSL). The maximum encountered thickness of the clay unit was 23 feet (SB-410) but it typically ranged between 15 and 20 feet in thickness.

Peat – A thin layer of peat was encountered on or near the top of the clay unit at seven borehole locations, see Figure 3-1. The peat was a dark brown to black organic humus and ranged in thickness from 0.1 to 0.5 feet. Since much of the area of the Site is known to have been marshland prior to filling activities, the peat layer was the youngest (uppermost) natural material encountered at the Site. Thus, where peat is present and



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BUFFALO LAKESIDE COMMERCE PARK
PARCEL 4

BUFFALO, NEW YORK

FIGURE 3-1
GEOLOGICAL CROSS SECTIONS

covered with fill material it is an indication that excavation of the native materials was not performed prior to filling at that location.

The man-made fill overburden units are described as follows:

Soil/Fill – The deepest and most prevalent fill unit encountered is designated as mixed soil/fill. This unit varied in composition, typically consisting of disturbed soil, and other natural materials mixed with concrete, iron, brick, wood and ash. This soil/fill unit was present at every soil boring location on Site. The thickness of this unit ranged from approximately 10 feet to 25 feet where it was the exclusive overburden unit in the southwestern portion of the Site, see Figure 3-1.

Debris Disposal Pile – The most noticeable Site feature is referred to as the debris disposal pile. This feature is a fill mound that forms a large ramp-like feature in the approximate center of the Site. The footprint area of the debris disposal pile is approximately two acres and its elevation rises from Site grade at its eastern edge to approximately 15 feet at its western edge where a steep cliff face is present. The contents of the debris disposal pile were observed at its western cliff face and at eight test pit locations and are described as mostly sand and gravel with clay, boulders, concrete, scrap iron, and various construction and demolition debris. Adjacent to the northwestern end of the debris disposal pile is an irregular shaped mound of hard fill which was observed to be composed of soil, rock, and concrete, see Figure 2-1.

Filter Cake/Flue Ash – A large pile of black filter cake/flue ash is located at the western end of the Site. This material is black, fine-grained, homogenous ash waste. The pile covers an area approximately 3.5 acres and is as high as 15 feet above grade at one location. Much of the flue ash in this pile is covered with either excavation spoils (the northwestern area of the pile) that was brought to the Site from a supermarket construction project in the City of Buffalo or with vegetated soil/fill (the northeastern corner of the pile). This same ash material was also encountered in the mixed soil/fill elsewhere on Site in three soil borings outside of the flue ash pile (SB-404, MW-406, and SB-409), see Figure 3-1.

Excavation Spoils – As mentioned above, soil fill from a supermarket construction site in the City of Buffalo covers some of the filter cake/flue ash pile. This material was brought to the site after Parcel 4 was accepted into the ERP program and without NYSDEC approval. The excavation spoils are composed of clay with crushed stone and concrete.

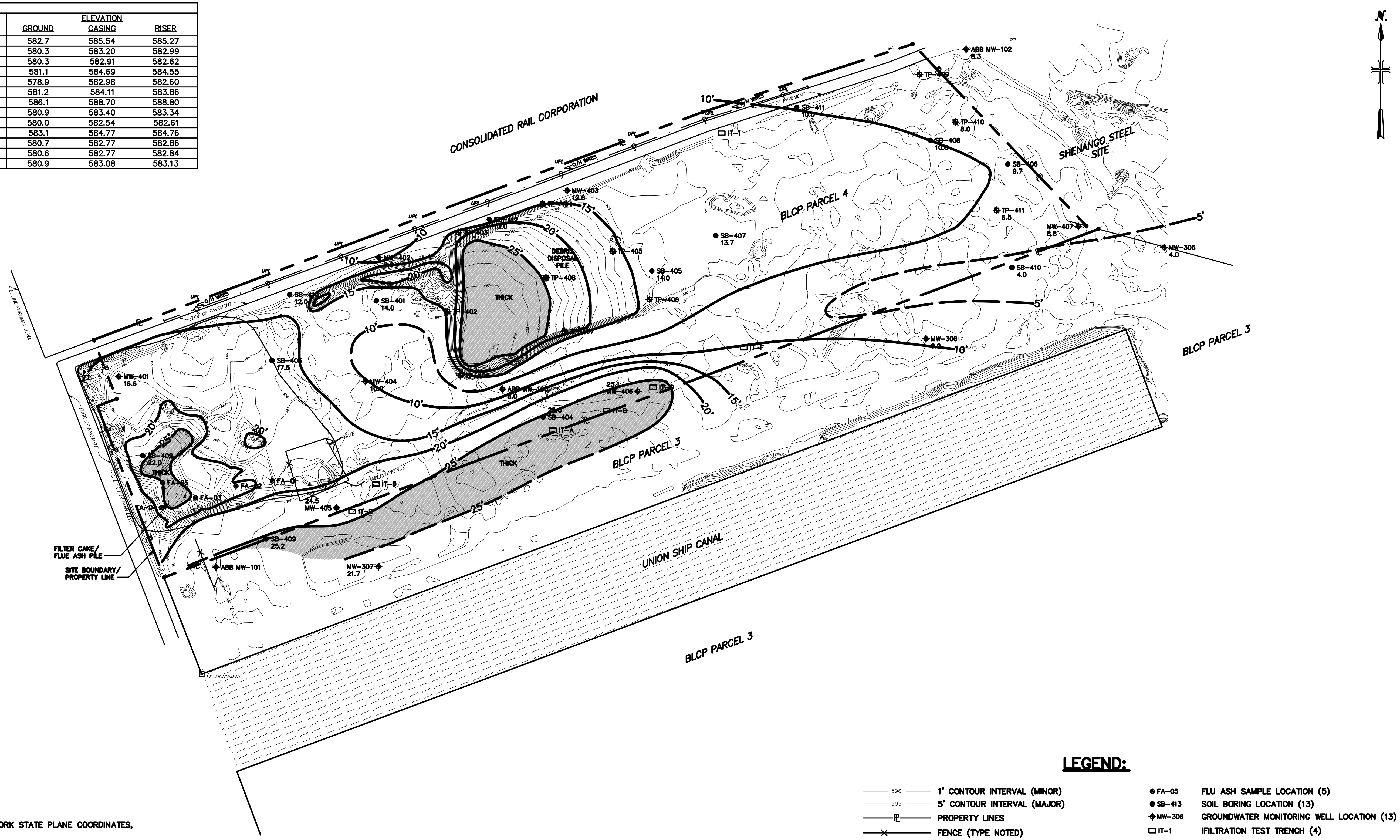
Blue Fill – A distinct blue-colored fill material was encountered in one area on Site at the approximate center of the southern Site boundary, at infiltration test trench (IT-B). The blue fill was composed of admixed soil and wood chips measuring approximately 1/8 to ¼ inch in size and stained a deep blue color. The fill material was approximately six inches thick and was buried approximately one foot below grade. The extent of this blue fill was delineated with trenches and is illustrated on Figure 2-1. As illustrated, most of the blue fill is actually located on Parcel 3. Based on similar findings identified at other steel manufacturing sites in the City of Buffalo as well as the physical and chemical composition of this material, the blue fill material is believed to be a waste product from a manufactured gas plant in which wood chips were used in the purifying process. The process results in elevated levels of cyanide in the wood chips.

As illustrated on the geologic cross sections, Figure 3-1, most of the fill units encountered are limited in aerial extent with only the mixed fill apparently present throughout the entire Site. The total thickness of fill ranged from as thin as less than five feet (in the southeast corner of the Site) to as much as an estimated 29 feet on top of the debris disposal pile, see Figure 3-2. A second area of maximum fill thickness is present along the western side of the southern Site boundary. This area is not raised above grade as in the case of the debris disposal pile but fill was encountered from grade to bedrock. This may be the result of excavation/filling related to the construction of the nearby Union Ship Canal.

Geotechnical Analysis

Samples were collected from both the native and non-native overburden materials for geotechnical characterization. Twelve samples were collected from five borings along the northern and southern Site boundary to provide geotechnical information at areas likely to be used for Site roads as part of the final Site redevelopment plan. A thirteenth sample was collected from the filter cake/flue ash pile to characterize the flue ash.

LOCATIONS/ELEVATIONS: MONITORING WELLS:					
WELL NUMBER	LOCATION		ELEVATION		
	NORTHING	EASTING	GROUND	CASING	RISER
ABB-MW101	1033018.1	427533.9	582.7	585.54	585.27
ABB-MW102	1034017.1	428981.1	580.3	583.20	582.99
ABB-MW103	1033361.8	428086.7	580.3	582.91	582.62
MW-305	1033634.9	429363.1	581.1	584.69	584.55
MW-306	1033458.7	428903.8	578.9	582.98	582.60
MW-307	1033019.1	427847.4	581.2	584.11	583.86
MW-401	1033386.0	427346.5	586.1	588.70	588.80
MW-402	1033615.0	427848.4	580.9	583.40	583.34
MW-403	1033744.5	428211.5	580.0	582.54	582.61
MW-404	1033376.4	427822.1	583.1	584.77	584.76
MW-405	1033132.3	427766.4	580.7	582.77	582.86
MW-406	1033357.3	428347.9	580.6	582.77	582.84
MW-407	1033675.3	429197.6	580.9	583.08	583.13



LEGEND:

596	1' CONTOUR INTERVAL (MINOR)
595	5' CONTOUR INTERVAL (MAJOR)
—PL—	PROPERTY LINES
—x—	FENCE (TYPE NOTED)
20'	FILL THICKNESS CONTOUR LINE WITH THICKNESS IN FEET (DASHED WHERE INFERRED)
● FA-05	FLU ASH SAMPLE LOCATION (5)
● SB-413	SOIL BORING LOCATION (13)
◆ MW-306	GROUNDWATER MONITORING WELL LOCATION (13)
▭ IT-1	IFILTRATION TEST TRENCH (4)
✦ TP-410	TEST PIT LOCATION (11)
○ IP	IRON PIN/PIPE

50 0 50 100

NOTES:

1. HORIZONTAL DATUM: NAD 27 NEW YORK STATE PLANE COORDINATES, WEST ZONE, US SURVEY FEET
2. VERTICAL DATUM: NGVD29
3. UNDERGROUND UTILITIES AND STRUCTURES ARE SHOWN IN THEIR APPROXIMATE LOCATION AND MAY NOT BE SHOWN IN THEIR ENTIRETY VERIFICATION IS REQUIRED PRIOR TO CONSTRUCTION.
4. TOPOGRAPHIC INFORMATION SHOWN ON THIS MAP WAS SURVEYED AND PREPARED BY WENDEL DUCHSCHERER FROM FIELD DATA GATHERED BETWEEN JANUARY 25 & JANUARY 30, 2006.

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05/06 4080F003-2

BUFFALO LAKESIDE COMMERCE PARK
PARCEL 4

BUFFALO, NEW YORK

FIGURE 3-2

THICKNESS OF FILL MAP

Table 3-1 provides a summary of the geotechnical analytical results of the 13 samples and Figure 2-1 provides the locations of the borings from which the samples were collected. The samples were analyzed for grain size, hydrometer, atterberg limits, moisture content, and organic content. Five of the 13 samples were of the natural clay. These clay samples were analyzed for all the same tests as the fill samples with the addition of unconfined compressive strength. Appendix E contains the analytical results of the geotechnical analyses as provided by the geotechnical laboratory.

The eight fill samples were variable in composition and therefore the analytical results differed significantly from one sample to the next, see Table 3-1. The analytical results of the clay samples however were somewhat similar. With the exception of one of the clay samples which had approximately 27% sand and gravel, the clay samples contained over 90% silt and clay. Organic mater was measured at an average of 1.9%, moisture content averaged 24.2%, liquid limit ranged from 35 to 45, plastic limit ranged from 18 to 20, plasticity index ranged from 16 to 25 and unconfined compressive strength ranged from 6.67 to 36.0 and averaged 20.75.

Bedrock

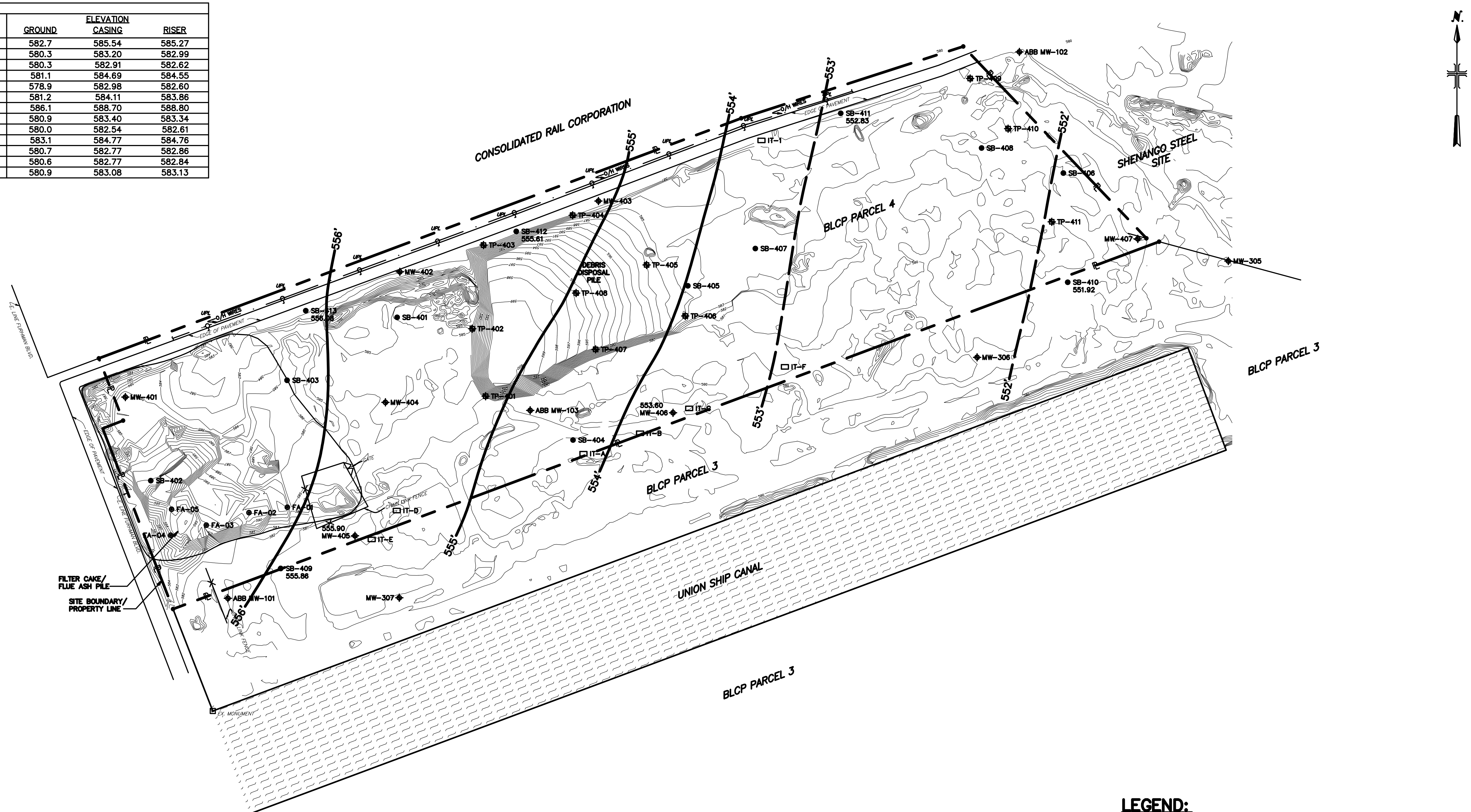
Soil borings were advanced to bedrock refusal at seven locations along the north and south Site boundaries. Bedrock was observed in split spoon samples to be dark gray shale. This rock unit is reportedly the Levanna member of the Middle Devonian Skaneateles Formation. Depth to bedrock ranged from approximately 24 to 28 feet below grade. The natural dip of the bedrock in the area is to the south/southeast at approximately 50 feet per mile. Elevations of the bedrock surface were mapped to show a general slope toward the east/southeast at a slope of 0.32 feet vertical per 100 feet horizontal, see Figure 3-3.

3.3 Site Hydrogeology

Seven groundwater monitoring wells were installed in the overburden as part of the SI and groundwater elevations were measured from these seven new wells as well as five existing wells on and near the Site. Groundwater was encountered at depths between one and seven feet on Site with the shallowest groundwater found along the northern Site boundary and adjacent to the south side of the debris disposal pile where standing water

LOCATIONS/ELEVATIONS: MONITORING WELLS:

WELL NUMBER	LOCATION NORTHING	LOCATION EASTING	ELEVATION GROUND	ELEVATION CASING	ELEVATION RISER
ABB-MW101	1033018.1	427533.9	582.7	585.54	585.27
ABB-MW102	1034017.1	428981.1	580.3	583.20	582.99
ABB-MW103	1033361.8	428086.7	580.3	582.91	582.62
MW-305	1033634.9	429363.1	581.1	584.69	584.55
MW-306	1033458.7	428903.8	578.9	582.98	582.60
MW-307	1033019.1	427847.4	581.2	584.11	583.86
MW-401	1033386.0	427346.5	586.1	588.70	588.80
MW-402	1033615.0	427848.4	580.9	583.40	583.34
MW-403	1033744.5	428211.5	580.0	582.54	582.61
MW-404	1033376.4	427822.1	583.1	584.77	584.76
MW-405	1033132.3	427766.4	580.7	582.77	582.86
MW-406	1033357.3	428347.9	580.6	582.77	582.84
MW-407	1033675.3	429197.6	580.9	583.08	583.13



NOTES:

1. HORIZONTAL DATUM: NAD 27 NEW YORK STATE PLANE COORDINATES, WEST ZONE, US SURVEY FEET
2. VERTICAL DATUM: NGVD29
3. UNDERGROUND UTILITIES AND STRUCTURES ARE SHOWN IN THEIR APPROXIMATE LOCATION AND MAY NOT BE SHOWN IN THEIR ENTIRETY VERIFICATION IS REQUIRED PRIOR TO CONSTRUCTION.
4. TOPOGRAPHIC INFORMATION SHOWN ON THIS MAP WAS SURVEYED AND PREPARED BY WENDEL DUCHSCHERER FROM FIELD DATA GATHERED BETWEEN JANUARY 25 & JANUARY 30, 2006.

LEGEND:

- 596 — 1' CONTOUR INTERVAL (MINOR)
- 595 — 5' CONTOUR INTERVAL (MAJOR)
- PROPERTY LINES
- FENCE (TYPE NOTED)
- 555' — BEDROCK SURFACE STRUCTURE CONTOURS IN UNITS OF FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)
- FA-05 FLU ASH SAMPLE LOCATION (5)
- SB-413 SOIL BORING LOCATION (13)
- MW-306 GROUNDWATER MONITORING WELL LOCATION (13)
- IT-1 IFILTRATION TEST TRENCH (4)
- TP-410 TEST PIT LOCATION (11)
- IP IRON PIN/PIPE

50 0 50 100

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BUFFALO LAKESIDE COMMERCE PARK
PARCEL 4

BUFFALO, NEW YORK

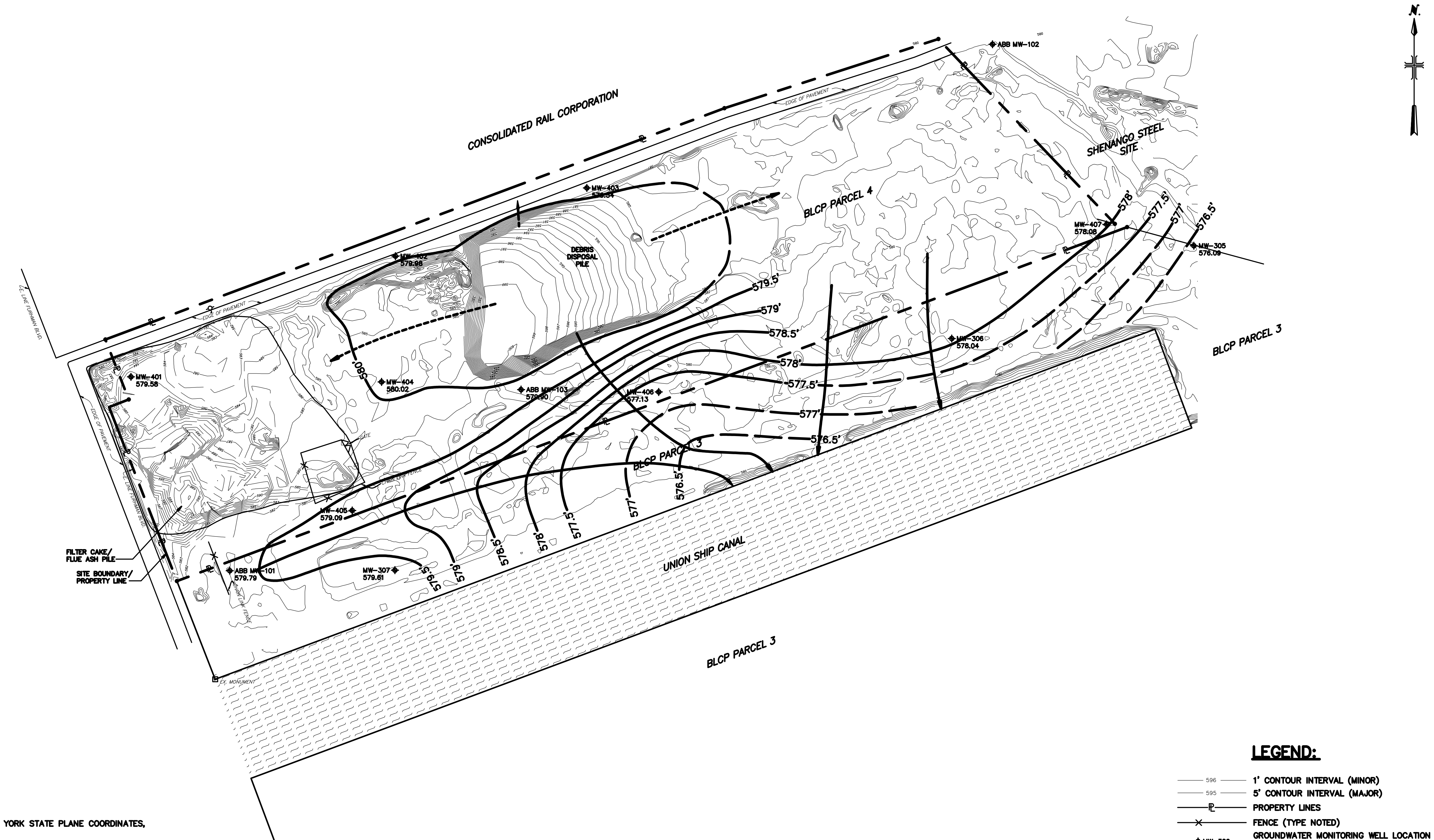
FIGURE 3-3

TOP OF BEDROCK
STRUCTURE CONTOUR MAP

TABLE 3-1
SUMMARY OF GEOTECHNICAL ANALYTICAL RESULTS
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4 SITE
BUFFALO, NEW YORK

			Percent Components									
Sample	**Sample Depth (feet bgs)**	**Field Description**	**Gravel**	**Sand**	**Silt**	**Clay**	**Organic Matter**	**Moisture Content**	**Liquid Limit**	**Plastic Limit**	**Plasticity Index**	**Unconfined Compressive Strength (psi)**
SB-409	5.0 - 6.0	Porous slag	**32.5%**	**27.2%**	**14.6%**	**25.7%**	**2.5%**	**19.9%**	**41**	**26**	**15**	
SB-409	18.5- 19.5	Black ash	**12.6%**	**55.0%**	**31.0%**	**1.4%**	**11.1%**	**112.7%**	**-**	**NP**	**non-plastic**	
SB-411	6.0 - 8.0	Fill - silt,clay, crushed stone	**44.6%**	**31.2%**	**11.4%**	**12.8%**	**2.1%**	**19.7%**	**29**	**24**	**5**	
SB-411	20.5 - 22.0	Clayey silt	**14.6%**	**36.8%**	**27.0%**	**21.6%**	**0.9%**	**19.7%**	**20**	**14**	**6**	
SB-411	26.0 - 26.7	Till	**27.8%**	**48.5%**	**13.0%**	**10.7%**	**1.8%**	**10.9%**	**25**	**14**	**11**	
SB-412	8.0 - 10.0	Fill - black slag and ash	**47.7%**	**44.5%**	**5.5%**	**2.3%**	**4.3%**	**27.7%**	**-**	**NP**	**non-plastic**	
SB-413	6.0 - 8.0	Brick and slag	**54.1%**	**32.5%**	**10.0%**	**3.4%**	**6.2%**	**29.9%**	**-**	**NP**	**non-plastic**	
FLUE ASH	0.5 - 1.0	Flue Ash	**4.9%**	**48.7%**	**40.3%**	**6.1%**	**12.5%**	**28.2%**	**-**	**NP**	**non-plastic**	
SB-410	6.0 - 8.0	Clay	**0.8%**	**9.0%**	**47.0%**	**43.2%**	**2.3%**	**23.5%**	**36**	**18**	**18**	**20.10**
SB-410	20.0-22.0	Clay	**0.5%**	**1.6%**	**50.0%**	**47.9%**	**1.7%**	**28.8%**	**35**	**19**	**16**	**10.98**
SB-411	14.0 16.0	Clay	**0.0%**	**0.8%**	**43.5%**	**55.7%**	**1.8%**	**24.0%**	**43**	**19**	**24**	**36.20**
SB-412	14.0 - 16.0	Clay	**0.0%**	**1.4%**	**37.2%**	**61.4%**	**2.1%**	**23.5%**	**45**	**20**	**25**	**29.80**
SB-413	20.0 - 22.0	Clay	**10.4%**	**16.5%**	**26.3%**	**46.8%**	**1.5%**	**21.2%**	**40**	**19**	**21**	**6.67**

is present. Groundwater elevations measured on February 7 and 8, 2006 were mapped to show the flow directions and horizontal gradient of the water table. As shown on Figure 3-4, the water table beneath the Site flows generally southward over the entire Site except in the raised area of the debris disposal pile where there is localized radial flow. Between the Site and the Union Ship canal to the south the groundwater appears to be influenced by the canals north wall. North of the western half of the north canal wall, where the wall is intact, the groundwater flows parallel to the canal towards the east until it reaches the eastern end of the canal where the wall is weathered and somewhat absent. In this area the groundwater discharges southward into the canal, see Figure 3-4. As further discussed in Section 2.9, the seven new groundwater monitoring wells were slug tested to determine the hydraulic conductivity of the fill material in which each well is screened. Although the composition of the fill material varied between each the wells, the hydraulic conductivity of the fill was generally high with a geometric mean value of 2.76×10^{-3} cm/sec.



LEGEND:

- 596 — 1' CONTOUR INTERVAL (MINOR)
- 595 — 5' CONTOUR INTERVAL (MAJOR)
- PROPERTY LINES
- FENCE (TYPE NOTED)
- MW-306 578.04 — GROUNDWATER MONITORING WELL LOCATION WITH GROUNDWATER ELEVATION MEASURED ON 2/7/2006 AND ON 2/8/2006
- ISOPOTENTIAL CONTOUR (DASHED WHERE INFERRED)
- GROUNDWTAER FLOW DIRECTION

50 0 50 100

NOTES:

1. HORIZONTAL DATUM: NAD 27 NEW YORK STATE PLANE COORDINATES, WEST ZONE, US SURVEY FEET
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4. TOPOGRAPHIC INFORMATION SHOWN ON THIS MAP WAS SURVEYED AND PREPARED BY WENDEL DUCHSCHERER FROM FIELD DATA GATHERED BETWEEN JANUARY 25 & JANUARY 30, 2006.

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BUFFALO LAKESIDE COMMERCE PARK PARCEL 4

BUFFALO, NEW YORK

FIGURE 3-4

SHALLOW GROUNDWATER ISOPOTENTIAL CONTOUR MAP

Data Validation/Usability

SECTION 4

All sample analyses were performed by Chemtech of Mountainside, New Jersey.

Judy Harry of Data Validation Services, a qualified data validator, performed third-party validation of the analytical results from the laboratory. The data validation was conducted according to the guidelines established by the NYSDEC's Data Usability Summary Review (DUSR) process. The DUSR process was performed to provide a determination of whether the data meets the project specific criteria for data quality and data use.

Laboratory data summary forms were reviewed by the validator for application of validation qualifiers, per the USEPA Region 2 validation SOP's and the USEPA National Functional Guidelines for Data Review, with consideration of the requirements of the project QAPP. The following items were reviewed:

- Laboratory narrative discussions
- Case narratives
- Custody Documentation
- Holding times
- Surrogate and internal standard recoveries
- Matrix spike recoveries/duplicate correlations
- Field duplicate correlations
- Preparation/calibration blanks
- Matrix spiked blanks/laboratory control samples
- Instrumental tunes
- Calibration/CRI/CRA standards
- ICP interface checks standards

- ICP serial dilution correlations
- Method compliance
- Sample result verification

A single Data Review Report was prepared for all sample analysis groups per analytical fraction and is attached to this report as Appendix E. The Data Review Report provides copies of the laboratory analytical results and descriptions of the criteria used to review the laboratory results and supporting quality control documentation.

4.1 Summary

While a few data points were rejected, overall, the majority of the data were deemed usable by the data validator. Exceptions to this were mostly due to sample matrix effects and/or high pH. The following were deemed as not useable; some or all of the volatile results of four samples, semivolatile results for three aqueous and two soil samples. It is likely that re-collection and processing of these samples would not result in more useable results. The usability of the data, as assessed by the data validator is summarized by analytical fraction in the following sections. All data summary tables in Section 5 and related discussions and conclusions present and use analytical results that have been validated. Full complete validation results see the full Data Summary Report (DUSR) in Appendix E.

4.2 Volatiles

Results for four soil field samples and one duplicate soil sample were rejected due to unacceptable surrogate recovery. The samples include MW-401B (8-10), MW-405B (24-25), SB-403 (11-12), SB-404B (8-10) and MW-000B-Dup. Non-detected analyte results were rejected (qualified R) and detected values were qualified as estimated (J).

The following detections were edited to reflect non-detection due to presence in associated blanks:

- All acetone and methylene chloride qualified as “B’ by the lab.
- Ethylbenzene and M.P-xylenes in two samples in delivery group X1166.

- 2-butanone, cyclohexane, and xylenes in samples reported in delivery group X1240.

Acetone results for trip blank samples TB011306 and TB11706 are not useable due to recoveries below 10% in the associated matrix spike blank. Therefore, low level acetone detections in associated samples should be used with caution as being potential external contamination.

Several other VOC sample detections were qualified as estimated (“J”) for various reasons. For specific explanations of these and complete results of the validation effort, see Appendix E.

4.3 Semivolatiles

The semivolatile results that report no detection in samples MW-402 and MW-405 are not useable due to surrogate recoveries below 10% for acid base/neutrals. Detections were qualified as estimated with possible very low biases. These samples have a pH of 12 which indicates a matrix that is hostile to acidic compounds and to mostbase/neutrals.

Similarly, the results for acid compounds (phenolics) reporting no detection are also not useable in MW-401 due to very low acid surrogate recoveries. The results for all of the base/neutral compounds and for detected phenolics in this sample were qualified as estimated, with a very low bias due to recoveries between 10 and 15%.

Detections of bis(2-ethylhexyl)phthalate in the aqueous samples re edited to reflect non-detection due to presence in the associated method and rinse blanks.

Several other SVOC sample detections were qualified as estimated (“J”) for various reasons. For specific explanations of these and complete results of the validation effort, see Appendix E.

4.4 Pesticides and PCBs

The result for Aroclor 1016 in sample SB-405A (0-0.5') was incorrectly reported as a detection due to a transcription error at the laboratory. This result has been edited to reflect non-detection.

The results for aroclors in sample MW-405 are not usable due to very low surrogate DCB recovery. The baseline responses for his sample shows very high matrix interface.

The results of for Aroclors 1016, 1121, 1232 and for a-BHC, g-BHC, heptachlor, and aldrin in sample Bluefill-01 are not useable due to a large matrix interface.

Results for all Aroclors in TP-410 and for pesticides in SB-401B (14-14.5) are not useable due to a large matrix interface.

Several other pesticides and PCB sample detections were qualified as estimated ("J") for various reasons. For specific explanations of these and complete results of the validation effort see Appendix E.

4.5 Metals and Cyanide

Zinc was incorrectly reported as not detected on the initial report forms for SB-403A (0-0.5) and SB-402B (11.5-12). The dilution analysis results were entered onto the report forms during validation.

Results for the elements initially flagged as "OR" by the laboratory were edited by the validator to reflect the dilution analysis.

Several other metals and cyanide sample detections were qualified as estimated ("J") for various reasons. For specific explanations of these and complete results of the validation effort, see Appendix E.

4.6 Other Validation Comments

Many of the tentatively identified compounds (TICS) reported by the laboratory had identifications that are inaccurate.

Site Contaminant Characterization

SECTION 5

5.1 Introduction

The nature and extent of contamination at the BLCP Parcel 4 Site was characterized through collection and analysis of surface soil/fill, subsurface soil/fill, solid waste, and groundwater. Sample locations are shown on Figure 2-1. Sampling methodologies were performed in accordance with the NYSDEC and NYSDOH-approved Remedial Investigation Work Plan (Malcolm Pirnie, Inc., November 2004). Sampling protocols and methodologies are described in Section 2.0 of this report for each sampled media. All samples analyzed were submitted under chain-of-custody to Chemtech of Mountainside, NJ. Analytical services were performed in accordance with the most current SW-846 analytical methods and protocols. Appendix E contains analytical data forms with validation results for each sample analyzed. Analytical summary tables (Tables 5-1, through 5-3) provided in this section include only those parameters for which a value greater than the laboratory detection limit was found in a minimum of one sample. Sampling locations for all media sampled are illustrated on Figure 2-1. A summary of samples collected by media is as follows:

- 20 Surface soil/fill samples – collected from soil/monitoring well borings.
- 31 Subsurface soil/fill samples – 20 from the same 20 soil borings as were the surface soil/fills sampled and one from each of 11 test pits "(TP-401 through TP-408 collected from the Debris Disposal Pile)"
- Six waste samples - five from the filter cake/flue ash pile, and one from a layer of blue fill encountered during the excavation of infiltration test trenches.
- 12 groundwater samples – seven from monitoring wells installed during this investigation and five from on-site or near-site wells that were installed during previous investigations.

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TABLE 5-1
SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL/FILL SAMPLES
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Sample Location	SCO Restricted Commercial Values	Urban Background Concentrations[2][3]	MW401A	MW402A	MW403A	MW-404A	MW-[illegible]-DUP (MW-404)	MW-405A	MW406A	MW407A
Depth (ft bgs)			(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)
Collection Date			1/9/2006	1/9/2006	1/10/2006	1/11/2006	1/11/2006	1/11/2006	1/10/2006	1/10/2006
PAHs - Method 8270 (ug/kg)										
Acenaphthene	500,000	-				520 J	520 J			2300 J
Anthracene	500,000	N/A				1400 J	1400 J			1100 J
Benzo(a)anthracene	5,600	169 -59,000			2200	3300	3300		540	9200
Benzo(a)pyrene	1,000	165 - 220			***3800***	***2900***	***2900 J***		64 J	***21000***
Benzo(b)fluoranthene	5,600	15,000 - 62,000		51 J	4500	4100	4100 J		220 J	20000
Benzo(g,h,i)perylene	500,000	900 - 47,000			2300	1200 J	1200 J			16000
Benzo(k)fluoranthene	56,000	300 - 26,000				1400 J	1400 J			5800
Chrysene	56,000	251 - 640			***2800***	***2900***	***2900***		***3100 D***	***9800***
Dibenz(a,h)anthracene	560	-								930 J
Fluoranthene	500,000	200 - 166,000			2000	7200	7200		1300	10000
Fluorene	500,000	-				560 J	560 J			
Indeno(1,2,3-cd)pyrene	5,600	8,000 - 61,000			1700 J	1200 J	1200 J			13000
Naphthalene	500,000	-				390 J	390 J			
Phenanthrene	500,000	N/A		120 J		5300	5300		270 J	4000 J
Pyrene	500,000	145 - 147,000			2400	6400	6400		220 J	10000
TICs		N/A								
Total PAHs		N/A	0	171	21,700	38,770	38,770	0	5,714	123,130
Total BaP Equivalent[4]		N/A	0	5	4,668	3,803	3,803	0	171	26,306
PCBs - Method 8082 (ug/kg)										
Aroclor-1254	1,000	N/A	99 PJ	78 PJ						
Total PCBs		N/A	99	78						
Inorganics / TAL Metals (mg/kg)										
Aluminum		33,000	10500 J	6140 J	7200 J	8620	7760	6800	4200 J	6300 J
Antimony		N/A	15.1 N*J	118 N*J			20.7 NJ	124 NJ		11.2 N*J
Arsenic	16	3-12 **	***21.2 NJ***	***27.4 NJ***	2.56 NJ	7.51 N	7.38 NJ	***12.2 NJ***	4.39 NJ	10.5 NJ
Barium	400	15-600	103 NJ	75.8 NJ	14.8 NJ	155 NJ	152 NJ	87.7 NJ	39.4 NJ	79.9 NJ
Beryllium	590	0-1.75	1.46 NJ	1.44 NJ	0.159 NJ	0.701 J	0.764 J	1.31 J	0.715 NJ	0.737 NJ
Cadmium	9.3	0.1-1	***5.26 NJ***					***1.59 NJ***		***1.24 NJ***
Calcium		130 - 35,000 **	***60000 J***	31800 J	1240 J	***51400 J***	***44600 J***	***70800 J***	***203000 DJ***	***57600 J***
Chromium	400	1.5 - 40 **	***54.4 NJ***	18 NJ	8.41 NJ	36.2 NJ	38.1 NJ	***67.6 NJ***	9.44 NJ	***196 NJ***
Cobalt		2.5 - 60 **	7.32 NJ	10.2 NJ	0.488 NJ	5.03 NJ	5.06 NJ	5.85 NJ	1.18 NJ	6.43 NJ
Copper	270	1 - 50	***124 NJ***	49.4 NJ	6.02 NJ	***75.7***	***91.8***	***121***	27 NJ	***261 NJ***
Cyanide	27	N/A	6.05	8.76		3.23	1.42	6.92	7.125	8.48
Iron		2,000 - 550,000	109000 J	217000 D	7990 J	36100 J	50600 J	87700 J	28100 J	107000 J
Lead	1,000	200 - 500	***1610 J***	258 J	7.31 J	331 J	467 J	***776 J***	88.2 J	244 J
Magnesium		100 - 5,000	***11600 J***	***7120 J***	535 J	***13300 J***	***10400 J***	***13400 J***	***38200 J***	***6510 J***
Manganese	10,000	50 - 5,000	3820	7570	115	1020	1460	2000	1240	***11200 D***
Mercury	2.8	0.001 - 0.2	0.089 N*	0.036 N*		***0.25 NJ***	***0.354 NJ***	0.05 NJ	0.027 N*	***0.232 N****
Nickel	310	0.5 -25	***27 NJ***	8.57 NJ	2.3 NJ	18.7 NJ	19.8 NJ	***49.4 NJ***	4.36 NJ	***41.9 NJ***
Potassium		8,500 - 43,000 **	2220 NJ	917 NJ	591 NJ	2860 J	1950 J	1540 J	798 NJ	1080 NJ
Selenium	1,500	0.1 - 3.9	3.18 N							
Silver	1,500	N/A	21.3 NJ	37.4 NJ	1.27 NJ	8.5 N*J	14.8 N*J	29.7 N*J	3.96 NJ	21.1 NJ
Sodium		6,000 - 8,000	327 NJ		58.7 NJ	364 NJ	337 NJ	371 NJ	424 NJ	253 NJ
Thallium		N/A	3.52 N				0.833 NJ	3.55 NJ		
Vanadium		1-300	28.5 NJ	17.8 NJ	7.27 NJ	18.4 J	18.7 J	20.5 J	5.8 NJ	47.7 NJ
Zinc	10,000	9-50	***846***	***921***	7.53	***389 N***	***606 N***	***1040***	***258***	***950***

Sample Location	SB-401A	SB-402A	SB-403A	SB-404A	SB-405A	SB-406A	SB-407A	SB-408A	SB-409A	SB-410A	SB-411A	SB-412A	SB-413A
Depth (ft bgs)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)	(0 - 0.5)
Collection Date	1/12/2006	1/12/2006	1/12/2006	1/16/2006	1/17/2006	1/13/2006	1/13/2006	1/17/2006	1/16/2006	1/17/2006	1/19/2006	1/18/2006	1/18/2006
PAHs - Method 8270 (ug/kg)													
Acenaphthene							90 J					130 J	
Anthracene	860 J	180 J										79 J	
Benzo(a)anthracene	1900 J	320 J		320 J	70 J	1500	360 J	150 J				79 J	
Benzo(a)pyrene	***1500 J***	***240 J***		***250 J***	120 J	***2300***	***720***	***240 J***			***680***	***1000***	
Benzo(b)fluoranthene	2100	320 J	56 J	350 J	150 J	3000	680	310 J			950	1200	
Benzo(g,h,i)perylene	610 J			96 J		1000	500	120 J			250 J	420 J	
Benzo(k)fluoranthene	670 J			97 J		1000						140 J	
Chrysene	***1700 J***	270 J		210 J		***2000***	460				600	***730***	
Dibenz(a,h)anthracene						70 J	82 J						
Fluoranthene	4800	750 J	80 J	660		1600	400 J				560	680	
Fluorene													
Indeno(1,2,3-cd)pyrene	710 J			68 J		850	460	80 J			170 J	310 J	
Naphthalene													
Phenanthrene	3300	800 J	78 J	510		290 J	190 J				130 J	320 J	
Pyrene	3800	710 J	78 J	700	100 J	1700	420	200 J			700	820	
TICs													
Total PAHs	21,950	3,590	292	3,261	440	15,310	4,362	1,100	0	0	4,040	5,908	0
Total BaP Equivalent[4]	1,995	307	6	327	142	2,935	957	294	0	0	798	1,168	0
PCBs - Method 8082 (ug/kg)													
Aroclor-1254	99 PJ		41										
Total PCBs	99		41		160								
Inorganics / TAL Metals (mg/kg)													
Aluminum	8830	10700	5320	7140 J	6890 J	4300 J	7020 J	4680 J	3180 J	1640 J	8740 J	6060 J	7320 J
Antimony		26.4 NJ	137 NJ		92.3 N*J		127 NJ	9.05 N*J	50.4 N*J	80.5 N*J	14.6 NJ	135 NJ	262 NJ
Arsenic	8.18 N	7.05 NJ	***14.3 NJ***	3.6 N	11.4 N*J	2.7	7.3	6.31 N*J	7.78 N*J	10.1 N*J	6.21	11.9	***20.4***
Barium	240 NJ	119 NJ	64.3 NJ	59.2 J	83.2 J	20.3 J	100 J	46.4 J	26.8 J	34.9 J	66.7 N*J	83.5 N*J	122 N*J
Beryllium	0.767 J	0.779 J	1.1 J	1.36 J	1.35 J	0.201 J	1.45 J	0.64 J	0.83 J	0.432 J	1.22 J	0.98 J	1.54 J
Cadmium		0.402 NJ	***6.89 NJ***	0.515 NJ	***1.02 N***	0.066 J	***5.74***		0.676 N		0.158 NJ	***1.09 N***	***6.86 N***
Calcium	***57500 J***	***60100 J***	25800 J	***199000 DJ***	***50500 J***	3670 J	***54900 J***	13100 J	***39200 J***	18400 J	29800 J	28100 J	43200 J
Chromium	22.6 NJ	21.6 NJ	***184 NJ***	10.2 J	***88.1 J***	9.11 J	***42.9 J***	***42.8 J***	22.3 J	4 J	8.13 NJ	***56.9 NJ***	***93.7 NJ***
Cobalt	5.6 NJ	6.39 NJ	7.24 NJ	0.921 J	6.5 J	1.17 J	4.99 J	4.31 J	3.77 J	6.03 J	2.19 J	5.69 J	6.84 J
Copper	42.8	44.1	***239***	26.4 N	***156 N***	12.9	***80.6***	***57.6 N***	41.9 N	11.6 N	15.1 N	***158 N***	***165 N***
Cyanide	0.939	12	4.53	17	5.85		3.22	2.86	8.34			4.69	3.94
Iron	30000 J	29100 J	190000 DJ	19300 J	107000 J	15600 J	92600	59100 J	51600 J	105000 J	13100 J	83200 J	129000
Lead	376 J	358 J	***1590 J***	61.6 J	281 J	27.9 J	***6300 J***	120 J	328 J		45.9 N*J	297 N*J	***1420 N*J***
Magnesium	***17200 J***	***14400 J***	***5950 J***	***29300 NJ***	***7910 NJ***	826 J	***16900 J***	3330 NJ	***7330 NJ***	***9970 NJ***	***5080 NJ***	***6110 NJ***	***9040 NJ***
Manganese	880	955	2810	1310 NJ	3360 NJ	481 NJ	2190 NJ	1830 NJ	1350 NJ	***150000 DJ***	567 J	3690 J	***5790 J***
Mercury	***0.573 NJ***	***0.278 NJ***	0.165 NJ	***0.211***	0.077	0.049 N	0.08 NJ	0.067	0.103	0.026	0.04	0.14	0.086
Nickel	23.6 NJ	19.1 NJ	***48.7 NJ***	7.29	***42***	3.56 J	16.8	***25.9***	20.7		9.76	***57.3***	***57.6***
Potassium	1950 J	2100 J	693 J	912 N	1320 N	407 J	1040	636 NJ	503 NJ	194 NJ	935	1240	1010
Selenium			***12.6 NJ***	0.92 NJ	1.82 N	1.15 NJ	3.56 NJ	2.94 N	1.78 N	1.69 N	0.678 NJ	0.698 NJ	0.866 NJ
Silver	6.22 N*J	6.42 N*J				2.52 NJ	13.9 NJ					4.41 J	5.63 J
Sodium	331 NJ	216 NJ	441 NJ	324 NJ	260 NJ	93.7 NJ	382 NJ	58.3 NJ	193 NJ	34.7 NJ	309 NJ	296 NJ	204 NJ
Thallium			4.98 NJ						0.681 J				4.03
Vanadium	23.5 J	21.8 J	20.6 J	6.18 J	20.3 J	4.96 J	12.2 J	13.2 J	17.1 J	17.5 J	3.46 J	19.3 J	15.8 J
Zinc	***360 N***	***459 N***	4910 N	***417 J***	***717 J***	***76 NJ***	***379 NJ***	***327 J***	***475 J***	14.7 J	***64.7 J***	***706 J***	

Created by: MM/JH Date: 03/06/2006
Checked by: JJR Date: 03/10/2006

MALCOLM PIRNIE

TABLE 5-1
SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL/FILL SAMPLES
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Notes:

Blank space indicates analyte was not detected.

-- Indicates sample was not analyzed for this parameter.

Shaded and framed concentrations exceed SCO values.

Bold/Italic values exceed upper limits of urban background concentrations.

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.

(1) 6 NYCRR subpart 375-6 soil cleanup objectives for restricted commercial use, Dec. 2006.

(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000.

(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S. and other), Toxicological Profile for PAHs, US Dept. of Health and Human Services, August 1995.

(4) Total BaP equivalent - Benzo (a) pyrene equivalent is calculated by multiplying the following individual PAH concentrations by their multiplier (#) and summing the results. Benzo (a) pyrene (1.00); Dibenzo (a,h) anthracene (1.00); Benzo (a) anthracene (0.10); Benzo (b) fluoranthene (0.10); Ideno (1,2,3-cd) pyrene (0.10); Benzo (k) fluoranthene (0.01); Chrysene (0.01).

(5) USEPA Region 3 Soil Screening Level.

*** New York State background concentration.*

**** - The Soil Cleanup Objective refers to the sum of these compounds.*

Data Qualifiers

U - The compound was not detected at the indicated concentration.

D - Indicates result from secondary dilution run.
J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than zero. The concentration given is an approximate value.

B - The analyte was found in the laboratory blank as well as the sample. This indicates possible laboratory contamination of the environmental sample.

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%.

** - For dual column analysis, the lowest quantitated concentration is being reported due to coeluting interference.*

Created by: MM/JH Date: 03//062006
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MALCOLM PIRNIE

TABLE 5-2
SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL/FILL SAMPLES
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Sample Location / Depth (ft bgs) / Collection Date	SCO Restricted Commercial Values	Urban Background Concentrations[(2)(3)]	MW401B 8 - 10 1/9/2006	MW402B 8 - 10 1/9/2006	MW403B 12.5 - 13 1/10/2006	MW-404B (11 - 12) 1/12/2006	MW-405B (24 - 25) 1/11/2006	MW-000B-DUP (MW-405B) 1/11/2006	MW406B 24.5 - 25 1/10/2006	MW407B 2 - 2.5 1/10/2006	SB-401B (14 - 14.5) 1/12/2006	SB-402B (11.5 - 12) 1/12/2006	SB-403B (11 - 12) 1/12/2006	SB-404B (8 - 10) 1/16/2006	SB-405B (8 - 9) 1/17/2006	SB-406B (3.5 - 4) 1/13/2006	SB-407B (3 - 4) 1/13/2006	SB-408B (5 - 6) 1/17/2006	SB-409B (10 - 11) 1/16/2006	SB-410B (3 - 4) 1/17/2006	SB-411B (6 - 7) 1/19/2006	SB-412B (2 - 4) 1/18/2006	SB-413B (12 - 13) 1/18/2006	BLUEFILL-01 (0.5 - 1) 1/19/2006
VOCs - Method 8260 (ug/kg)																								
1,2-Dichlorobenzene		N/A											4.8 J											
2-Butanone		N/A			26 J	38 J			61 J		87 J				27 JB		120 J							
Acetone		N/A	67 J		220											330								
Benzene	44,000	N/A		17 J						3.4 J		22 J												
Carbon Disulfide		N/A			29 J	51 J	15 J	17 J	110		31 J				23 J				34					
Cyclohexane		N/A	50 J						20 J												100 J	130 J	110 J	
Ethyl Benzene		N/A							5.3 J	4.2 J			3.4 J								18 J	31 J		
Methyl Acetate		N/A																						
Methylcyclohexane		N/A	50 J								5.8 J											230 J	190 J	
Methylene Chloride		N/A			25 JB					30 JB														
Toluene	390,000	N/A								5.6 J		28 J				20 J					23 J	34 J	20 J	
m/p-Xylenes	500,000	N/A	8.6 J										17 J								140 J	260 J	110 J	
o-Xylene	500,000	N/A	6 J						5.4 J			3.4 J	14 J								37 J	58 J	26 J	
Total Xylenes		N/A	14.6	0	0	0	0	0	5.4	0	0	3.4	31	0	0	0	0	0	0	0	177	318	136	0
TICs		N/A	1345	550		160	34	90	6650		770		2680			3390	12200				2920	400	1759	
Total VOCs		N/A	1526.6	567	300	249	49	107	6851.7	43.2	893.8	53.4	2719.2	0	50	3740	12320	0	34	0	3238	1143	2215	0
SVOCs - Method 8270 (ug/kg)																								
1,1-Biphenyl		N/A																				82 J		
2-Methylnaphthalene		N/A	160 J								290 J					210 J								
3+4-Methylphenols		N/A		98 J																				
4-Nitrophenol		N/A																						
Acenaphthene	500,000	N/A	110 J								250 J			82 J	120 J			100 J						
Anthracene	500,000	N/A	380 J								450 J	83 J		280 J								81 J		
Benzo(a)anthracene	5,600	169 -59,000	280 J		310 J					240 J	540 J	150 J		630	310 J			750				83 J		1300 J
Benzo(a)pyrene	1,000	165 - 220			***420 J***					***260 J***	***370 J***	90 J		***400 J***	***610 J***		71 J	***1100 J***						780 J
Benzo(b)fluoranthene	5,600	15,000 - 62,000	250 J		490					410 J	450 J	250 J		590 J	650 J		76 J	1400 J				88 J		1300 J
Benzo(g,h,i)perylene	500,000	900 - 47,000			220 J					100 J	270 J			150 J	340 J			440						
Benzo(k)fluoranthene	56,000	300 - 26,000									190 J			160 J	210 J			530 J						
bis(2-Ethylhexyl)phthalate		N/A							120 J															
Carbazole		N/A									260 J													
Chrysene	56,000	251 - 640	460 J		390 J					270 J	430 J	250 J		500	200 J			***880***				130 J		
Dibenz(a,h)anthracene	560	N/A																120 J						1500 J
Dibenzofuran		N/A									330 J			160 J										
Fluoranthene	500,000	200 - 166,000	800 J		290 J					370 J	1600	310 J		1300	200 J		72 J	710				120 J	95 J	3200
Fluorene	500,000	N/A	290 J								470 J													
Indeno(1,2,3-cd)pyrene	5,600	8,000 - 61,000			200 J						270 J	72 J		130 J	210 J		69 J	270 J						
Isophorone		N/A																						
Naphthalene	500,000	N/A	140 J								1300					230 J								3200
Nitrobenzene		N/A																						
Pentachlorophenol		N/A																						16000
Phenanthrene	500,000	N/A	1100 J		130 J				840 J	240 J	2100	270 J		1400								180 J	140 J	3400
Phenol		N/A		170 J																				
Pyrene	500,000	145 - 147,000	910		330 J					460	1300	270 J		1200	410 J			960				140 J	98 J	2000 J
TICs		N/A	15,000	3,210	2,779	7,500	1,160	1,000	9,680	2,302	19,720	3,830	2,030	3,249	3,020			6,770	3,121	1,400	2,200	3,840	10,360	43,700
Total SVOCs		N/A	19880	3478	5559	7500	1160	1000	10640	4652	30590	5575	2030	10231	6280	440	288	14030	3121	1400	2200	4744	10693	76380
Total BaP Equivalent[(4)]		N/A	57.6	0	523.9	0	0	0	0	327.7	502.2	139.7	0	541.6	731.1	0	85.5	1476.1	0	0	0	18.4	0	2540
PESTICIDES - Method 8081 (ug/kg)																								
All Pesticides		N/A	56	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
Endosulfan I	200	-	56 PJ																					
Endrin	89	-										4.7 PJ												
Endrin aldehyde		-										2.3 J												
PCBs - Method 8082 (ug/kg)																								
Aroclor-1254		N/A	520 PJ																			43 PJ		
Aroclor-1260		N/A										140												
Total PCBs		N/A	520	0	0	0	0	0	0	0	0	140	0	0	0	0	0	0	0	0	0	43	0	0
Inorganics / TAL Metals (mg/kg)																								
Aluminum		33,000	21000 J	12800 J	15300 J	10100	9050	10100	14300 J	5820 J	12500	9060	18800	6850 J	4380 J	8650 J	7150 J	3480 J	8930 J	8110 J	12600 J	11500 J	12400 J	40.3 J
Antimony		N/A			84.6 N*J		27.1 NJ			121 N*J		249 NJ		6.13 N*J	54.1 N*J	5.33 NJ	73.2 NJ				13.9 NJ	37.4 NJ	48.9 NJ	10.0 NJ
Arsenic	16	3-12 **	***43.5 NJ***	11.8 NJ	***12.3 NJ***	***22.3 N***	10.6 N	***13.3 N***	2.96 NJ	***18 NJ***	8.96 N	***22.6 NJ***	***24.1 N***	5.66 N	10.4 N*J	1.87	***17.4***	1.58 N	3.12 N	10.7 N	3.61	10	3	***17.1***
Barium	400	15-600	147 NJ	77 NJ	115 NJ	133 NJ	44.3 NJ	54.4 NJ	73.5 NJ	65.5 NJ	76.1 NJ	96.3 NJ	189 NJ	61.6 J	57.7 J	17.4 J	95.1 J	12.6 J	8.98 J	79.6 J	51.2 N*J	112 N*J	123 N*J	18.3 N*J
Beryllium	590	0-1.75	1.64 NJ	0.784 NJ	***2.81 NJ***	0.786 J	0.767 J	0.81 J	***2.3 NJ***	0.975 NJ	0.702 J	***1.86 J***	1.54 J	1.28 J	0.738 J	0.121 J	1.35 J	0.12 J	0.44 J	1.31 J	0.807 J	1.4 J	0.698 J	0.186 J
Cadmium	9.3	0.1-1	***3.13 NJ***	0.106 NJ								***7.66 NJ***	***3.81 NJ***		0.483 NJ		***3.56***					0.073 NJ		
Calcium		130 - 35,000 **	***267000 DJ***	20700 J	***66800 J***	***96600 J***	24300 J	***38400 J***	***47600 J***	***36800 J***	8490 J	31000 J	***243000 DJ***	***38800 J***	25100 J	820 J	***35800 J***	967 J	***51500 J***	***50200 J***	***38000 J***	***51100 J***	8050 J	18600 J
Chromium	400	1.5 - 40 **	36.3 NJ	19.3 NJ	20.8 NJ	***44.5 NJ***	18.9 NJ	21.4 NJ	3.45 NJ	23.4 NJ	21.2 NJ	***182 NJ***	27.5 NJ	4.66 J	***180 J***	6.95 J	***104 J***	5.33 J	15.6 J	11.5 J	15.1 NJ	10.6 NJ	14.8 NJ	4.930 NJ
Cobalt		2.5 - 60 **	11.6 NJ	7.71 NJ	4.57 NJ	7.49 NJ	12.1 NJ	10.7 NJ	1.6 NJ	7.6 NJ	10.2 NJ	14.1 NJ	11.2 NJ	1.4 J	6.78 J	0.721 J	12.7 J		9.96 J	3.62 J	10.5 J	5.2 J	13.2 J	
Copper	270	1 - 50	41.9 NJ	33.5 NJ	45.7 NJ	***109***	24.9	26.3	13 NJ	***62.7 NJ***	38.9	***298***	40.5	***62.5 N***	***205 N***	2.99	***348***	3.02 N	20.4 N	28.3 N	18.3 N	15.7 N	22.8 NJ	2,440 NJ
Cyanide	27	N/A		9.27	6.04	13	2.64 J	0.95 J	7.25	8.07		24		6.04	4.56		1.64			5.86		0.665		918
Cyanide - Amenable		N/A	-	-	-	-	1.1 J		-	-	-	-	-	-	-	-	-	-		-	-	-	-	19.4
Iron		2,000 - 550,000	20100 J	33300 J	55900 J	112000 J	114000 J	78600 J	11000 J	186000 DJ	21600 J	244000 DJ	17400 J	39700 J	115000 J	4720 J	212000 DJ	4640 J	19400 J	45700 J	20000 J	39600 J	44100 J	10100 J
Lead	1,000	200 - 500	102 J	61.2 J	44.7 J	165 J		17.7 J	5.98 J	69 J	22.8 J	***2970 J***	126 J	33.5 J	218 J	6.75 J	434 J	6.14 J	15.3 J	43.6 J	18.7 N*J	35.3 N*J	5.32 N*J	27.5 N*J
Magnesium		100 - 5,000	4100 J	***5300 J***	***17600 J***	***6490 J***	4410 J	***5090 J***	4450 J	***10400 J***	4820 J	***8590 J***	3110 J	***7400 NJ***	***5600 NJ***	231 J	***9030 J***	299 NJ	***5410 NJ***	***14000 NJ***	***7090 NJ***	***10500 NJ***	***7260 NJ***	173 NJ
Manganese	10,000	50 - 5,000	180	668	2450	1640	1090	728	544	4050	320	4960	182	2270 NJ	3120 NJ	51.2 NJ	4970 NJ	46.3 NJ	439 NJ	1030 NJ	576 J	4830 J	1350 J	77.2 J
Mercury	2.8	0.001 - 0.2	0.031 N*	0.031 N*	0.024 N*	***0.231 NJ***	0.014 NJ	0.064 NJ	0.017 N*	0.063 N*	0.05 NJ	***0.292 NJ***	0.023 NJ				0.05 N				0.018	0.064	0.046	
Nickel	310	0.5 -25	22.9 NJ	***25.7 NJ***	16.8 NJ	***34.9 NJ***	23.5 NJ	***26.6 NJ***	3.1 NJ	12.2 NJ	***37.4 NJ***	***103 NJ***	23 NJ	8.52	75.6	0.841 J	***72.2***	2.82 J	***36.3***	8.24	***38.1***	13.6	***31.1***	
Potassium		8,500 - 43,000 **	9520 NJ	9310 NJ	2310 NJ	8030 J	5800 J	7660 J	3700 NJ	1080 NJ	6380 J	2310 J	11000 J	2260 N	1150 N	675	1840	284 NJ	3570 N	1070 N	2520	2290	4810	425 J
Selenium	1,500	0.1 - 3.9	3.61 N	1.36 NJ	1.05 NJ				1.63 N		1.9 NJ		***6.43 NJ***	1.52 N	2.72 N	0.448 NJ	***5.22 N***		0.832 NJ	1.96 N				1.460 NJ
Silver	1,500	N/A	1.75 NJ	5.45 NJ	12.4 NJ	34.6 N*J	42.1 N*J	25.6 N*J	1.63 NJ	31.6 NJ	2.11 N*J	80.4 N*J				0.811 NJ	28.2 NJ					0.772 J	1.23 J	0.278 J
Sodium		6,000 - 8,000	614 NJ	575 NJ	633 NJ	865 NJ	191 NJ	362 NJ	304 NJ	101 NJ	406 NJ	887 NJ	942 NJ	435 NJ	99.5 NJ	200 NJ	555 NJ	117 NJ	141 NJ	191 NJ	172 NJ	220 NJ	138 NJ	208 NJ
Thallium		N/A	1.55 N				2.47 NJ	1.54 NJ				6.92 NJ	2 NJ											
Vanadium		1-300	35.3 NJ	18.5 NJ	10.8 NJ	27.2 J	36.2 J	29.4 J	4.94 NJ	23.9 NJ	28.5 J	28.1 J	42.7 J	7.92 J	22.4 J	5.28 J	25.1 J	3.06 J	11.9 J	12.2 J	10.6 J	10.2 J	20.5 J	
Zinc	10,000	9-50	***778 NJ***	***275 NJ***	***341 NJ***	***573 N***	42.9 NJ	***137 NJ***	35.1	***585***	***141 N***	6830 N	***956 N***	***520 J***	***513 J***	6.8 NJ	***895 NJ***	8.93 J	38.1 J	***239 J***	27.6 J	***188 J***	***63.1 J***	17.4 J

Created by: MM/JH Date: 03/06/2006
Checked by: JJR Date: 03/10/2006

MALCOLM PIRNIE

TABLE 5-2
SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL/FILL SAMPLES
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Notes:

Blank space indicates analyte was not detected.

-- Indicates sample was not analyzed for this parameter.

Shaded and framed concentrations exceed SCO values.

Bold/Italic values exceed upper limits of urban background concentrations.

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.

(1) 6 NYCRR subpart 375-6 soil cleanup objectives for restricted commercial use, Dec. 2006.

(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000.

(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S. and other), Toxicological Profile for PAHs, US Dept. of Health and Human Services, August 1995.

(4) Total BaP equivalent - Benzo (a) pyrene equivalent is calculated by multiplying the following individual PAH concentrations by their multiplier (#) and summing the results. Benzo (a) pyrene (1.00); Dibenzo (a,h) anthracene (1.00); Benzo (a) anthracene (0.10); Benzo (b) fluoranthene (0.10); Ideno (1,2,3-cd) pyrene (0.10); Benzo (k) fluoranthene (0.01); Chrysene (0.01).

(5) USEPA Region 3 Soil Screening Level.

*** New York State background concentration.*

**** - The Soil Cleanup Objective refers to the sum of these compounds.*

Data Qualifiers

U - The compound was not detected at the indicated concentration.
J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than zero. The concentration given is an approximate value.

D - Indicates result from secondary dilution run.

B - The analyte was found in the laboratory blank as well as the sample. This indicates possible laboratory contamination of the environmental sample.

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%.

** - For dual column analysis, the lowest quantitated concentration is being reported due to coeluting interference.*

Created by: MM/JH Date: 03//062006
Checked by: JJR Date: 03/10/2006

MALCOLM PIRNIE

TABLE 5-3
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER SAMPLES
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Sample ID Sampling Date	NYSDEC Class GA Standards(1)	ABB-MW-101 02/08/06	ABB-MW-103 02/07/06	MW-305 02/08/06	MW-306 02/07/06	MW-307 02/07/06	MW-401 02/08/06	MW-402 02/08/06	MW-403 02/08/06	MW-404 02/08/06	MW-405 02/08/06	MW-406 02/07/06	GWDUP-1 02/07/06	MW-407 02/07/06	TB-0207 02/07/06	EQ-BLANK 02/08/06
VOCs - Method 8260 (ug/L)																
1,1,1-Trichloroethane	5*															
2-Butanone	50					18.0 J										
4-Methyl-2-Pentanone	NA					2 J										
Acetone	50					**210**	23 J									
Benzene	1					0.55 J				0.75 J		**1.2 J**	**1.3 J**			
Carbon Disulfide	60					5.8						3.3 J	3.5 J			
Tetrachloroethene	5*															1.9 JB
Toluene	5*	0.98 J				1.1 J	0.89 J		0.84 J	0.99 J		1 J	1 J	0.91 J		
Total Confident Conc. VOC	NA	2.68	0.41	2	0	237.45	30.29	180	2.44	3.84	43	5.5	5.8	0.91	0	1.9
Total TICs	NA	0	0	0	0	11.2	0	0	0	26	0	8.9	8.6	0	0	0
SVOCs- Method 8270 (ug/L)																
2,4,6-Trichlorophenol	NA											2.3 J			--	
2,4-Dichlorophenol	5*											4.9 J	**5.4 J**		--	
2,4-Dimethylphenol	(50)					1.4 J									--	
2-Methylnaphthalene	NA									1.2 J					--	
3+4-Methylphenols	NA					3.6 J									--	
Acenaphthene	(20)									6.7 J					--	
Anthracene	(50)									1.7 J					--	
Carbazole	NA									16					--	
Dibenzofuran	NA									4 J					--	
Fluoranthene	(50)									2 J					--	
Fluorene	(50)									6.6 J					--	
Naphthalene	(10)	5.2 J	2.5 J				1.7 J	1.5 J		7.2 J		5.7 J	6 J		--	
Pentachlorophenol	1‡					**5.6 J**									--	
Phenanthrene	(50)									3.6 J					--	
Phenol	1‡					**16**	**1.3 J**	**4.3 J**			**5.2 J**				--	
Total Confident Conc. SVOC	NA	10.2	7.4	6.4	2.3	31.8	8	9.7	3.5	54.1	9.3	16	15	6.7	--	6.6
Total TICs	NA	12.7	15.7	5.8	5.9	126.2	6.5	91.7	26.4	73	40.4	112.2	122.9	6.4	--	12
Pesticides - Method 8081 (ug/L)																
All Pesticides	NA														--	
PCBs- Method 8082 (ug/L)																
Total PCBs	0.09														--	
TAL Metals, Mercury, & Cyanide- Methods 6010, 7470, 9012 (ug/L)																
Aluminum	NA	113 J	101 J	860	225	1870	6760	12400	432	390	3260	220	201	26300	--	50.8 J
Antimony	3			**7.5 J**				**12.1 J**			**19.6 J**			**25.0 J**	--	
Arsenic	25			**135.0**		**47.3**	**59.5**	**98.4**			**617.0**	14.4	13.3	18.2	--	
Barium	1000	65.9 J	28.1 J	497.0	18.8 J	46.4 J	12.3 J	18.2 J	13.1 J	319.0	20.7 J	41.5 J	36.8 J	288.0	--	4.3 J
Beryllium	(3)			0.27 J			0.16 J	0.97 J	0.09 J			0.1 J		**4.8 J**	--	
Cadmium	5													0.6 J	--	
Calcium	NA	199000	49700	144000	75300	180000	24400	27100	20300	72800	13300	126000	113000	175000	--	1290 J
Chromium	50		3.1 J	14.4 J			8.2 J	47.6 J	1.7 J	2.9 J				34.8 J	--	
Cobalt	NA		0.43 J	2.8 J		1.9 J	0.53 J	3.7 J			10.2 J	6.5 J	5.2 J	9.3 J	--	
Copper	200	15.7 J	16.8 J	**217.0**	5.6 J	8.5 J	5.40 J	7.50 J	9.20 J	7.0 J	13.1 J	7.4 J	12.2 J	114.0	--	10.9 J
Cyanide	200	**410.0**	**241.0**		57.0	**5710.0**	163.0	**244.0**	74.0	43.0	72.0	**6390.0 J**	**1380.0 J**	35.0	--	
Iron	300	**356**	**342**	**58300**	**1530**	**3010**	**902**	**2970**	**690**	**3640**	**4070**	**3840**	**3520**	**58300**	--	
Lead	25		4.4 J	**29.1**	5.9		6.6	5.9		17.3				**224.0**	--	
Magnesium	(35,000)	378 J	2500 J	**49100**	17200	483 J	430 J	432 J	2240 J	**88600**		3010 J	3210 J	**36500**	--	256 J
Manganese	300	1.0 J	11.9 J	**343.0**	188.0	10.4 J	25.8	99.8	25.6	191.0	4.8 J	32.8	29.8	**3560.0**	--	0.9 J
Mercury	0.7		0.100 J					0.090 J			0.310			0.140 J	--	
Nickel	100	2.0 J		5.9 J		22.8 J	18.2 J	57.3			**289.0**	7.6 J	6.9 J	22.9 J	--	
Potassium	NA	76600.0 DL	225000.0 DL	1840.0 J	20700.0	727000.0 DL	1220000.0 DL	342000 DL	110000.0	196000.0 DL	547000.0 DL	608000.0 DL	553000.0 DL	33600.0	--	
Selenium	10	3.1 J		5.3 J	8.1 J	7.5 J	**10.8**	**12.5**			**29.0**	4.3 J		**10.1**	--	
Silver	50			1.8 J										2.6 J	--	
Sodium	20,000	**56900 J**	**95400 J**	**27900 J**	11300 J	**112000 J**	**65400 J**	**102000 J**	**26000 J**	**39900 J**	**557000 J**	**133000 J**	**111000 J**	**26000 J**	--	
Thallium	(0.5)				**10.3**										--	
Vanadium	NA	9.2 J		17.0 J		29.0 J	95.6	284.0	4.4 J	9.9 J	478.0	5.2 J	4.7 J	43.3 J	--	0.83 J
Zinc	(2,000)													747.0	--	35.3
Water Quality pH-Method 150.1																
pH (2)	NA	12	7	6.80	7	10	12	12	9.6	7.7	12	8		7	--	5.90

Notes:

Created by: B. Walker Date: 03/16/2006
Checked by: Date:

TABLE 5-3
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER SAMPLES
BUFFALO LAKESIDE COMMERCE PARK - PARCEL 4
BUFFALO, NY

Notes:

(1) Class GA Ambient Water Quality Standards and Guidance Values from TOGS series 1.1.1, June 1998, and April 2000 Addendum.

** The principal organic contaminant standard for groundwater of 5 ug/l applies to this substance.*

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.

Blank space indicates analyte was not detected.

-- Indicates sample was not analyzed for this parameter.

Shaded and framed concentrations exceed Class GA groundwater standards or guidance values.

Values in ( ) represent Guidance Values.

NA - Not Applicable or Not Available.

Ŧ - applies to the sum of these subsatnces

Data Qualifiers

J - Organics: Indicates and estimated value. Inorganics: The reported value is less than CRDL, but greater than the IDL.

D - Indicates result from secondary dilution run.

B - Indicates analyte was found in the blank as well as the sample result.

Analytical results for the above sample groups are summarized on tables 5-1 through 5-3 and are compared to the following regulatory standards and/or criteria:

- Surface and subsurface soil/fill data were compared to 6 NYCRR Subpart 375-6 Soil Cleanup Objectives (SCOs) for restricted commercial use, December 2006. Metals were also compared to Eastern U.S. Background Concentrations listed in TAGM 4046. Polycyclic aromatic hydrocarbons (PAHs) were compared to the SCOs and background concentrations for urban soils as referenced from the U.S. Department of Health and Human Services Toxicological Profile for PAHs

- Groundwater data were compared to NYSDEC Class GA groundwater standards and guidance values, (6NYCRR Part 360).

5.2 Surface Soil/Fill

Twenty surface soil/fill samples were collected from the 0 to 6" depth from 13 soil borings (SB-401 to SB-413) and seven monitoring well borings (MW-401 to MW-407), see Figure 2-1 for sample locations. One of the surface soil/fill samples (MW-403A) was of flue ash present at the surface at that location. Two of the surface soil samples (MW-401A and SB-402A) were collected from the excavation spoils located on top of the filter cake/flue ash pile. Analytical results of the flue ash sample are discussed in Section 5.3 with the rest of the flue ash sample results. Surface soil/fill samples were analyzed for PAHs, polychlorinated biphenyls (PCBs), the target analyte list of metals (TAL metals), and cyanide. Analytical results for surface soil/fill samples are summarized in Table 5-1.

PAHs

Four PAHs were present in surface soil/fill at the site at concentrations in excess of the 6 NYCRR Subpart 375-6 SCOs for restricted commercial use in six of the 19 surface soil/fill samples collected. All four of these PAHs are known carcinogenic PAHs and therefore have relatively low SCOs as compared to other SVOCs. However, only one of these, benzo(a)pyrene, was present above the typical range found in urban soils. All other PAHs detected were within or below the typical urban background concentrations for PAHs.

PCBs

Four of the 19 surface soil/fill samples contained trace concentrations of aroclor 1254. All detections of PCBs in surface soil/fill were well below SCO of 1 Mg/Kg.

Inorganics

Six of the 19 surface soil/fill samples contained one or more metals at concentrations greater than the 6 NYCRR Subpart 375-6 SCOs for restricted commercial use. Elevated concentrations are not uncommon on former industrial sites in urban settings that are covered with anthropogenic fill materials, such is the case for Parcel 4. Metals present above the restricted commercial SCOs were arsenic, lead, and manganese.

5.3 Subsurface Soil/Fill

Subsurface soil/fill samples were collected from the same 20 borings as were the surface soil samples discussed in Section 5.2 above. One of the 20 samples (MW-402B) consisted of flue ash and will be evaluated with the other flue ash (FA) samples in section 5.4. All of the subsurface soil/fill samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, PCBs, TAL metals, and cyanide. Three samples (MW-405B, SB-404B, and SB-409B) were also analyzed for free cyanide based on historic data collected near the southwestern portion of the site. Similar to surface soil results, the distribution of the subsurface soils containing constituents greater than SCOs or urban background concentrations were well distributed across the site, and that these measured concentrations may be characteristic of the fill material underlying the site rather than from a former or current on-site source. Analytical results for the subsurface soil/fill samples collected are discussed below and summarized in Table 5-2.

VOCs

No VOCs were present in the subsurface soil/fill samples at concentrations in excess of SCOs for restricted commercial use. Concentrations of most VOCs present were less than laboratory detection limits.

In addition to the TCL VOC analyte list, tentatively identified compounds (TICs), or non-target, unspecified compounds detected in samples during analyses were quantified.

These concentrations were combined to represent a total TIC concentration for each sample. One sample, (SB-407B), located directly east of the debris disposal pile contained a total TIC concentration of 12,200 micrograms per kilogram (µg/kg). This sample contained the highest total VOC concentration of the 20 subsurface soil/fill samples collected due to the presence of the TICS. This total VOC concentration, however, is well below the SCO for restricted commercial use which is capped at 500 mg/km of total VOCs.

SVOCs

Most of the subsurface soil/fill samples collected contained various PAHs at concentrations below the SCOs for restricted commercial use. Only one sample, SB-408B (5'-6') contained a PAH above the SCO. This sampled contained benzo(a)pyrene at a concentration of 1100 ug/kg which is slightly above the SCO of 1000 ug/kg. Compared to the surface soil samples, the concentrations of SVOCs detected in the subsurface soil/fill samples are much lower.

Pesticides

Only two samples contained pesticides and at concentrations well below the SCOs.

PCBs

Only three samples contained PCBs and at very low concentrations below the SCO of 1 mg/kg.

Inorganics

Metals concentrations in subsurface soil/fill samples were generally consistent with those observed in surface soil at the Site. These data indicate that the metals may be characteristic of fill material present at the Site. Arsenic, copper, and lead were detected in one or more samples at concentrations above but within the same order of magnitude of the respective SCOs. The samples containing metals at concentrations in excess of SCOs and eastern United States background concentrations were well distributed across the Site with no one concentrated area.

5.4 Solid Waste Materials

Samples were collected from two distinct waste materials present at the Site. These materials are visibly unique in physical composition and seemingly homogenous where encountered.

The first material is known to be filter cake/flue ash and is a fine grained black ashy material with silver mica-like reflective flecks present. A large pile of this material is present in the western end of the Site and is known to contain elevated lead concentrations. This material was sampled for total lead at five locations from a depth of between 0.5 and 1.0 feet below surface. Also, this material was present in other areas of the Site at the surface and in the subsurface and was sampled at the surface at well boring MW-403A (0-0.5') and in the subsurface at well boring MW-402B (8-10'). These two samples are evaluated along with the five samples collected from the western flue ash pile. Total lead concentrations were as high as 11,000 mg/kg from the pile. Because of this high value, the five samples collected from the pile were analyzed for TCLP lead. The same sample (FA-02) that was highest in total lead content was above the TCLP limit of 5,000 ug/L of lead extract at which it would be considered a hazardous waste. The TCLP lead concentration of that sample was 11,700 ug/L. Analytical results of the flue ash samples were discussed in Section 2.8 with the XRF pilot study and are summarized in Table 2-3.

The second distinct solid waste material sampled was a deep blue colored layer of fill that was encountered during the excavation of one of the test trenches (IT-B), located near the center of the southern site property boundary. The material was composed of wood chips approximately 1/8 inch in size but stained a deep indigo blue color. The composition and color of this fill material indicates that it may be a byproduct of coal gasification from an off-site source. The extent of this material was defined using multiple extended trenches which were subsequently backfilled. This material was sampled for SVOCs, pesticides, PCBs, Metals, cyanide, and free cyanide. Analytical results of this sample of blue fill are included on Table 5-2. One PAH (dibenzo(a,h)anthracene) and one metal (arsenic) were present slightly above SCOs. Cyanide was also present at 918 mg/kg which is significantly higher than the SCO of 27 mg/kg. Amenable cyanide was present in this sample at concentration of 19.4 mg/kg. USEPA Region 9 preliminary remedial goals (PRGs) and Region 3 risk based criteria (RBC) were used to evaluate the amenable cyanide value in the blue fill. Using the conservative residential PRG and RBC, the detected amenable cyanide concentration of 19 mg/kg is far below the PRG of 1200 mg/kg and the RBC of 1600 mg/kg.

5.5 Groundwater

Twelve groundwater samples were collected from the seven new and five pre-existing overburden groundwater monitoring wells. Groundwater samples were analyzed for VOCs, SVOCs, pesticides, PCBs, TAL metals, cyanide, and pH. In January of 2007 wells MW-307 and MW-406 were re-sampled and analyzed for total cyanide and free cyanide. Analytical results of the groundwater samples are presented in Table 5-3.

VOCs

Few VOCs were detected in groundwater samples and only two were present above the groundwater standards. Acetone (a common laboratory contaminant) was present at a concentration of 210 ug/l in off-site well MW-307. The groundwater standard for acetone is 50ug/l. Benzene was present in well MW-406 at a concentration of 1.2 ug/l, slightly above the standard of 1 ug/l. Other VOCs were detected in groundwater samples but at very low concentrations and below groundwater standards.

SVOCs

Several SVOCs were detected in groundwater samples at very low concentrations. Three compounds were detected at concentrations above their respective groundwater standards, all of which are phenols (2,4-dichlorophenol, pentachlorophenol, and phenol). These compounds were present in one to four of the 12 wells sampled and only slightly above their groundwater standards.

Pesticides and PCBs

No Pesticides or PCBs were detected in the groundwater samples.

Inorganics

Several metals were present in groundwater samples at concentrations above groundwater standards. Some of these are common nutrients such as iron, magnesium, and sodium. Others, including arsenic copper, lead, and cyanide were detected at similar concentrations to those found at Parcels 1 and 2 of the BLCP. One notable exception is two relatively high concentrations of cyanide. Well MW-406, which is located in the vicinity of the cyanide-rich blue fill material, contained 6390 ug/L of total cyanide and off-site well MW-307 contained 5,710 ug/L. These two wells were re-sampled for total cyanide, free cyanide, and amenable cyanide in January 2007. The groundwater sample from well MW-406 contained 5,970 ug/l of total cyanide, 4,100 ug/l of free cyanide, and 1900 ug/l amenable cyanide. The groundwater sample from well MW-307 contained 196 ug/L of total cyanide, all of which was free cyanide, the amenable result was non-detect. The NYSDEC class GA standard for total cyanide is 200 ug/l.

pH

The groundwater pH was measured in the field at the completion of each boring and during the purging process prior to sample collection using a field meter that was calibrated using a calibration solution of a pH of 4. Since the pH meter was calibrated at the low end of the pH range, pH readings on the higher end of the scale should be considered approximate. PH of the groundwater samples was again measured in the laboratory under more controlled conditions. The pH values used for characterization are those measured by the laboratory. The average pH value of the groundwater sampled during the Parcel 4 SI was 9.3, with highest pH measurements identified at monitoring wells located predominantly along the western end of the Site. PH values of 12.0 were measured at wells ABB-MW-101, MW-401, MW-402, and MW-405. Elevated groundwater pH measurements were also documented at Parcel 3 wells ABB-MW-101 and MW-307 during the Site Investigation of Parcel 3 in 2001 and was attributed to potential leaching of lime from lime-rich slag present in that area.

Laboratory measured groundwater pH values for the 12 sampled groundwater wells show that the pH of groundwater in the western quadrant of the Site is elevated. Groundwater collected from wells ABB-MW-101, MW-401, MW-402, and MW-405 all had a pH of 12. Elevated groundwater pH measurements were also documented at the adjacent northwestern corner of Parcel 3 during the Site Investigation of Parcel 3 in 2001 and were also attributed to potential leaching of lime from lime-rich slag present in that area.

Solubility of metals can be influenced by pH and generally increases toward both extremes of the pH scale. However, the effect of pH on solubility differs depending on the solubility curve for the specific metal so that a given pH maybe optimal for reduced solubility of one metal while at the same time causing increased solubility for other metals.

Comparison of pH and metals analytical data collected from subsurface soil/fill and groundwater in Parcel 4 (Tables 5-2 and 5-3) finds no clear correlation between wells with highest pH readings and those with highest, or lowest, concentrations of metals and/or cyanide. Also, comparison of the groundwater pH data to the shallow groundwater isopotential map reveals that the high pH groundwater travels easterly to the point of discharge at the northeastern end of the Union Ship Canal. At this discharge location, groundwater pH is 7.0 as measured in well MW-306. This indicates that high pH groundwater is not discharging to the canal at this location.

MALCOLM PIRNIE

Human Health Evaluation

SECTION 6

The human health evaluation (HHE) presents a qualitative evaluation of the potential for exposure and adverse human health effects associated with chemicals detected in the soil/fill sampled at the Buffalo Lakeside Commerce Park (BLCP) Parcel 4 Site and groundwater sampled at the BLCP Parcels 3 and 4.

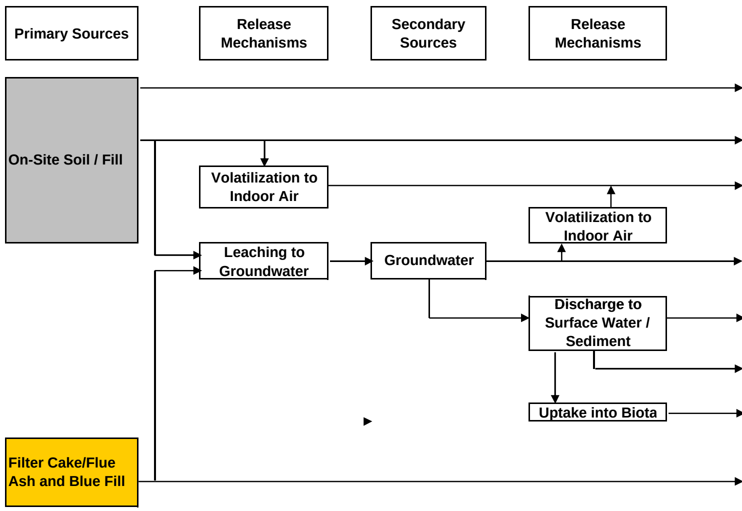
The exposure assessment is facilitated through the development of a conceptual site model (CSM), presented in Figure 6-1. The CSM is a graphic illustration that outlines chemical source areas, release mechanisms, environmental media that currently show or may show the presence of chemicals in the future, possible exposure pathways to potentially-exposed human populations, and potential exposure routes. It considers current site conditions and surrounding land use, as well as the most likely future conditions and land use based on the proposed redevelopment of the Site. It is anticipated that redevelopment of Parcel 4 will include regrading of the Site to support the construction of commercial/industrial buildings associated with BLCP.

6.1 Overview

Although qualitative, the human health evaluation follows the four-step process typically used to assess potential human health risk. This consists of:

Data evaluation: relevant investigation sample data are compiled and analyzed to determine the usability of the data and to select chemicals of potential concern (COPC) that are representative of the conditions present at the Site.

Exposure Assessment: actual and/or potential chemical release mechanisms and migration pathways are evaluated and potentially exposed human populations, possible exposure pathways, and potential exposure routes are identified.



Exposure Media	Exposure Routes	Potential Human Receptor Populations				
		Current/Future		Future		
		Trespasser/ Recreationist	Off-site Recreationist	Construction/ Utility Worker	Site Worker	Off-site Recreationist
Surface Soil / Fill	Ingestion	●		●	●	
	Dermal Contact	●		●	●	
	Inhalation	●		●	●	
Subsurface Soil / Fill	Ingestion			●		
	Dermal Contact			●		
	Inhalation			●		
Indoor Air	Inhalation				●	
Groundwater	Dermal Contact			●		
	Inhalation			●		
Surface Water **	Dermal Contact		●			●
Sediment **	Ingestion					
	Dermal Contact					
Biota **	Ingestion		●			●
Filter Cake/Flue Ash and Blue Fill	Ingestion	●		●	●	
	Dermal Contact	●		●	●	
	Inhalation	●		●	●	

LEGEND
→ Chemical Migration Pathway
● Potentially Complete Exposure Pathway
** Applies to Union Ship Canal (located 200 feet south of Parcel 4 boundary)

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CONCEPTUAL SITE MODEL
Buffalo Lakeside Commerce Park Parcel 4
Buffalo, New York

April 2006

FIGURE 6-1

Toxicity Assessment: qualitative toxicity information is presented for each COPC.

Risk Characterization: the potential for adverse human health effects, in terms of both non-carcinogenic health effects and carcinogenic risk, is evaluated, currently and for the future, in the absence of remedial action. The uncertainty in this qualitative evaluation is also briefly discussed.

6.2 Data Evaluation

The data evaluation focuses on the compilation of useable analytical data to assess the potential for human exposure and the selection of COPC. As such, detected chemicals in soil (i.e., surface soil/fill, subsurface soil/fill, filter cake/flue ash, and blue fill) and groundwater were evaluated. While the entire data sets for these media were discussed previously, data summary tables (Tables 6-1 to 6-5) were organized to facilitate the data evaluation. Tables 6-1 to 6-5 also present the screening criteria used to select COPC for each medium, as discussed below. This process identifies those COPC that, if exposed to, may pose potential risk to human health.

Selection of Environmental Media of Concern: Surface and subsurface soil/fill, filter cake/flue ash, blue fill, groundwater, surface water, sediment, and biota were identified as environmental media of concern because they are or may become, in the future, readily available for human contact. Surface water and sediment samples were not collected for analysis. Biota, while not sampled for analysis, is an exposure medium of concern due to the potential for human consumption of fish that have bioaccumulated COPC.

Although eleven test pits were excavated in the debris disposal area (eight pits) and the area along the easternmost edge of the parcel (three pits), these test pit samples are not evaluated further. Samples collected from the debris disposal area were submitted for TCLP pesticides analysis, and samples collected along the eastern perimeter were submitted for PCB analyses. However, no pesticides or PCBs were detected in these samples; therefore, the soil/fill material within test pits were eliminated as a medium of concern.

Selection of COPC: The following sub-sections describe the soil/fill, filter cake/flue ash, blue fill, and groundwater analytical data and the identification of COPC in these media. COPC were selected by comparing the maximum detected concentration of each

TABLE 6-1

Summary of COPCs by Environmental Medium

Buffalo Lakeside Commerce Park, Parcel 4

Buffalo, New York

	Surface Soil/Fill	Subsurface Soil/Fill	Blue Fill	Filter Cake / Flue Ash		Groundwater
				Surface	Subsurface	
Volatile Organic Compounds						
Acetone	N/A	**X**	ND	N/A	ND	**X**
Benzene	N/A	O	ND	N/A	O	**X**
Cyclohexane	N/A	**X**	ND	N/A	ND	ND
4-Methyl-2-pentanone	N/A	ND	ND	N/A	ND	**X**
Methylcyclohexane	N/A	**X**	ND	N/A	ND	ND
Semi-volatile Organic Compounds						
Benzo(a)anthracene	**X**	**X**	**X**	ND	O	ND
Benzo(a)pyrene	**X**	**X**	**X**	ND	**X**	ND
Benzo(b)fluoranthene	**X**	**X**	**X**	O	O	ND
Benzo(k)fluoranthene	**X**	O	ND	ND	ND	ND
1,1-Biphenyl	N/A	**X**	ND	N/A	ND	ND
bis(2-Ethylhexyl)phthalate	ND	O	ND	N/A	O	**X**
Carbazole	N/A	**X**	ND	N/A	ND	**X**
Chrysene	**X**	**X**	ND	ND	O	ND
Dibenzo(a,h)anthracene	**X**	**X**	**X**	ND	ND	ND
Dibenzofuran	N/A	O	ND	N/A	ND	**X**
2,4-Dichlorophenol	N/A	ND	ND	N/A	ND	**X**
Indeno(1,2,3-cd)pyrene	**X**	O	ND	ND	O	ND
2-Methylnaphthalene	ND	O	ND	ND	ND	**X**
3&4-Methylphenols	N/A	O	ND	N/A	ND	**X**
4-Nitrophenol	N/A	**X**	ND	N/A	ND	ND
Pentachlorophenol	N/A	ND	**X**	N/A	ND	**X**
Phenol	N/A	**X**	ND	N/A	ND	**X**
2,4,6-Trichlorophenol	N/A	ND	ND	N/A	ND	**X**
Metals						
Aluminum	O	O	O	O	O	**X**
Antimony	**X**	**X**	**X**	**X**	**X**	**X**
Arsenic	**X**	**X**	**X**	**X**	**X**	**X**
Beryllium	O	**X**	O	O	**X**	**X**
Cadmium	**X**	**X**	ND	**X**	**X**	O
Chromium	**X**	**X**	O	**X**	**X**	O
Cobalt	O	O	ND	O	O	**X**
Copper	**X**	**X**	O	**X**	**X**	**X**
Lead	**X**	O	O	**X**	**X**	**X**
Manganese	**X**	O	O	O	O	**X**
Mercury	**X**	**X**	**X**	O	**X**	O
Nickel	**X**	**X**	ND	**X**	**X**	**X**
Selenium	O	**X**	O	**X**	O	**X**
Silver	**X**	**X**	O	O	**X**	O
Thallium	**X**	**X**	ND	**X**	**X**	**X**
Vanadium	O	O	ND	O	O	**X**
Zinc	**X**	**X**	O	ND	ND	O
Other						
Cyanide	**X**	**X**	**X**	**X**	**X**	**X**
Cyanide - Amenable	N/A	**X**	**X**	N/A	N/A	N/A

X = Chemical selected as COPC

O = Chemical detected but not selected as COPC

N/A = Not analyzed

ND = Not detected

TABLE 6-2

Summary of Surface Soil/Fill Data and Comparison to Screening Criteria
Buffalo Lakeside Commerce Park
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations	NYSDEC Soil Cleanup Objectives (1)	Background Concentrations (2)(3)
Polycyclic Aromatic Hydrocarbons - (ug/kg)				
Acenaphthene	4 / 19	90 J - 2,300 J	41,000	NA
Anthracene	5 / 19	79 J - 1,400 J	50,000 (4)	NA
Benzo(a)anthracene	12 / 19	70 J - **9,200**	224 or MDL	169 - 59,000
Benzo(a)pyrene	13 / 19	**64 J** - **21,000**	61	165 - 220
Benzo(b)fluoranthene	14 / 19	51 J - **20,000**	1,100	15,000 - 62,000
Benzo(g,h,i)perylene	10 / 19	96 J - 16,000	50,000 (4)	900 - 47,000
Benzo(k)fluoranthene	6 / 19	97 J - **5,800**	1,100	300 - 26,000
Chrysene	11 / 19	210 J - **9,800**	400	251 - 640
Dibenzo(a,h)anthracene	3 / 19	**70 J** - **930 J**	14 or MDL	NA
Fluoranthene	11 / 19	400 J - 10,000	50,000 (4)	200 - 166,000
Fluorene	1 / 19	560 J - 560 J	50,000 (4)	NA
Indeno(1,2,3-cd)pyrene	10 / 19	68 J - **13,000**	3,200	8,000 - 61,000
Naphthalene	1 / 19	390 J - 390 J	13,000	NA
Phenanthrene	11 / 19	120 J - 5,300	50,000 (4)	NA
Pyrene	13 / 19	100 J - 10,000	50,000 (4)	145 - 147,000
Polychlorinated Biphenyls - (ug/kg)				
Aroclor-1016	1 / 19	160 - 160	NA	NA
Aroclor-1254	3 / 19	78 - 99 P	NA	NA
Total PCBs	4 / 19	78 - 160	1,000 (5)	NA
Metals (mg/kg)				
Aluminum	19 / 19	1,640 - 10,700	SB	33,000
Antimony	14 / 19	**9.1** - **262**	SB	< 1 - 8.8 (6)
Arsenic	19 / 19	2.6 - **27**	7.5 or SB	3 -12 (7)
Barium	19 / 19	15 J - 240	300 or SB	15 - 600
Beryllium	19 / 19	0.16 J - 1.5	0.16 or SB	0 - 1.75
Cadmium	12 / 19	0.07 J - **6.9**	1 or SB	0.1 - 1
Calcium*	19 / 19	1,240 - 203,000 D	SB	130 - 35,000
Chromium	19 / 19	4.0 - **196**	10 or SB	1.5 - 40 (7)
Cobalt	19 / 19	0.49 J - 10	30 or SB	2.5 - 60 (7)
Copper	19 / 19	6.0 - **261**	25 or SB	1 - 50
Iron*	19 / 19	7,990 - 217,000 D	2,000 or SB	2,000 - 550,000
Lead	18 / 19	7.3 - **6,300**	710 - 1,712 (8)	200 - 500
Magnesium*	19 / 19	535 J - 38,200	SB	100 - 5,000
Manganese	18 / 19	115 - **11,100 D**	SB	50 - 5,000
Mercury	18 / 19	0.03 - **0.57**	0.1	0.001 - 0.2
Nickel	18 / 19	2.3 J - **58**	13 or SB	0.5 - 25
Potassium*	19 / 19	194 J - 2,405	SB	8,500 - 43,000 (7)
Selenium	11 / 19	0.68 J - 3.6	2 or SB	0.1 - 3.9
Silver	13 / 19	1.3 - **37**	SB	ND - 5.0 (9)
Sodium*	18 / 19	35 J - 424 J	SB	6,000 - 8,000
Thallium	5 / 19	**0.58 J** - **4.0**	SB	NA
Vanadium	19 / 19	3.5 J - 48	150 or SB	1 - 300
Zinc	18 / 19	7.5 - **1,040**	20 or SB	9 - 50
Other (mg/kg)				
Cyanide	14 / 19	**0.94** - **17**	NA	NA (10)

Notes

Bold concentrations indicate chemical is selected as a chemical of potential concern (COPC).

*Indicates analyte is an essential nutrient and is categorically eliminated as a COPC.

D - Indicates result from secondary dilution run

J - The concentration given is an approximate value

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%

(1) Recommended Soil Cleanup Objectives, New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000

(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000

(3) Background for PAHs are urban concentrations from the Agency for Toxic Substances and Disease Registry, 1995

(4) NYSDEC TAGM 4046, Dec. 2000, Individual SVOCs < 50 ppm

(5) NYSDEC TAGM 4046, Dec. 2000, Recommended Soil Cleanup Objective for surface soil is 1,000 µg/kg

(6) Value for eastern USA soils, Dragun and Chiasson, 1991

(7) NYSDEC TAGM 4046, Dec. 2000, New York State background

(8) USEPA soil screening level for non-residential soils (USEPA, 2003)

(9) Value for soils of the conterminous USA, Dragun and Chiasson, 1991

cyanide should be taken into consideration when establishing soil cleanup objective.

SB - Site Background

NA - Not Available

TABLE 6-3

Summary of Subsurface Soil/Fill Data and Comparison to Screening Criteria
Buffalo Lakeside Commerce Park
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations	NYSDEC Soil Cleanup Objectives [1]	Background Concentrations [2][3]
Volatile Organic Compounds (ug/kg)				
Acetone	4 / 19	67 J - **580**	200	NA
Benzene	2 / 19	3.4 J - 17 J	60	NA
2-Butanone	8 / 19	23 JB - 120 J	300	NA
Carbon disulfide	6 / 19	23 J - 110	2,700	NA
Cyclohexane	5 / 19	**20 J - 130**	NA	NA
1,2-Dichlorobenzene	1 / 19	4.8 J	7,900	NA
Ethylbenzene	5 / 19	3.4 J - 31 J	5,500	NA
Methylcyclohexane	4 / 19	**5.8 J - 230**	NA	NA
Methylene chloride	5 / 19	12 JB - 46 J	100	NA
Toluene	5 / 19	5.6 J - 34	1,500	NA
Total Xylenes	6 / 19	5.4 J - 318	1,200	NA
Semivolatile Organic Compounds (ug/kg)				
Acenaphthene	5 / 19	82 J - 250 J	50,000 [4]	NA
Anthracene	4 / 19	81 J - 450 J	50,000 [4]	NA
Benzo(a)anthracene	8 / 19	83 J - **750**	224 or MDL	169 - 59,000
Benzo(a)pyrene	7 / 19	**71 J - 1,100**	61	165 - 220
Benzo(b)fluoranthene	9 / 19	76 J - **1,400**	1,100	15,000 - 62,000
Benzo(g,h,i)perylene	6 / 19	100 J - 440	50,000 [4]	900 - 47,000
Benzo(k)fluoranthene	4 / 19	160 J - 530	1,100	300 - 26,000
1,1-Biphenyl	1 / 19	**82 J**	NA	NA
bis(2-Ethylhexyl)phthalate	4 / 19	88 J - 440	50,000 [4]	NA
Carbazole	1 / 19	**260 J**	NA	NA
Chrysene	8 / 19	130 J - **880**	400	251 - 640
Dibenzo(a,h)anthracene	1 / 19	**120 J**	14 or MDL	NA
Dibenzofuran	2 / 19	160 J - 330 J	6,200	NA
Fluoranthene	10 / 19	72 J - 1,600	50,000 [4]	200 - 166,000
Fluorene	2 / 19	290 J - 470 J	50,000 [4]	NA
Indeno(1,2,3-cd)pyrene	6 / 19	69 J - 270 J	3,200	8,000 - 61,000
2-Methylnaphthalene	3 / 19	160 J - 290 J	36,400	
3&4-Methylphenols	1 / 19	98 J	900 [5]	NA
Naphthalene	3 / 19	140 - 1,300	13,000	NA
4-Nitrophenol	1 / 19	**140 J**	100 or MDL	NA
Phenanthrene	8 / 19	130 J - 2,100	50,000 [4]	NA
Phenol	1 / 19	**170 J**	30 or MDL	NA
Pyrene	9 / 19	98 J - 1,300	50,000 [4]	145 - 147,000
Pesticides/Polycyclic Aromatic Hydrocarbons (ug/kg)				
Endosulfan I	1 / 19	56 P	900	NA
Aroclor-1254	2 / 19	43 P - 520 P	NA	NA
Total PCBs	2 / 19	43 P - 520 P	10,000 [6]	NA
Metals (mg/kg)				
Aluminum	19 / 19	3,480 - 21,000	SB	33,000
Antimony	10 / 19	5.33 J - **121**	SB	< 1 - 8.8 [8]
Arsenic	19 / 19	1.58 - **43.5**	7.5 or SB	3 -12 [9]
Barium	19 / 19	8.98 J - 189	300 or SB	15 - 600
Beryllium	19 / 19	0.12 J - **2.81**	0.16 or SB	0 - 1.75
Cadmium	6 / 19	0.073 - **3.81**	1 or SB	0.1 - 1
Calcium*	19 / 19	820 - 267,000 D	SB	130 - 35,000
Chromium	19 / 19	3.45 - **180**	10 or SB	1.5 - 40 [9]
Cobalt	18 / 19	0.721 J - 13.2	30 or SB	2.5 - 60 [9]
Copper	19 / 19	2.99 - **348**	25 or SB	1 - 50
Iron*	19 / 19	4,640 - 212,000 D	2,000 or SB	2,000 - 550,000
Lead	19 / 19	5.32 - 434	710 - 1,712 [7]	200 - 500
Magnesium*	19 / 19	231 J - 17,600	SB	100 - 5,000
Manganese	19 / 19	46.3 - 4,970	SB	50 - 5,000
Mercury	13 / 19	0.017 - **0.231**	0.1	0.001 - 0.2
Nickel	19 / 19	0.841 J - **75.6**	13 or SB	0.5 - 25
Potassium*	19 / 19	284 J - 11,000	SB	8,500 - 43,000 [9]
Selenium	12 / 19	0.448 J - **6.43**	2 or SB	0.1 - 3.9
Silver	12 / 19	0.772 J - **34.6**	SB	ND - 5.0 [10]
Sodium*	19 / 19	99.5 J - 942	SB	6,000 - 8,000
Thallium	3 / 19	**1.55 J - 2.005**	SB	NA
Vanadium	19 / 19	3.06 J - 42.7	150 or SB	1 - 300
Zinc	19 / 19	6.8 - **956**	20 or SB	9 - 50
Other (mg/kg)				
Cyanide	10 / 19	**1.64 - 13**	NA	NA [11]
Cyanide - Amenable	1 / 3	**0.845**	NA	NA [11]

Notes

Bold concentrations indicate chemical is selected as a chemical of potential concern (COPC).

*Indicates analyte is an essential nutrient and is categorically eliminated as a COPC.

D - Indicates result from secondary dilution run

J - The concentration given is an approximate value

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%

(1) Recommended Soil Cleanup Objectives, New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000

(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000

(3) Background for PAHs are urban concentrations from the Agency for Toxic Substances and Disease Registry, 1995

(4) NYSDEC TAGM 4046, Dec. 2000, Individual SVOCs < 50 ppm

(5) NYSDEC TAGM 4046, Dec. 2000, Value is for 4-Methylphenol

(6) NYSDEC TAGM 4046, Dec. 2000, Recommended Soil Cleanup Objective for subsurface soil is 10,000 µg/kg

(7) USEPA soil screening level for non-residential soils (USEPA, 2003)

(8) Value for eastern USA soils, Dragun and Chiasson, 1991

(9) NYSDEC TAGM 4046, Dec. 2000, New York State background

(10) Value for soils of the conterminous USA, Dragun and Chiasson, 1991

(11) Some forms of cyanide are complex and very stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of cyanide should be taken into consideration when establishing soil cleanup objective.

SB - Site Background

NA - Not Available

TABLE 6-4
Summary of Blue Fill Data and Comparison to NYSDEC TAGM
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Blue Fill Sample Result	NYSDEC Soil Cleanup Objectives (1)	Urban Background Concentrations (2)(3)
Semi-volatile Organic Compounds (ug/kg)			
Acenaphthene	980 J	50,000 (4)	NA
Benzo(a)anthracene	**1,300 J**	224 or MDL	169 - 59,000
Benzo(a)pyrene	**780 J**	61	165 - 220
Benzo(b)fluoranthene	**1,300 J**	1,100	15,000 - 62,000
Dibenzo(a,h)anthracene	**1,500 J**	14 or MDL	NA
Fluoranthene	3,200	50,000 (4)	200 - 166,000
Naphthalene	3,200	13,000	NA
Pentachlorophenol	**16,000**	1,000 or MDL	NA
Phenanthrene	3,400	50,000 (4)	NA
Pyrene	2,000 J	50,000 (4)	145 - 147,000
Metals (mg/kg)			
Aluminum	40.3	SB	33,000
Antimony	**10 J**	SB	< 1 - 8.8 (6)
Arsenic	**17.1**	7.5 or SB	3 -12 (7)
Barium	18.3 J	300 or SB	15 - 600
Beryllium	0.186 J	0.16 or SB	0 - 1.75
Calcium*	18,600	SB	130 - 35,000
Chromium	4.93	10 or SB	1.5 - 40 (7)
Copper	2.44 J	25 or SB	1 - 50
Iron*	10,100	2,000 or SB	2,000 - 550,000
Lead	27.5	710 - 1,712 (5)	200 - 500
Magnesium*	173 J	SB	100 - 5,000
Manganese	77.2	SB	50 - 5,000
Mercury	**2.7**	0.1	0.001 - 0.2
Potassium*	425 J	SB	8,500 - 43,000 (7)
Selenium	1.46 J	2 or SB	0.1 - 3.9
Silver	0.278 J	SB	ND - 5.0 (8)
Sodium*	208 J	SB	6,000 - 8,000
Zinc	17.4	20 or SB	9 - 50
Other (mg/kg)			
Cyanide	**918**	NA	NA (9)
Amenable cyanide	**19.4**	NA	NA (9)

Notes

Bluefill sample depth is approximately 1 foot bgs.

Bold concentrations indicate chemical is selected as a chemical of potential concern (COPC).

*Indicates analyte is an essential nutrient and is categorically eliminated as a COPC.

J - The concentration given is an approximate value

(1) Recommended Soil Cleanup Objectives, New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000

(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000

(3) PAH background concentrations are from the Agency for Toxic Substances and Disease Registry, 1995

(4) NYSDEC TAGM 4046, Dec. 2000, Individual SVOCs < 50 ppm

(5) USEPA soil screening level for non-residential soils (USEPA, 2003)

(6) Value for eastern USA soils, Dragun and Chiasson, 1991

(7) NYSDEC TAGM 4046, Dec. 2000, New York State background

(8) Value for soils of the conterminous USA, Dragun and Chiasson, 1991

(9) Some forms of cyanide are complex and very stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of cyanide should be taken into consideration when establishing soil cleanup objective.

SB - Site Background

NA - Not Available

TABLE 6-5

Selection of COPECs in Filter Cake/Flue Ash Samples
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Surface Soil Samples (0-2' bgs)		Subsurface Soil Sample (11.5-12' bgs)		NYSDEC Soil Cleanup Objectives [1]	Urban Background Concentrations [2][3]
	Frequency of Detection	Range of Detected Concentrations	Frequency of Detection	Range of Detected Concentrations		
Volatile Organic Compounds - (ug/kg)						
Benzene	Not Analyzed		1 / 1	22 J	60	NA
Ethylbenzene	Not Analyzed		1 / 1	11 J	5,500	NA
Toluene	Not Analyzed		1 / 1	23 J	1,500	NA
Total Xylenes	Not Analyzed		1 / 1	12.1 J	1,200	NA
Polycyclic Aromatic Hydrocarbons - (ug/kg)						
Anthracene	0 / 1	ND	1 / 1	83 J	50,000 [4]	NA
Benzo(a)anthracene	0 / 1	ND	1 / 1	150 J	224 or MDL	169 - 59,000
Benzo(a)pyrene	0 / 1	ND	1 / 1	**90 J**	61	165 - 220
Benzo(b)fluoranthene	1 / 1	56 J	1 / 1	250 J	1,100	15,000 - 62,000
bis(2-Ethylhexyl)phthalate	0 / 1	ND	1 / 1	210 J	50,000 [4]	NA
Chrysene	0 / 1	ND	1 / 1	250 J	400	251 - 640
Fluoranthene	1 / 1	80 J	1 / 1	310 J	50,000 [4]	200 - 166,000
Indeno(1,2,3-cd)pyrene	0 / 1	ND	1 / 1	72 J	3,200	8,000 - 61,000
Phenanthrene	1 / 1	78 J	1 / 1	270 J	50,000 [4]	NA
Pyrene	1 / 1	78 J	1 / 1	270 J	50,000 [4]	145 - 147,000
Pesticides/Polychlorinated Biphenyls - (ug/kg)						
Endrin	Not Analyzed		1 / 1	4.7 P	100	NA
Endrin aldehyde	Not Analyzed		1 / 1	2.3 J	NA	NA
Aroclor-1254	1 / 1	41	1 / 1	140	NA	NA
Total PCBs	1 / 1	41	1 / 1	140	1,000; 10,000 [5]	NA
Metals (mg/kg)						
Aluminum	1 / 1	5,320	1 / 1	9,060	SB	33,000
Antimony	1 / 1	**137**	1 / 1	**249**	SB	< 1 - 8.8 [6]
Arsenic	1 / 1	**14.3**	1 / 1	**22.6**	7.5 or SB	3 -12 [7]
Barium	1 / 1	64.3	1 / 1	96.3	300 or SB	15 - 600
Beryllium	1 / 1	1.1	1 / 1	**1.86**	0.16 or SB	0 - 1.75
Cadmium	1 / 1	**6.89**	1 / 1	**7.66**	1 or SB	0.1 - 1
Calcium*	1 / 1	25,800	1 / 1	31,000	SB	130 - 35,000
Chromium	1 / 1	**184**	1 / 1	**182**	10 or SB	1.5 - 40 [7]
Cobalt	1 / 1	7.24	1 / 1	14.1	30 or SB	2.5 - 60 [7]
Copper	1 / 1	**239**	1 / 1	**298**	25 or SB	1 - 50
Iron*	1 / 1	190,000 D	1 / 1	244,000 D	2,000 or SB	2,000 - 550,000
Lead	6 / 6	1,470 - **11,000**	1 / 1	**2,970**	710 - 1,712 [8]	200 - 500
Magnesium*	1 / 1	5,950	1 / 1	8,590	SB	100 - 5,000
Manganese	1 / 1	2,810	1 / 1	4,960	SB	50 - 5,000
Mercury	1 / 1	0.165	1 / 1	**0.292**	0.1	0.001 - 0.2
Nickel	1 / 1	**48.7**	1 / 1	**103**	13 or SB	0.5 - 25
Potassium*	1 / 1	693	1 / 1	2,310	SB	8,500 - 43,000 [7]
Selenium	1 / 1	**12.6**	0 / 1	ND	2 or SB	0.1 - 3.9
Silver	0 / 1	ND	1 / 1	**80.4**	SB	ND - 5.0 [9]
Sodium*	1 / 1	441 J	1 / 1	887	SB	6,000 - 8,000
Thallium	1 / 1	**4.98**	1 / 1	**6.92**	SB	NA
Vanadium	1 / 1	20.6	1 / 1	28.1	150 or SB	1 - 300
Other (mg/kg)						
Cyanide	1 / 1	**4.35**	1 / 1	**24**	NA	NA [10]

Notes

Surface soil dataset includes five flue ash samples (0.5-1.5 ft bgs) analyzed for lead only and 1 surface soil sample (0-0.5 ft bgs).

Bold concentrations indicate chemical is selected as a chemical of potential concern (COPC).

*Indicates analyte is an essential nutrient and is categorically eliminated as a COPC.

J - The concentration given is an approximate value.

D - Indicates result from secondary dilution run.

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%.

4046, Dec. 2000

(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000

(3) PAH background concentrations are from the Agency for Toxic Substances and Disease Registry, 1995

(4) NYSDEC TAGM 4046, Dec. 2000, Individual SVOCs < 50 ppm

(5) NYSDEC TAGM 4046, Dec. 2000, Recommended Soil Cleanup Objective for surface soil is 1,000 mg/kg; for subsurface soil is 10,000 µg/kg

(6) Value for eastern USA soils, Dragun and Chiasson, 1991

(7) NYSDEC TAGM 4046, Dec. 2000, New York State background

(8) USEPA soil screening level for non-residential soils (USEPA, 2003)

(9) Value for soils of the conterminous USA, Dragun and Chiasson, 1991

(10) Some forms of Cyanide are complex and very stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objective.

SB - Site Background

NA - Not Available

chemical in each data set to appropriate screening criteria (e.g., NYSDEC TAGM 4046 Recommended Soil Cleanup Objectives or NYSDEC Class GA Ambient Water Quality Standards and Guidance Values). Chemicals with maximum detected concentrations greater than the screening criteria were selected as COPC. However, for the inorganic chemicals in soil/fill, if a maximum detected concentration exceeded the screening criterion, but was still within the range of the conterminous or eastern United States background concentrations, then it was not selected as a COPC. Chemicals without corresponding screening criteria were also selected as COPC. Finally, inorganic chemicals regarded as essential nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) were categorically eliminated as COPC in both soil/fill and groundwater. A summary of the COPC selected in the sampled environmental media of concern are summarized in Table 6-1.

6.2.1 Surface Soil/Fill

For the purposes of the human health evaluation, surface soil/fill is identified as samples collected between the depths of 0-2 feet bgs. The collection of surface soil/fill samples is presented in Section 2.7.1, and sample locations are illustrated on Figure 2-1. Surface soil/fill samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and Target Analyte List (TAL) metals plus cyanide analytes. One surface soil/fill sample (SB-403A) was visually characterized as flue ash and is evaluated with the filter cake/flue ash data. Table 6-2 provides a summary of surface soil/fill data, with the frequency of detection, range of detected chemical concentrations, and appropriate screening criteria. The results of duplicate samples were averaged with those of the corresponding field samples.

The screening criteria used to select COPC are the NYSDEC's recommended soil cleanup objectives and the eastern United States background concentrations for inorganic chemicals provided in TAGM 4046 [or, in their absence, as provided in *Elements in North American Soils* (Dragun and Chiasson, 1991)]. There were no site-specific background samples collected. Background concentrations of PAHs in urban soils (ATSDR, 1995) were included in Table 6-2 for comparison purposes only and were not used as screening criteria.

The following chemicals were selected as COPC in surface soil/fill:

- PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene

- Metals: antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, thallium, and zinc

- Other: cyanide

Cyanide was included as a COPC due to the lack of screening criteria. Of the PAHs selected as COPC, only benzo(a)pyrene and chrysene were detected at concentrations greater than those typically found in urban soils.

6.2.2 Subsurface Soil/Fill

For the purposes of the human health evaluation, subsurface soil/fill is identified as samples collected at depths greater than 2 feet bgs. The collection of subsurface soil/fill samples is presented in Section 2.7.2, and sample locations are illustrated on Figure 2-1. Subsurface soil samples (> 2 ft bgs) were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PCBs and pesticides, and TAL metals plus cyanide analytes. One subsurface soil sample (SB-402B) was visually characterized as flue ash and is evaluated with the filter cake/flue ash data. Table 6-3 provides a summary of subsurface soil/fill data, with the frequency of detection, range of detected chemical concentrations, and appropriate screening criteria. The results of duplicate samples were averaged with those of the corresponding field samples.

The screening criteria are as described above for surface soil. The following chemicals were selected as COPC in subsurface soil/fill:

- VOCs: acetone, cyclohexane, and methylcyclohexane

- SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, 1,1'-biphenyl, carbazole, chrysene, dibenzo(a,h)anthracene, 4-nitrophenol, and phenol

- Metals: antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, nickel, selenium, silver, thallium, and zinc.

- Other: cyanide and amenable cyanide

Cyclohexane, methylcyclohexane, 1,1'-biphenyl, carbazole, cyanide, and amenable cyanide were included as COPCs due to the lack of screening criteria. Of the PAHs selected as COPCs, only benzo(a)pyrene and chrysene were detected at concentrations greater than those typically found in urban soils.

6.2.3 Blue Fill

One sample was collected from an area of blue fill, at a depth of approximately 1.0-1.5' bgs and in the vicinity of MW-406, along the southern boundary of the Site. Because of its unique physical composition and limited distribution across the Site, this material is evaluated as a separate environmental medium from surface and subsurface soil/fill. The blue fill sample was analyzed for TCL SVOCs, pesticides/PCBs, TAL metals, and amenable cyanide. No pesticides, or PCBs were detected. Table 6-4 presents the data summary for this sample, with the frequency of detection, range of detected chemical concentrations, and appropriate screening criteria.

The screening criteria are as described above for surface soil. The following chemicals were selected as COPC in subsurface soil/fill:

- SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and pentachlorophenol

- Metals: antimony, arsenic, and mercury

- Other: cyanide and amenable cyanide

Cyanide and amenable cyanide were included as COPCs due to the lack of screening criteria. Of the PAHs selected as COPCs, only benzo(a)pyrene was detected at concentrations greater than those typically found in urban soils.

6.2.4 Filter Cake/Flue Ash

Five samples were collected, from the 0.5-1.5' bgs depth interval within the filter cake/flue ash (flue ash) pile located on the western side of Parcel 4. Because of its unique physical composition, the flue ash is evaluated as a separate environmental medium from surface and subsurface soil/fill. The flue ash samples were only analyzed for lead, based on an elevated lead detection in a historic sample from this material. The flue ash lead results, combined with the analytical results from surface soil sample SB-403A, are summarized with frequency of detection and range of detected chemical concentrations in Table 6-5. The analytical results from subsurface soil sample SB-402B are presented separately in Table 6-5, due to the difference in sample depth and resultant differences in potentially relevant exposure pathways.

The screening criteria to select COPCs in filter cake/flue ash are as described above for surface soil/fill. The following chemicals were selected as COPC in filter cake/flue ash:

<u>Surface samples (0-2 feet bgs)</u>

- Metals: antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, and thallium
- Other: cyanide

<u>Subsurface sample (11.5 – 12 feet bgs)</u>

- SVOCs: benzo(a)pyrene
- Metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, and thallium
- Other: cyanide

Cyanide was included as a COPC due to the lack of screening criteria. Benzo(a)pyrene was detected at concentrations less than those typically found in urban soils.

6.2.5 Groundwater

Groundwater data are available from samples collected in February 2006 from twelve monitoring wells on or in proximity to BLCP Parcel 4. Monitoring well locations are depicted on Figure 2-1 and are summarized below:

- ABB MW-103 and MW-401 through MW-407 are located on Parcel 4.
- ABB MW-101, MW-305, MW-306, and MW-307 are located on BLCP Parcel 3, between Parcel 4 and Union Ship Canal.

Groundwater samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs, and TAL metals plus cyanide. No pesticides or PCBs were detected in any groundwater samples. Groundwater data are summarized in Table 6-6. The frequency of detection, range of detected chemical concentrations, and screening criteria are provided. The screening criteria used to select COPCs in groundwater are for "Class GA" groundwater from *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations,* NYSDEC's Technical and Operational Guidance Series (TOGS) 1.1.1, June 1998, and April 2000 Addendum.

The following chemicals were selected as COPC based on the comparison of groundwater sample data to the selected screening criteria:

- VOCs: acetone, benzene, and 4-methyl-2-pentanone
- SVOCs: bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, 2,4-dichlorophenol, 2-methylnaphthalene, 3&4-methylphenols, pentachlorophenol, phenol, and 2,4,6-trichlorophenol
- Metals: aluminum, antimony, arsenic, beryllium, cobalt, copper, lead, manganese, nickel, selenium, thallium, and vanadium
- Other: cyanide

TABLE 6-6

Summary of Groundwater Data and Comparison to Screening Criteria
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations	NYSDEC Class "GA" Standards (1)
Volatile Organic Compounds (ug/L)			
Acetone	2 / 12	23 J - **210**	50 (2)
Benzene	3 / 12	0.55 J - **1.25 J**	1
2-Butanone	1 / 12	18.0	50 (2)
Carbon disulfide	2 / 12	3.4 J - 5.8	60 (2)
4-Methyl-2-pentanone	1 / 12	**2 J**	NA
Toluene	7 / 12	0.84 J - 1.1 J	5 (3)
1,1,1-Trichloroethane	1 / 12	0.41 J	5 (3)
Semi-volatile Organic Compounds (ug/L)			
Acenaphthene	1 / 12	6.7 J	20 (2)
Anthracene	1 / 12	1.7 J	50 (2)
bis(2-Ethylhexyl)phthalate	12 / 12	2.3 JB - **6.7**	5
Carbazole	1 / 12	**16**	NA
Dibenzofuran	1 / 12	**4 J**	NA
2,4-Dichlorophenol	1 / 12	**5.2 J**	5 (3)
2,4-Dimethylphenol	1 / 12	1.4 J	50 (2)
Fluoranthene	1 / 12	2 J	50 (2)
Fluorene	1 / 12	6.6 J	50 (2)
2-Methylnaphthalene	1 / 12	**1.2 J**	NA
3&4-Methylphenols	1 / 12	**3.6 J**	NA
Naphthalene	6 / 12	1.5 J - 7.2	10 (2)
Pentachlorophenol	1 / 12	**5.6 J**	NA
Phenanthrene	1 / 12	3.6 J	50 (2)
Phenol	4 / 12	**1.3 J** - **16**	NA
2,4,6-Trichlorophenol	1 / 12	**1.5 J**	NA
Metals (ug/L)			
Aluminum	12 / 12	**101 J** - **26,300**	NA
Antimony	4 / 12	**7.5 J** - **25 J**	3
Arsenic	7 / 12	13.9 - **617**	25
Barium	12 / 12	12.3 J - 497	1,000
Beryllium	6 / 12	0.07 - **4.8 J**	3 (2)
Cadmium	1 / 12	0.56 J	5
Calcium*	12 / 12	13,300 - 199,000	NA
Chromium	7 / 12	1.7 J - 47.6	50
Cobalt	8 / 12	**0.43 J** - **10.2 J**	NA
Copper	12 / 12	5.40 J - **217**	200
Iron*	12 / 12	342 - 58,300	NA
Lead	7 / 12	4.4 J - **224**	25
Magnesium*	11 / 12	378 J - 88,600	35,000 (2)
Manganese	12 / 12	**1.0 J** - **3,560**	NA
Mercury	4 / 12	0.090 J - 0.31	0.7
Nickel	8 / 12	2.0 J - **289**	100
Potassium*	11 / 12	1,840 J - 1,220,000 DL	NA
Selenium	9 / 12	2.2 J - **29**	10
Silver	2 / 12	1.8 J - 2.6 J	50
Sodium*	12 / 12	11,300 - 557,000	20,000
Thallium	1 / 12	**10.3**	0.5 (2)
Vanadium	10 / 12	**4.4 J** - **478**	NA
Zinc	12 / 12	28.6 J - 747	2,000 (2)
Other (ug/L)			
Cyanide	11 / 12	35 - **5,710**	200

Notes

Bold concentrations indicate chemical is selected as a chemical of potential concern (COPC).

*Indicates analyte is an essential nutrient and is categorically eliminated as a COPC.

DL - Indicates result from secondary dilution run.

J - Organics: Indicates and estimated value. Inorganics: The reported value is less than CRDL, but greater than the IDL.

B - Indicates analyte was found in the blank as well as the sample result.

Addendum

(2) Value represents Guidance Value

(3) The principal organic contaminant standard of 5 µg/L applies to this substance

NA = Not Available

Carbazole, dibenzofuran, 2-methylnaphthalene, 3&4-methylphenols, 4-methyl-2-pentanone, pentachorophenol, phenol, 2,4,6-trichlorophenol, aluminum, cobalt, manganese, and vanadium were included as COPCs due to the lack of screening criteria.

6.3 Exposure Assessment

The exposure assessment is facilitated by a Site visit/field survey that was conducted on May 24, 2005. The objective of the exposure assessment is to estimate the type of and potential for human exposure to the COPC that are present in, or potentially migrating from, the environmental media of concern identified in Section 6.2. The exposure assessment consists of the consideration of populations that have the potential for exposure to conditions at the Site, currently and in the future, in the absence of Site remediation, and an analysis of the pathways and routes by which receptors may be exposed to COPC at the Site.

As shown on Figure 1-1, the BLCP is located within an industrial area on the southwestern edge of the City of Buffalo. The BLCP has been segregated into four parcels to facilitate investigation, remediation, and redevelopment. Parcel 3 borders the southern boundary of Parcel 4 and consists of the Union Ship Canal and 200 feet of surrounding land. Directly north of Parcel 4 is a vacant lot currently owned by Consolidated Rail Corporation; to the east is a vacant lot currently owned by Shenango Steel. Separate environmental investigations and redevelopment plans exist for the neighboring properties to the north and east. North-south NYS Route 5 forms the BLCP's western boundary. Lake Erie is on the opposite (western) side of NYS Route 5, within 0.5-mile of Parcel 4.

Parcel 4 is currently vacant but is frequented on a daily basis by recreationists who have been witnessed to drive 4WD vehicles on the Site, to fish in the nearby Union Ship Canal and/or under NYS Route 5 on Fuhrmann Boulevard Extension, or park and eat lunch during the noon hour. In addition, during the Site visit, it was observed that Parcel 4 is used as a local dumpsite for household and construction/demolition waste and worn tires. Residential properties in the Cities of Buffalo and Lackawanna are located within two miles of the Site, and the proximity of Parcel 4 to the highway lends to its current use by trespassers and recreationists.

6.3.1 Potential Human Receptors

The potential for human exposure to the COPC identified in environmental media at the Site was considered under potential current/future and future exposure scenarios.

Current/Future

The current/future scenario addresses the current Site conditions that may exist into the future, in the event of no Site redevelopment and no Site remediation. The following categories of human receptors were identified:

- Trespasser/Recreationist: (adults, adolescents) who may spend time within the boundaries of the Site without access permission.

- Off-site Recreationist: (adults, adolescents) who may fish and consume fish caught in the nearby Union Ship Canal. This scenario includes those who fish from Parcel 3 and Fuhrmann Boulevard Extension and those who may fish from boat in Union Ship Canal.

Future

The following categories of potential future human receptors, based on the planned redevelopment of the Site for future commercial/industrial use, were identified:

- Construction/Utility Worker: (adults) whose work may require excavation at the Site while improving and/or maintaining the Site for future use.

- Site Worker: (adults) who may perform area supervisory or security activities, grounds maintenance, or work within future buildings on the Site.

- Off-site Recreationist: (adults, adolescents) who may fish and consume fish caught in the Union Ship Canal. This scenario includes those who fish from Parcel 3 and Fuhrmann Boulevard Extension and those who may fish from boat in Union Ship Canal.

6.3.2 Exposure Pathways

Chemical release mechanisms, in the absence of remedial action, used in determining potential exposure pathways from COPC in environmental media of concern to potential human receptors at the Site, are summarized in Table 6-7. Potentially complete exposure pathways are noted, with descriptions justifying their inclusion.

6.3.2.1 Current/Future Scenario

The following exposure scenarios were based on current Site conditions, that may exist into the future in the event of no Site redevelopment and no Site remediation.

Trespasser/Recreationist: Based on evidence that trespassing (e.g., dumping household and construction/demolition waste and recreational vehicle use) has occurred at the Site and may continue to occur in the future, the following exposure pathways were identified as potentially complete:

- Dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in blue fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in filter cake/flue ash.

Off-Site Recreationist: Since fishing occurs in the nearby Union Ship Canal and will most likely continue into the future, the following exposure pathways were identified as potentially complete:

- Dermal contact with COPC in groundwater that discharges to surface water in Union Ship Canal.
- Ingestion of COPC in groundwater that discharges to surface water and have bioaccumulated in fish caught in or near Union Ship Canal.

TABLE 6-7

Chemical Release Mechanisms and Exposure Pathways in the Absence of Site Remediation
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Source Media	Release Mechanism	Exposure Media	Site Conditions	Potential Current/Future [1] Exposure Pathway?	Potential Future[2] Exposure Pathway?
On-Site Soil/Fill	Not applicable	Surface Soil/Fill (0-2' bgs)	Parcel 4 is currently vacant but is frequented by potential human receptors on a daily basis. Evidence and observation of recreational vehicle use on the site was documented during the site visit. Parcel 4 is also used as a local dumpsite for household waste and worn tires. Residential properties in the Cities of Buffalo and Lackawanna are located within two miles south of the site, and the proximity of the site to NY State Route 5 lends to its current use by trespassers and recreationists.	Yes - surface soil/fill samples were collected for analysis; data are considered representative of conditions throughout the site. COPC have been identified in surface soil/fill. As such, human receptors may be exposed to COPC present in surface soil/fill.	Yes - in the absence of site remediation, future release mechanisms will not differ from the current scenario. In the event of site redevelopment, site workers and construction/utility workers may also be exposed to COPC in surface soil/fill.
	Not applicable	Subsurface Soil/Fill (> 2' bgs)	The majority of the site historically consisted of swampy areas with depths up to 15 feet that were subsequently backfilled with silty sand, slag, and gravel to support site operations.	No - subsurface soil samples were collected for analysis; data are considered representative of conditions across the site. COPC have been identified in subsurface soil/fill. However, based on current land use activities, human receptors are not expected to contact subsurface soil/fill.	Yes - in the event of site redevelopment and in the absence of site remediation, human receptors performing construction/utility work on the site may be exposed to COPC in subsurface soil/fill.
Blue Fill	Not applicable	Blue Fill	An area of blue fill was encountered in the vicinity of MW-406, along the southern boundary of the site. The blue fill sample was collected at a depth of approximately 1' bgs from a layer about 4-6" thick. The subsurface footprint of the blue fill material is of limited areal extent.	Yes - the blue fill was encountered at a depth of approximately 1' bgs. COPC have been identified in blue fill. Based on current land use activities, human receptors may be exposed to COPC present in blue fill.	Yes - in the absence of site remediation, future release mechanisms will not differ from the current scenario. Additionally, in the event of site redevelopment, site workers and construction/utility workers may also be exposed to COPC in blue fill.
Filter Cake/Flue Ash	Not applicable	Filter Cake/Flue Ash	Site history indicates filter cake and flue ash were disposed of in the western portion of the site. A filter cake/flue ash pile is present on the site; the subsurface footprint of the filter cake/flue ash disposal area may be of a greater lateral extent.	Yes - samples were collected from the filter cake/flue ash pile for lead analysis. Additionally, 1 surface soil and 1 subsurface soil sample were characterized and evaluated as flue ash. COPC have been identified in all filter cake/flue ash samples. As such, human receptors may be exposed to COPC present in filter cake/flue ash at the surface of the site.	Yes - in the absence of site remediation, future release mechanisms will not differ from the current scenario. Additionally, in the event of site redevelopment, site workers and construction/utility workers may also be exposed to COPC in filter cake/flue ash.
On-Site Soil/Fill	Volatilization	Indoor Air	See descriptions of "Surface Soil/Fill" and "Subsurface Soil/Fill" above. VOCs and SVOCs have been detected in subsurface soil/fill and groundwater samples. Results of the hydrogeologic investigation indicate the groundwater table is present approximately 1 - 7 feet below grade.	No - although VOCs and SVOCs have been detected in subsurface soil/fill, there are currently no buildings on the site. Therefore, there is no potential for vapor intrusion under the current land use scenario.	Yes - in the absence of site remediation, redevelopment of the site may result in the potential for volatilization of VOCs in subsurface soil/fill and/or groundwater to indoor air of future buildings on the site. Site workers may be exposed to VOCs in subsurface soil/fill and/or groundwater that have migrated to indoor air.
	Leaching	Groundwater	See descriptions of "Surface Soil/Fill" and "Subsurface Soil/Fill" above. Results of the hydrogeologic investigation indicate the groundwater table is present approximately 1 - 7 feet below grade. There are no potable groundwater wells in the vicinity of the site.	No - groundwater samples were collected for analysis; data are considered representative of conditions across the site. COPC have been identified in groundwater. However, based on current land use and depth to shallow groundwater, there are no human receptors who are expected to contact COPC in shallow groundwater.	Yes - in the event of site redevelopment and the absence of site remediation, human receptors performing construction/utility work on the site may be exposed to COPC in shallow groundwater.
		Surface Water	Shallow groundwater on the site flows in a southerly direction and discharges to surface water of Union Ship Canal, located 200 feet from the southern boundary of BLCP Parcel 4.	Yes - groundwater samples were collected for analysis; data are considered representative of conditions across the site. COPC have been identified in groundwater. Recreationists/fishermen may contact COPC in groundwater that discharges to surface water of Union Ship Canal.	Yes - in the absence of site remediation, future release mechanisms will not differ from the current scenario.
		Biota	Shallow groundwater on the site flows in a southerly direction and discharges to surface water of Union Ship Canal, located 200 feet from the southern boundary of BLCP Parcel 4.	There is the potential for COPC to biomagnify from lower to higher trophic levels in the aquatic food web and for fish to bioaccumulate COPC. Fishermen may be exposed to COPC bioaccummulated in fish.	Yes - in the absence of site remediation, future release mechanisms will not differ from the current scenario.

Notes

COPC = Chemicals of Potential Concern

1 = The current/future scenario considers current land use that may exist into the future, in the event of no site redevelopment and no site remediation.

1 = The future scenario considers future land use, assuming site redevelopment and no site remediation.

6.3.2.2 Future Scenario

The following additional exposure scenarios were evaluated based on the planned future commercial/industrial use of the Site and in the absence of Site remediation. The future scenario includes foreseeable events such as construction and maintenance activities.

Construction/Utility Worker: During future redevelopment or maintenance of the Site, the following exposure pathways are identified as potentially complete:

- Dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in subsurface soil/fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in blue fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in filter cake/flue ash.
- Dermal contact with and inhalation of volatile COPC in shallow groundwater.

Site Worker: Since the future redevelopment of the Site includes commercial/industrial buildings, indoor Site workers are expected to be present. There may also be workers who perform area supervisory or security activities and grounds maintenance. The following exposure pathways were identified as potentially complete:

- Dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in blue fill.
- Dermal contact with and incidental ingestion and inhalation of COPC in filter cake/flue ash.

- Inhalation of COPCs that have volatilized from subsurface soil and/or groundwater and migrated to indoor air of future buildings on the Site.

Off-site Recreationist: Since the future redevelopment of the Site will allow access to the public, fishing will most likely continue to occur in the nearby Union Ship Canal. The following exposure pathways were identified as potentially complete:

- Dermal contact with COPC in groundwater that discharges to surface water in Union Ship Canal.

- Ingestion of COPC in groundwater that discharges to surface water and have bioaccumulated in fish caught in or near Union Ship Canal.

6.4 Toxicity Assessment

For each COPC, critical non-carcinogenic and carcinogenic health effects, for oral and inhalation exposures, are presented in Tables 6-8 and 6-9, respectively. The critical health effects given were those that are used by the USEPA to derive reference doses and reference concentrations (to assess the potential for chronic non-carcinogenic health effects), and slope factors (to assess carcinogenic risk), that are typically used in the quantification of human health risks.

6.5 Risk Characterization

Based on Site conditions, observations, and the fact that the Site redevelopment plan includes future commercial/industrial use, relative exposure and potential for adverse health effects are discussed for the identified receptor populations below. The potential for exposure is classified as “Not Expected”, “Possible”, or “Likely”. Table 6-10 provides a summary of the human health risk characterization.

6.5.1 Current/Future Scenarios

The potential for exposure to COPC via the pathways described in the Exposure Assessment is discussed for each receptor population in the current/future scenario, under the assumption that there will be no remediation or redevelopment at the Site.

TABLE 6-8
Non-carcinogenic Health Effects of Chemicals of Potential Concern
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Chemical of Potential Concern	CAS #	Non-carcinogenic Oral Critical Effect	Non-carcinogenic Inhalation Critical Effect
Volatile Organic Compounds			
Acetone	67-64-1	Nephropathy	--
Benzene	71-43-2	Decreased lymphocyte count	Decreased lymphocyte count
Cyclohexane	110-82-7	--	--
4-Methyl-2-pentanone	108-10-1	--	Reduced fetal body weight, skeletal variations, and increased fetal death in mice, and skeletal variations in rats.
Methylcyclohexane	108-87-2	--	--
Semivolatile Organic Compounds			
Benzo(a)anthracene	56-55-3	--	--
Benzo(a)pyrene	50-32-8	--	--
Benzo(b)fluoranthene	205-99-2	--	--
Benzo(k)fluoranthene	208-08-9	--	--
1,1-Biphenyl	92-52-4	Kidney damage	--
bis(2-Ethylhexyl)phthalate	117-81-7	Increased relative liver weight	--
Carbazole	86-74-8	--	--
Chrysene	218-01-9	--	--
Dibenzo(a,h)anthracene	53-70-3	--	--
Dibenzofuran	132-64-9	--	--
2,4-Dichlorophenol	120-83-2	Decreased delayed hypersensitivity response	--
Indeno(1,2,3-cd)pyrene	193-39-5	--	--
2-Methylnaphthalene	91-57-6	Pulmonary alveolar proteinosis	--
3-Methylphenol	108-39-4	Decreased body weights and neurotoxicity	--
4-Methylphenol	106-44-5	--	--
4-Nitrophenol	100-02-7	--	--
Pentachlorophenol	87-86-5	Liver and kidney pathology	--
Phenol	108-95-2	Decreased maternal weight gain	--
2,4,6-Trichlorophenol	88-06-2	--	--

TABLE 6-8
Non-carcinogenic Health Effects of Chemicals of Potential Concern
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Inorganics			
Aluminum	121-82-4	Minimal neurotoxicity	Psychomotor and cognitive impairment
Antimony	7440-36-0	Decreased longevity, decreased blood glucose levels, and altered chloesterol levels	--
Arsenic	7440-38-2	Hyperpigmentation, keratosis and possible vascular complications	--
Barium	7440-39-3	Nephropathy	--
Cadmium	7440-43-9	Significant proteinuria	--
Chromium (as Chromium III)	16065-83-1	No effects observed	--
Chromium (as Chromium VI)	18540-29-9	--	Nasal septum atrophy; lactate dehydrogenase in bronchioalveolar lavage fluid
Cobalt	7440-48-4	--	--
Copper	7440-50-8	--	--
Lead	7439-92-1	--	--
Manganese	7439-96-5	Central nervous system effects (other effect: Impairment of neurobehavioral function)	Impairment of neurobehavioral function
Mercury (as mercuric chloride)	7487-94-7	Autoimmune effects	--
Nickel (as soluble salts)	7440-02-0	Decreased body and organ weights	--
Selenium	7782-49-2	Clinical selenosis	--
Silver	7440-22-4	Argyria - medically benign but permanent bluish gray discoloration of the skin	--
Thallium (as thallium(I)sulfate)	7446-18-6	No observed adverse effects	--
Vanadium	7440-62-2	--	--
Zinc	7440-66-6	Decrease in erythrocyte superoxide dismutase activity	--
Other			
Cyanide (as hydrogen cyanide)	74-90-8	Weight loss, thyroid effects, and myelin degeneration	Central nervous systems and thyroid effects

Notes
Source: USEPA Integrated Risk Information System (IRIS)

TABLE 6-9

Carcinogenic Health Effects of Chemicals of Potential Concern
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Chemical of Potential Concern	CAS #	Oral Carcinogenic Cancer Type	Inhalation Carcinogenic Cancer Type	Weight-of-Evidence Classification (*)
Volatile Organic Compounds				
Acetone	67-64-1	--	--	D
Benzene	71-43-2	Leukemia	Leukemia	A
2-Butanone	78-93-3	--	--	--
Cyclohexane	110-82-7	--	--	--
4-Methyl-2-pentanone	108-10-1	--	--	--
Methylcyclohexane	108-87-2	--	--	--
Tetrachloroethene	127-18-4	--	--	--
Semivolatile Organic Compounds				
Benzo(a)anthracene	56-55-3	--	--	B2
Benzo(a)pyrene	50-32-8	Forestomach, squamous cell papillomas, and carcinomas	--	B2
Benzo(b)fluoranthene	205-99-2	--	--	B2
Benzo(k)fluoranthene	207-08-9	--	--	B2
1,1-Biphenyl	92-52-4	--	--	D
bis(2-Ethylhexyl)phthalate	117-81-7	Hepatocellular carcinoma and adenoma	--	B2
Carbazole	86-74-8	--	--	--
Chrysene	218-01-9	--	--	B2
Dibenzo(a,h)anthracene	53-70-3	--	--	B2
Dibenzofuran	132-64-9	--	--	D
2,4-Dichlorophenol	120-83-2	--	--	--
Indeno(1,2,3-cd)pyrene	193-39-5	--	--	B2
2-Methylnaphthalene	91-57-6	--	--	--
3-Methylphenol	108-39-4	--	--	C
4-Methylphenol	106-44-5	--	--	C
4-Nitrophenol	100-02-7	--	--	--
Pentachlorophenol	87-86-5	Hepatocellular adenoma/carcinoma, pheochromocytoma/ malignant pheochromocytoma, hemangiosarcoma/ hemangioma (pooled incidence)	--	B2
Phenol	108-95-2	--	--	D
2,4,6-Trichlorophenol	88-06-2	Leukemia	Leukemia	B2

TABLE 6-9

Carcinogenic Health Effects of Chemicals of Potential Concern
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Chemical of Potential Concern	CAS #	Oral Carcinogenic Cancer Type	Inhalation Carcinogenic Cancer Type	Weight-of-Evidence Classification (*)
Inorganics				
Aluminum	121-82-4	--	--	D
Antimony	7440-36-0	--	--	--
Arsenic	7440-38-2	Increased mortality from multiple internal organ cancers (liver, kidney, lung, bladder), and increased incidence of skin cancer	Lung cancer	A
Barium	7440-39-3	--	--	D
Cadmium	7440-43-9	--	Lung, trachea, and bronchus cancer deaths	B1
Chromium (as Chromium III)	16065-83-1	--	--	D
Chromium (as Chromium VI)	18540-29-9	--	Lung cancer	A
Cobalt	7440-48-4	--	--	--
Copper	7440-50-8	--	--	D
Lead	7439-92-1	Increased renal tumors; suppressed gene expression	--	B2
Manganese	7439-96-5	--	--	D
Mercury (as mercuric chloride)	7487-94-7	--	--	C
Nickel (as soluble salts)	7440-02-0	--	--	--
Selenium	7782-49-2	--	--	D
Silver	7440-22-4	--	--	D
Thallium (as thallium(I)sulfate)	7446-18-6	--	--	--
Vanadium	7440-62-2	--	--	--
Zinc	7440-66-6	--	--	--
Other				
Cyanide (as hydrogen cyanide)	74-90-8	--	--	--

Notes

(*): USEPA Weight-of-Evidence Classification:

A: Human carcinogen

B1: Probable human carcinogen; limited human data are available

B2: Probably human carcinogen; sufficient evidence in animals and inadequate or no evidence in humans

C: Possible human carcinogen

D: Not classifiable as to human carcinogenicity

--: Not evaluated

Source: USEPA Integrated Risk Information System (IRIS)

TABLE 6-10

Summary of Human Health Evaluation Risk Characterization
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Scenario Timeframe	Receptor Population	Environmental Medium	Exposure Routes Evaluated			Likelihood of Exposure		
						Not Expected	Possible	Likely
Current / Future	Recreationist / Trespasser	Surface Soil/Fill	Ingestion	Dermal Contact	Inhalation			X
		Blue Fill	Ingestion	Dermal Contact	Inhalation			X
		Filter Cake/Flue Ash	Ingestion	Dermal Contact	Inhalation			X
	Off-Site Recreationist	Surface Water		Dermal Contact			X	
		Biota (Fish)	Ingestion				X	
Future	Construction / Utility Worker	Surface Soil/Fill	Ingestion	Dermal Contact	Inhalation			X
		Blue Fill	Ingestion	Dermal Contact	Inhalation			X
		Filter Cake/Flue Ash	Ingestion	Dermal Contact	Inhalation			X
		Subsurface Soil	Ingestion	Dermal Contact	Inhalation			X
		Groundwater		Dermal Contact	Inhalation		X	
	Site Worker	Surface Soil/Fill	Ingestion	Dermal Contact	Inhalation		X	
		Blue Fill	Ingestion	Dermal Contact	Inhalation		X	
		Filter Cake/Flue Ash	Ingestion	Dermal Contact	Inhalation		X	
		Indoor Air			Inhalation	X		
	Off-Site Recreationist	Surface Water		Dermal Contact			X	
		Biota (Fish)	Ingestion				X	

Trespasser/Recreationist:

Dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill:

Evidence and observation of recreational vehicle use on Parcel 4 was documented during the Site visit. Parcel 4 is also used as a local dumpsite for household waste and worn tires. Residential properties in the Cities of Buffalo and Lackawanna are located within two miles south of the Site, and the proximity of the Site to NY State Route 5 lends to its current use by trespassers and recreationists. Due to the known presence of trespassers and recreationists on the Site, and especially because of the dust that may be generated by all-terrain vehicle use on uncovered soil, exposure to COPC in the surface soil/fill via dermal contact, incidental ingestion, and inhalation of particulates released from the soil/fill, is likely.

Dermal contact with and incidental ingestion and inhalation of COPC in blue fill:

As with the surface soil/fill exposure media, exposure to blue fill would be through the same release mechanisms and exposure pathways. Therefore, exposure to COPC in blue fill via dermal contact, incidental ingestion, and inhalation of particulates is likely. The subsurface footprint of the blue fill material may be as great as 50 x 75 feet, and it was approximately 4-6” thick in the area sampled. However, the blue fill material is limited to a particular area in the vicinity of MW-406, near the center of the southern boundary of the Site. In addition, the blue fill layer was encountered at a depth of approximately 1’ bgs.

Dermal contact with and incidental ingestion and inhalation of COPC in filter cake/flue ash:

As with the surface soil/fill exposure media, exposure to filter cake and flue ash would be through the same release mechanisms and exposure pathways. Therefore, exposure to COPC via dermal contact, incidental ingestion, and inhalation of particulates released from filter cake/flue ash, is likely. The subsurface footprint of the flue ash pile may extend further east than is visible. However, the filter cake/flue ash pile is limited to a particular area on the western portion of the Site.

Off-Site Recreationist:

Dermal contact with COPC in surface water:

Fishermen have been observed fishing in nearby Union Ship Canal from the concrete canal walls on Parcel 3 and from the side of the road on Fuhrmann Boulevard Extension. Fishermen may also fish from boat in Union Ship Canal. Therefore, dermal contact exposure to COPCs in groundwater that discharges to surface water is possible. However, groundwater COPCs were selected on the basis of comparison to Class GA standards, which are protective of potable groundwater. Therefore, the potential for risk from dermal contact exposure to COPCs in surface water is likely overstated.

Ingestion of COPC that have bioaccumulated in fish:

It is expected that fish are caught in Union Ship Canal and that some of those fish are consumed. Therefore, ingestion of COPC in fish caught for consumption in the vicinity of the Site is possible. However, not all of the chemicals detected in groundwater are known to be bioaccumulative. COPCs detected in groundwater that are also considered bioaccumulative are pentachlorophenol and a few metals (i.e., arsenic, copper, lead, nickel, and selenium) (Table 4-2; USEPA, 2002).

6.5.2 Future Scenarios

The potential for exposure to COPC via the pathways described in the Exposure Assessment is discussed for each receptor population in the future scenario, assuming Site redevelopment for commercial/industrial use and no Site remediation.

Construction/Utility Worker:

Dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill:

Redevelopment and/or maintenance-related excavation or grading work at the Site could lead to contact with surface soil/fill. Therefore, dermal contact with and incidental ingestion of COPC in surface soil/fill, and inhalation of windblown or mechanically driven COPC adsorbed to fugitive dust released from soil/fill, are likely. The duration of such exposure would be limited to the construction/maintenance period.

Dermal contact with and incidental ingestion and inhalation of COPC in subsurface soil/fill:

Redevelopment and/or maintenance-related excavation or grading work at the Site could lead to contact with subsurface soil/fill. Therefore, dermal contact with and incidental ingestion of COPC in subsurface soil/fill, and inhalation of windblown or mechanically driven COPC adsorbed to fugitive dust released from soil/fill are likely. The duration of such exposure would be limited to the construction/maintenance period.

Dermal contact with and incidental ingestion and inhalation of COPC in blue fill:

As with the surface and subsurface soil/fill exposure media, exposure to blue fill would be through the same release mechanisms and exposure pathways. Therefore, exposure to COPC via dermal contact, incidental ingestion, and inhalation of windblown or mechanically driven COPC adsorbed to fugitive dust released from blue fill, is likely. However, the duration of such exposure would be limited to the construction/maintenance period. The blue fill material is limited to a particular area in the vicinity of MW-406, near the center of the southern boundary of the Site.

Dermal contact with and incidental ingestion and inhalation of COPC in filter cake/flue ash:

As with the surface and subsurface soil/fill exposure media, exposure to filter cake and flue ash would be through the same release mechanisms and exposure pathways. Therefore, exposure to COPC via dermal contact, incidental ingestion, and inhalation of windblown or mechanically driven COPC adsorbed to fugitive dust released from filter cake/flue ash, is likely. The duration of such exposure would be limited to the construction/maintenance period, and the filter cake/flue ash pile is limited to a particular area on the western portion of the Site.

Dermal contact with and inhalation of volatile COPC in shallow groundwater:

Groundwater was encountered at the Site during drilling activities at depths ranging from one to seven feet below ground surface; therefore, exposure to shallow groundwater during construction/utility work may be possible. Depending on the location on the Site, it is conceivable that excavation work may encounter groundwater. Should this occur, dermal contact with COPC in shallow groundwater and inhalation of VOCs detected in shallow groundwater is possible. The duration of such exposure would be limited to the construction/maintenance period.

<u>Site Worker</u>:

Dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill:

Planned redeveloped of the Site as a commercial/industrial office park will most likely include Site workers responsible for the management/maintenance of landscaped grounds. Site workers may also perform area supervisory or security activities or work within future buildings on the Site. Therefore, exposure to COPC in the surface soil/fill, via dermal contact or incidental ingestion, or inhalation of particulates released from the soil/fill, is possible.

However, the planned redevelopment of the Site will result in the entirety of Parcel 4 being covered with either pavement, clean fill and landscaped vegetation, or commercial/office buildings. It is expected that Site workers would have limited, and at most occasional, exposure to surface soil/fill. Lawn maintenance and tree-planting activities are expected to be occasional. Most likely, lawn grasses and/or ornamental shrubs/trees will limit dust generation and direct contact exposure to surface soil/fill.

Dermal contact with and incidental ingestion and inhalation of COPC in blue fill:

As with the surface soil/fill exposure media, exposure to blue fill would be through the same release mechanisms and exposure pathways. Therefore, exposure to COPC via dermal contact, incidental ingestion, and inhalation of particulates released from blue fill, is possible. However, the blue fill material is limited to a particular area in the vicinity of MW-406, near the center of the southern boundary of the Site, and it is expected that Site workers would have limited, and at most occasional, exposure to COPC in blue fill.

Dermal contact with and incidental ingestion and inhalation of COPC in filter cake/flue ash:

As with the surface soil/fill exposure media, exposure to filter cake and flue ash would be through the same release mechanisms and exposure pathways. Therefore, exposure to COPC via dermal contact, incidental ingestion, and inhalation of particulates released from filter cake/flue ash, is possible. However, the filter cake/flue ash pile is limited to a particular area on the western portion of the Site, and it is expected that Site workers would have limited, and at most occasional, exposure to COPC in filter cake/flue ash.

Inhalation of COPCs that have volatilized from subsurface soil and/or groundwater and migrated to indoor air of future buildings on the Site:

Given that the planned redevelopment of the Site includes the construction of buildings as part of a commercial/industrial park and that VOCs were detected in subsurface soil/fill and groundwater, there is the potential for vapor intrusion of chemicals in subsurface soil/fill and groundwater to future buildings on the Site. However, the detected concentrations of VOCs detected in subsurface soil/fill and groundwater are relatively low. New York State currently has no soil or groundwater screening values for protection of indoor air. However, the maximum detected concentrations of the majority of VOCs in subsurface soil/fill and groundwater are considerably lower than readily available screening values for soil (PADEP, 2004) and groundwater (PADEP, 2004; NJDEP, 2005). In addition, the screening values based on commercial/industrial land use for acetone, toluene, and 1,1,1-trichloroethene are greater than the water solubility's for these substances, meaning there would be no potential for human health risks at any concentrations of these COPCs in groundwater. Therefore, the potential for risks due to inhalation exposure of Site workers to VOCs in subsurface soil/fill and/or groundwater, as a result of vapor intrusion to indoor air of future buildings on the Site, is not expected.

Off-Site Recreationist:

Dermal contact with COPC in surface water:

It is expected that with planned redevelopment of the Site and surrounding areas, Parcel 3 will be accessible to visitors who may fish in nearby Union Ship Canal. It is also expected that fishing will continue from the side of the road on Fuhrmann Boulevard Extension, and it is possible that fishermen may access Union Ship Canal from boat. Therefore, dermal contact exposure to COPCs in groundwater that discharges to surface water is possible. However, groundwater COPCs were selected on the basis of comparison to Class GA standards, which are protective of potable groundwater. Therefore, the potential for risk from dermal contact exposure to COPCs in surface water is likely overstated.

Ingestion of COPC that have bioaccumulated in fish:

It is expected that with redevelopment of the Site and surrounding areas, fishing will still occur in nearby Union Ship Canal. It is expected that fish are caught in Union Ship Canal and that some of those fish are consumed. Therefore, ingestion of COPC in fish caught for consumption in the vicinity of the Site is possible. However, not all of the chemicals detected in groundwater are known to be bioaccumulative. COPCs detected in groundwater that are also considered bioaccumulative are pentachlorophenol and a few metals (i.e., arsenic, copper, lead, nickel, and selenium) (Table 4-2; USEPA, 2002).

6.6 Uncertainty Analysis

Uncertainty is inherent in the process of conducting human health evaluations. In qualitative evaluations, information and assumptions regarding the likelihood, frequency, and magnitude of exposure, and information on the toxicity of the chemicals are used to infer the potential for exposure and health risk. By design, the evaluations relied on simple and conservative assumptions with the sole intent of identifying and eliminating from concern those scenarios that were unlikely to result in exposure and health risk and highlighting those scenarios that, depending on actual circumstances, may result in exposure and health risk. Uncertainty was associated with each component of this process, including environmental sampling and analysis, chemical fate and transport analysis, exposure assessment, and the toxicological information used to characterize potential human health risks. Uncertainty in any of these components could alter the conclusions regarding the likelihood of exposure and health risk for a given receptor population.

6.6.1 Sampling and Analysis

The potential for exposure may be overstated or understated depending on how well each environmental medium was characterized. Uncertainty associated with environmental sampling is generally related to the limitations of the sampling in terms of the number and distribution of samples, while uncertainty associated with the sample analysis is generally associated with systematic or random errors (e.g., false positive or false negative results).

6.6.2 Exposure Assessment

Use of the maximum detected concentration to identify COPCs generally results in overstatement of the potential for human health risks from long-term exposure. In addition, the release mechanisms for COPC may have been overstated. Of the environmental media of potential concern at the Site, only four media (i.e., surface and subsurface soil/fill, groundwater, and filter cake/flue ash) were sampled. Other media (e.g., surface water, sediment, and biota) were not sampled, and conservative assumptions were made for their inclusion as possible media of concern.

6.6.3 Toxicological/Screening Criteria

Screening criteria were not available for all chemicals that were detected in samples collected at the Site. Based on the lack of available screening criteria and associated toxicological criteria for some COPCs, the potential for adverse human health effects as a result of exposure to those chemicals, should exposure occur, was uncertain. In most cases, the critical effects listed for the COPC were for laboratory animals, not humans. Differences in toxicity may exist between laboratory animals and humans.

6.7 Summary and Discussion

This qualitative HHE provides an indication as to the potential for exposure and adverse human health effects associated with chemicals detected in sampled environmental media at the Site. The evaluation is based on the most relevant potential exposure pathways, the most likely human receptors, and current land use as well as the proposed redevelopment of the Site.

Based on the comparison of the maximum detected concentration to chemical- and medium-specific screening values, COPC were identified in surface and subsurface soil/fill, blue fill, filter cake/flue ash, and shallow groundwater. Based on current Site conditions and land uses in the vicinity of the Site, two potential human receptor populations were identified for the current/future land use scenario: trespassers/recreationists who access the Site without permission and off-site recreationists who fish in nearby Union Ship Canal. Based on the proposed Site redevelopment, three human receptor populations were identified for the future scenario: construction/utility workers, Site workers, and off-site recreationists.

The following provides a summary of the exposure pathways identified in Section 6.3 and the determination as to the potential for exposure and risk of adverse human health effects, as indicated in Section 6.5. Table 6-10 provides a summary of the HHE findings.

6.7.1 Current/Future Scenario

The current/future scenario considers the potential for exposure and risk of adverse human health effects, assuming no Site redevelopment and no Site remediation.

Current/future exposure pathways for the trespasser/recreationist are limited to dermal contact with and incidental ingestion and inhalation of COPC in surface soil/fill, including blue fill and filter cake/flue ash. Based on observations and current Site conditions, and in the absence of Site remediation, the potential for trespasser/recreationist exposure to COPC in surface soil/fill, including blue fill and filter cake/flue ash, is likely. However, the extent of the blue fill layer and the filter cake/flue ash pile are limited. In addition, the blue fill was encountered at a depth of approximately 1' bgs.

Potential exposure pathways identified for the off-site recreationist are dermal contact with COPCs in groundwater that discharges to surface water of the nearby Union Ship Canal and ingestion of COPC that have bioaccumulated in fish. The potential for off-site recreationist exposure to COPC in surface water and through the ingestion of fish that have bioaccumulated COPC, in the absence of Site remediation, is possible. However, the potential for risk from dermal contact exposure to COPCs in groundwater discharging to surface water may be overstated, since COPCs in groundwater were selected on the basis of comparison to standards protective of potable use. In addition, not all of the chemicals detected in groundwater are known to be bioaccumulative. COPCs detected in groundwater that are also considered bioaccumulative are pentachlorophenol and a few metals (i.e., arsenic, copper, lead, nickel, and selenium) (Table 4-2; USEPA, 2002).

6.7.2 Future Scenario

The future scenario considers Site redevelopment for commercial/industrial use, in the absence of Site remediation.

Potential future exposure pathways for the construction/utility worker include dermal contact with, incidental ingestion of, and inhalation of volatile and mechanically-driven COPC in surface and subsurface soil/fill, including blue fill and filter cake/flue ash. There is also the potential for construction/utility workers to contact COPC in groundwater, via the dermal contact and inhalation routes of exposure. In the event of Site redevelopment and in the absence of Site remediation, the potential for construction/utility worker exposure to COPC in soil/fill, blue fill, filter cake/flue ash, and groundwater is likely. However, the duration of such exposure would be limited to the construction/maintenance period.

Potential exposure pathways for the Site worker include dermal contact with, incidental ingestion of, and inhalation of COPC in surface soil/fill, including blue fill and filter cake/flue ash. In the event of Site redevelopment and in the absence of Site remediation, the potential for Site worker exposure to COPC in surface soil/fill, blue fill, and flue ash is likely. However, the planned redevelopment of the Site will result in the entirety of Parcel 4 being covered with either pavement, clean fill and landscaped vegetation, or commercial/office buildings. It is expected that Site workers would have limited, and at most occasional, exposure to surface soil/fill. Lawn maintenance and tree-planting activities are expected to be occasional. Most likely, lawn grasses and/or ornamental shrubs/trees will limit dust generation and direct contact exposure to surface soil/fill.

VOCs were detected in soil/fill and groundwater, lending to the potential for Site workers to be exposed to volatile COPC that have migrated from soil/fill or groundwater to the indoor air of future buildings on the Site. However, the detected VOC concentrations in soil/fill and groundwater are much lower than readily available screening values derived to be protective of vapor intrusion of VOCs in soil and groundwater to indoor air. Therefore, the potential for Site worker exposure to volatile COPC detected in soil/fill and groundwater is not expected.

In the event of Site redevelopment, it is still expected that off-site recreationists may fish in the nearby Union Ship Canal. The exposure pathways are as described above for the current/future scenario. Therefore, the potential for off-site recreationist exposure to COPCs in groundwater via dermal contact with surface water is possible. However, the potential for risk from dermal contact exposure to COPCs in groundwater that discharges to surface water may be overstated, since COPCs in groundwater were selected on the basis of comparison to Class GA groundwater standards, which are protective of potable use. In addition, not all of the chemicals detected in groundwater are known to be bioaccumulative. COPCs detected in groundwater that are also considered bioaccumulative are pentachlorophenol and a few metals (i.e., arsenic, copper, lead, nickel, and selenium) (Table 4-2; USEPA, 2002).

A more robust determination of the potential for human health risk would require further investigation as to the bioaccumulative potential of chemicals at the detected groundwater concentrations, the collection of surface water data from Union Ship Canal, and the determination of actual off-site recreationist consumption of fish. However, consideration should be given to the Site's location within a currently urban and historically industrial area of Buffalo, New York. In reality, the discharge of COPCs in groundwater from the Site is most likely a relatively minor contributor to the potential for risks to off-site recreationists fishing in Union Ship Canal.

Fish and Wildlife Impact Analysis

SECTION 7

7.1 Introduction

The Fish and Wildlife Impact Analysis (FWIA) for Parcel 4 incorporates the screening-level process outlined in the U.S. Environmental Protection Agency's (USEPA) Ecological Risk Assessment Guidance for Superfund (USEPA, 1997) and was conducted in accordance with the NYSDEC guidance for performing Fish and Wildlife Impact Analyses for Inactive Hazardous Waste Sites (NYSDEC, 1994). Steps I (Site Description) and IIA (Pathway Analysis) of the NYSDEC guidance were used as a frame of reference. The FWIA is qualitative in nature and is based on investigation sample results collected for the Site Investigation Remedial Alternatives Evaluation.

The FWIA process synthesizes available data on the toxicity of site-related chemicals in environmental media and on potential exposure pathways to ecological receptors, to determine the potential for ecological risks at the Site. The primary objective is to assess the likelihood that chemicals detected at the Site are causing or may cause adverse effects on resident and migratory biota (plants and animals). Adverse ecological effects range from sublethal chronic effects in individual organisms, such as impaired reproductive ability, to a loss of ecosystem function (USEPA, 1997). Information obtained during the formulation of the FWIA allows risk managers to make informed decisions concerning remediation goals and potential response actions at the Site.

This FWIA consists of the following sections:

- Site characterization;
- Problem formulation;
- Identification of chemicals of potential ecological concern (COPECs);

- Ecological risk characterization;
- Assessment of uncertainties and limitations; and
- Summary.

7.2 Site Characterization

The objectives of the Site characterization are to identify plant communities and aquatic resources on and adjacent to Parcel 4; identify potential wildlife receptors utilizing resources on and adjacent to the Site; observe any visible signs of stress to plants and animals; and document significant ecological resources on and/or near the Site. The Site characterization is limited to Parcel 4 and the area within an approximately 1.0-mile radius. A visual survey was conducted during a May 24, 2005 Site visit. Other sources of information include the New York State Natural Heritage Program (NHP) and The National Map (USGS, 2006), which illustrate various geographic and natural features, including wetlands as designated by USFWS.

As shown on Figure 1-1, the BLCP is located within a former industrial area on the southwestern edge of the City of Buffalo. The BLCP has been segregated into four parcels to facilitate investigation, remediation, and redevelopment. Parcel 3 borders the southern boundary of Parcel 4 and consists of the Union Ship Canal and 200 feet of surrounding land. North-south NYS Route 5 forms the BLCP's western boundary. Lake Erie is on the opposite (western) side of NYS Route 5, within 0.5-mile of Parcel 4. Directly north of Parcel 4 is a vacant lot currently owned by Consolidated Rail Corporation; to the east is a vacant lot currently owned by Shenango Steel. Separate environmental investigations and redevelopment plans exist for the neighboring properties to the north, south, and east.

7.2.1 Terrestrial Characterization

With the exception of unpaved dirt paths and some large areas of exposed soil (e.g., debris disposal area, filter cake/flue ash pile, etc.), Parcel 4 is mostly vegetated with young trees and thick, tall grasses and forbs. Some shrubs, such as sumac (*Rhus* sp.)and redosier dogwood (*Cornus sericea*) are also present but not in such density as to necessarily constitute scrub/shrub habitat. Various non-native substrate types are present within Parcel 4 and include fill/sand, slag, and rubble. Common reed (*Phragmites australis*), a disturbance-tolerant and invasive species, can be found in patches throughout the Site. The following two cover types were identified as dominant on Parcel 4 during the Site visit and are based on the descriptions within *Draft Ecological Communities of New York State, Second Edition* (NYSDEC, 2002):

Urban vacant lot **–** Defined as "an open site in a developed, urban area that has been cleared either for construction or following the demolition of a building. Vegetation may be sparse, with large areas of exposed soil, and often rubble and other debris" (NYSDEC, 2002). The western half of the 20-acre Parcel 4 is most adequately characterized as an urban vacant lot, due to the obvious signs of human disturbance. According to the Site historical account, the Pennsylvania Railroad first owned the land north of Union Ship Canal and used the property for unloading ores from ships in the canal to train cars. The 1940 and 1950 Sanborn maps show a watchman's building and a 35,000 gallon elevated water tower in this area. The Hanna Furnace Corporation purchased Parcel 4 from the Railroad in 1960. Poorly drained swampy areas with depths up to 15 feet occupied much of the property at the time. The swampy areas were backfilled with silty sand and gravel. Hanna Furnace also disposed filter cake and flue ash in the western portion of the parcel and building rubble, furnace brick, and other debris in a pond in the central portion of the parcel.

Successional northern hardwood **–** Defined as "a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed" (NYSDEC, 2002). A wooded stand dominated by quaking aspen (Populus tremuloides) is present on the eastern side of Parcel 4. The understory is composed mainly of thick tall grasses and some shrubs. Small depressional wet areas are present within the wooded stand. Common reed, a disturbance-tolerant and invasive grass, is present at the edges of these wet areas and is found throughout the Site.

During the Site visit, it was observed that Parcel 4 is often used as a local dumpsite for household waste and worn tires. People were witnessed driving onto and through the Site during the noon hour, and 4WD vehicles were heard in the distance. Unvegetated, well-worn paths with 4WD vehicle tracks were present within the wooded area and on the western half of the Site. Such frequent human activity results in physical disturbance/stress to vegetation and the soil structure in those areas of Parcel 4. It is also likely that the daily human presence on the Site detracts wildlife and thereby limits the quality of potential wildlife habitat.

The vacant lot directly north of Parcel 4 is the historic location of an east-west railroad spur that serviced Hanna Furnace Corporation and the Union Ship Canal. Wetlands are present on the northern side of this Site, along both sides of east-west Tifft Street, see Figure 1-1. The property north of Tifft Street and within 0.5-mile of Parcel 4 is Tifft Nature Preserve, a 264-acre wildlife refuge created in 1972 on land that had partially been used in the 1950s and 1960s as a dumpsite for the City of Buffalo (Buffalo Museum of Science, 2006). In the 1970s, the municipal waste was capped with clay and covered with soil; ponds were enlarged and vegetation was planted. Currently, Tifft Nature Preserve attracts migratory birds to its large cattail marsh and provides an urban sanctuary for year-round wildlife.

Within 1 mile to the southeast of Parcel 4 is South Park, part of the Buffalo Olmsted Park System. This 155-acre park and arboretum includes a conservatory that houses the Buffalo & Erie County Botanical Gardens. A large lake within South Park and contiguous wetlands to the north are shown on Figure 1-1.

7.2.2 Surface Water Bodies and Wetlands

As indicated above, Parcel 3 of the BLCP Site borders Parcel 4 to the south and contains Union Ship Canal, located within approximately 200 feet of the Site. The portion of the canal owned by the City of Buffalo is approximately 1,900 feet long, 200 feet wide, and 20 feet deep. The Union Ship Canal was constructed in 1910 and connects with the Buffalo Outer Harbor of Lake Erie. Buffalo Outer Harbor is approximately 0.5-mile west of the BLCP Site. The Union Ship Canal and adjacent portions of Lake Erie are classified as Class C, under the New York State surface water quality standards (Part 837.4, Items 129-130; NYSDEC, 1999). According to the New York State water quality regulations, Class C waters are suitable for fish propagation and survival (Part 701.8; NYSDEC, 1999). The water quality is suitable for primary and secondary contact recreation; however, other factors may limit the use for these purposes.

Within the quaking aspen woodland on the eastern half of the Site, there are scattered pockets of standing water and depressional wet areas. Evidence that the Site historically contained wetlands has been documented from soil borings collected during previous environmental investigations. In addition, the Site historical account indicates that at the time Parcel 4 was purchased by the Hanna Furnace Corporation in 1960, poorly drained swampy areas with depths up to 15 feet occupied much of the property. The swampy area was subsequently backfilled with silty sand and gravel. The Hanna Furnace Corporation reportedly disposed of debris in an historic pond in the central portion of Parcel 4.

State freshwater wetlands information for Buffalo, NY was obtained through the Erie County (2006) Internet Mapping Project. According to the map generated using this service, no state wetlands exist on the Site. However, the federal wetlands layer displays the former location of the wetland in the center of Parcel 4. A state and federal-listed wetland (presumably the cattail marsh) is present on the Tifft Nature Preserve, north of the Site. BLCP Parcel 4 is within the 100-year floodplain for Lake Erie.

Freshwater wetlands information compiled by the National Wetlands Inventory was obtained from the National Map for BLCP Parcel 4 and surrounding areas (USGS, 2006). The portion of the National Map containing Parcel 4 is attached in Appendix F. The following wetland types, as defined by the Cowardin Classification System (Cowardin et al., 1979), are identified as present on or within 0.5-mile of the Site:

Cowardin Classifications (On-site; reflects historical presence of wetlands on the Site)

- PSS1E- palustrine, scrub/shrub, broad-leaved deciduous, seasonally flooded/saturated
- PUBZx- palustrine, unconsolidated bottom, intermittently exposed/permanent, excavated

Cowardin Classifications (Union Ship Canal and Lake Erie)

- L1UBH- lacustrine, limnetic, unconsolidated bottom, permanently flooded
- L2UBKh- lacustrine, littoral, unconsolidated bottom, artificially flooded, diked/impounded

Cowardin Classifications (Off-site)

- PEMF- palustrine, emergent, semipermanently flooded
- PEM5E- palustrine, emergent, seasonally flooded/saturated
- PEM5F- palustrine, emergent, semipermanently flooded
- PFO1E- palustrine, forested, broad-leaved deciduous, seasonally flooded/saturated
- PUBH- palustrine, unconsolidated bottom, permanently flooded
- PUBZ- palustrine, unconsolidated bottom, intermittently exposed/permanent
- PUBZx- palustrine, unconsolidated bottom, intermittently exposed/permanent, excavated
- L1UBHx- lacustrine, limnetic, unconsolidated bottom, permanently flooded, excavated

7.2.3 Sensitive Species and Ecological Communities

The New York State NHP was contacted regarding the presence of threatened/endangered species and sensitive ecological communities on or in the vicinity of Parcel 4. A review of the records indicates there are no known occurrences of rare or state-listed animals and plants, significant natural communities, or other significant habitats on the Site. There is one documented occurrence of a state threatened species (lake sturgeon) in Lake Erie in the vicinity of the Buffalo River, within 0.5-mile north of the Site. In addition, a sensitive/rare community (gull colony) exists at the south end of Buffalo Harbor, Lake Erie. The response letter received from the NHP can be found in Appendix F.

7.3 Problem Formulation

Problem formulation integrates available information on Site history and vegetative and wildlife habitat to identify assessment endpoints that adequately reflect the ecosystem they represent. Assessment endpoints are statements of the resources (e.g., populations or communities) to be protected from adverse impacts. The product of problem formulation is a Conceptual Site Model (CSM) that illustrates potentially complete exposure pathways between chemicals of potential ecological concern (COPECs) in sampled environmental media and identified ecological receptors at the Site.

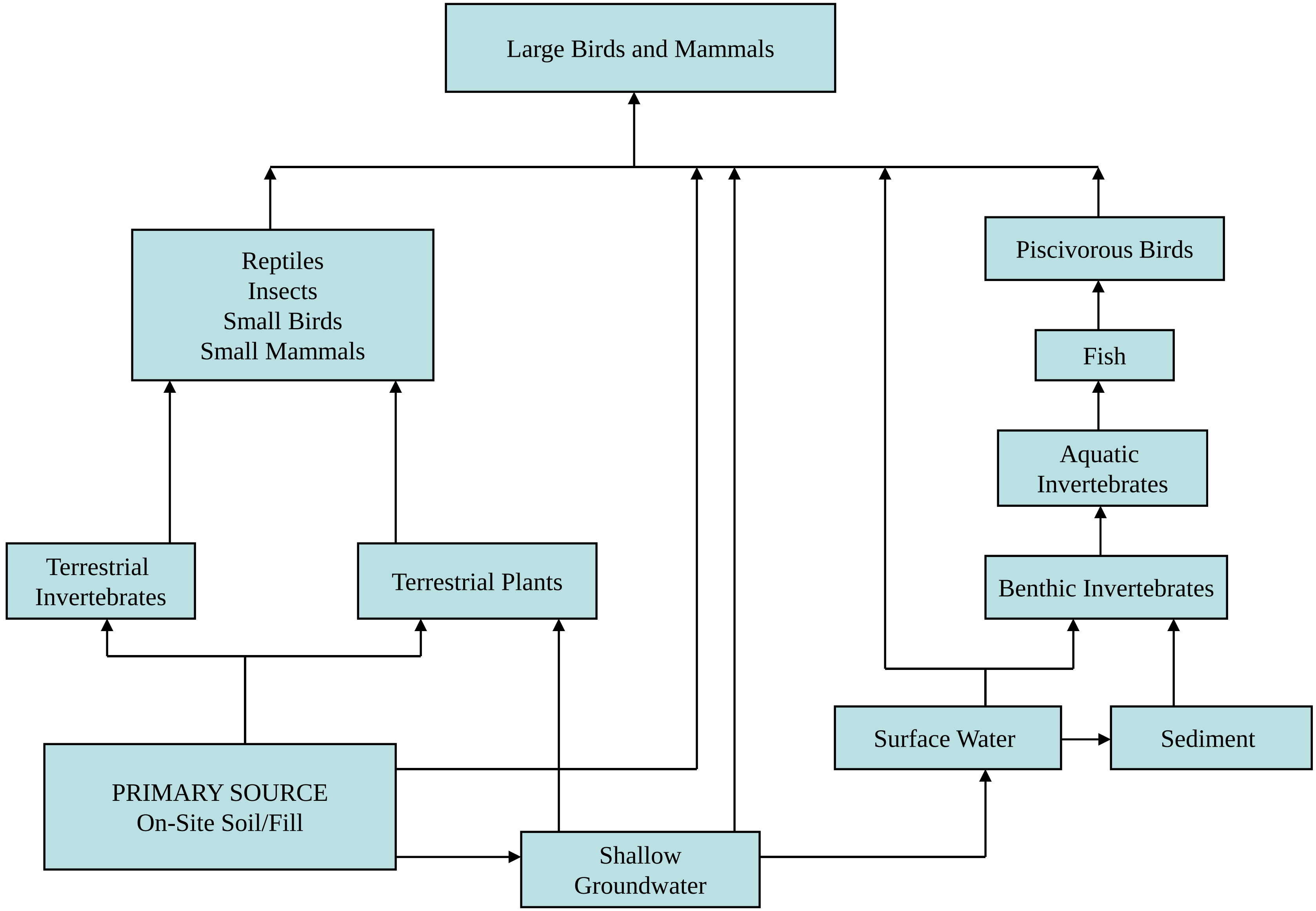
7.3.1 Potential Ecological Receptors

Based on the Site description above, potential ecological receptors on Parcel 4 are terrestrial vegetation and terrestrial wildlife, including soil invertebrates. Terrestrial wildlife receptors include small and large mammals, songbirds, reptiles, and raptors. Buck rubs were observed during the Site visit, and deer were observed on multiple occasions by field personnel during the Site investigation. Large open areas with tall grass species on the Site offer food resources for whitetail deer and secure nesting areas for songbirds. The quaking aspen woodland offers the largest contiguous area of relatively undisturbed habitat on the Site and may provide food and cover for small and large mammals, songbirds, and reptiles. The variation in vegetative cover types throughout the Site provides suitable perches and hunting grounds for raptors. Amphibians were not considered potential terrestrial receptors given that the depressional wet areas within the quaking aspen woodland are isolated, small in size, and devoid of semi-aquatic vegetation.

Potential ecological receptors in the vicinity of the Site include aquatic receptors (i.e., aquatic and benthic invertebrates, fish, etc.) in Union Ship Canal. In addition, piscivorous birds are expected to utilize food resources within the canal. During the Site visit, a black-crowned night heron was observed on BLCP Parcel 3, perched on the concrete pad at the western end of the canal. No aquatic vegetation was observed within the Union Ship Canal, nor is expected to be present due to the canal’s depth (20 feet) and steep concrete sides.

7.3.2 Conceptual Site Model

A conceptual Site model (CSM) describes the pathways through which ecological receptors are potentially exposed to chemicals of potential ecological concern (COPECs) at or near the Site. Figure 7-1 illustrates the various exposure pathways, or migration pathways from COPECs in impacted media to potential ecological receptors at or near the Site. For an exposure pathway to be complete, there must be a source medium of



MALCOLM PIRNIE

CONCEPTUAL SITE MODEL
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

April 2006

FIGURE 7-1

COPEC exposure, a migration pathway to the receptor, and a route by which the receptor may be exposed (i.e., ingestion, absorption, etc.; USEPA 1997).

The primary source of COPEC exposure is on-site soil that has been impacted by historical Site activities. Given that the Site was historically a swampy area and subsequently filled with sand and industrial waste (i.e. filter cake, flue ash, slag, etc.), this evaluation necessarily accounts for the potential for ecological risk as a result of impacts to soil by Site activities (i.e., on-site storage and transfer of iron ores from ships to rail cars) as well as due to the chemical composition of the substrate/fill material itself. Chemical migration can occur via percolation through the soil, infiltration to shallow groundwater, and subsequent discharge to nearby surface water bodies (e.g., Union Ship Canal). COPECs may accumulate in sediments when they settle out of surface water and bind to soil and/or clay particles in Union Ship Canal.

Therefore, there is a potential exposure route for terrestrial wildlife receptors from the incidental ingestion of COPECs in soil during preening, grooming, and feeding. Inhalation of VOCs and soil particulates is not considered a primary exposure route for animals living on the soil surface because of dilution with surface air currents. Dermal contact is also not considered a primary exposure route, because grooming and preening behaviors reduce the probability that soil will contact and be absorbed through the skin. Exposure to terrestrial plants could occur through the dissolution of COPECs in soil pore water and the subsequent assimilation by plant roots. Plants may also accumulate COPECs through coating with windblown dust. Exposure to soil invertebrates could occur via ingestion of soil particles and uptake of COPECs from the soil pore water. Therefore, an additional exposure route to upper trophic level birds and mammals is the ingestion of COPECs that have been assimilated by the vegetation and organisms that comprise their diet.

Due to the depth to shallow groundwater (1-7' bgs) at the Site, it is not likely that wildlife receptors will have direct contact with groundwater. Burrowing wildlife may encounter groundwater, but will abandon flooded dens. For this reason, groundwater is only evaluated for the potential for ecological risk to aquatic receptors following discharge of groundwater to the Union Ship Canal.

Potential exposure routes to aquatic receptors (i.e., aquatic and benthic invertebrates and fish) in Union Ship Canal are the ingestion of COPECs in surface water and the incidental ingestion of COPECs in sediment. An additional route of exposure to fish is through the ingestion of COPECs that have been incorporated into the organisms that make up their diet. Potential exposure routes to piscivorous birds are the ingestion of COPECs in surface water and through the ingestion of COPECs that have been incorporated into the fish that make up their diet.

7.3.3 Assessment and Measurement Endpoints

Assessment endpoints refer to the valued resources that are to be protected from adverse effects caused by exposure to site-related COPECs. Consistent with USEPA (1997) guidance, assessment endpoints are any adverse effects (e.g., reduced vigor or population decline) on ecological receptors, such as populations, communities, and sensitive habitats specific to the ecosystem in question. In practice, the potential for adverse effects on communities is inferred from measures on individuals (i.e., fecundity, mortality, etc.) or populations (e.g., species richness) within those communities. Measurement endpoints can be measures of effect or measures of exposure (e.g., chemical concentrations in soil), but are measurable ecological characteristics nonetheless.

<u>Assessment Endpoints</u>

The assessment endpoints for terrestrial areas of Parcel 4 are the following:

- Maintenance and survival of terrestrial plant communities (primary producers) as food resources for upper trophic level consumers (herbivores and omnivores) and as habitat for wildlife.

- Maintenance and survival of soil invertebrate communities as decomposers and detritivores and as a forage base for upper trophic level consumers.

- Maintenance and survival of healthy avian and mammalian herbivore communities as important links for energy transfer from primary producers to top predators and as effective seed dispersers for terrestrial plants.

- Maintenance and survival of healthy avian and mammalian insectivore communities as important links for energy transfer from lower trophic level organisms (herbivores and omnivores) to top predators and as regulators of prey populations.

- Maintenance and survival of healthy avian carnivore communities as regulators of prey populations.

Reptiles were identified as potential receptors for Parcel 4, but were not selected as assessment endpoints for the Site due to the lack of readily available exposure models and toxicity data.

Due to the potentially complete exposure pathway for groundwater to surface water in Union Ship Canal, the following aquatic assessment endpoints were identified:

- Maintenance and survival of aquatic invertebrate communities as an additional food source for upper trophic level consumers and as important links between primary producers and upper trophic level consumers.

- Maintenance and survival of fish communities as important links between lower trophic level organisms (aquatic invertebrates) and upper trophic level consumers.

- Maintenance and survival of piscivorous bird communities as regulators of prey populations.

Benthic invertebrates in Union Ship Canal were identified as potential receptors for Parcel 4 but were not chosen as an assessment endpoint, because no sediment data were collected for the Site Investigation Remedial Alternatives Evaluation for Parcel 4.

Measurement Endpoints

In this FWIA, measurement endpoints for the assessment of terrestrial plant, soil invertebrate, and wildlife communities are detected chemical concentrations in sampled shallow soil/fill (0-4 feet bgs). The measurement endpoints for the assessment of aquatic invertebrate, fish, and piscivorous bird communities are detected chemical concentrations in groundwater. Detected concentrations in shallow soil/fill and groundwater are compared to chemical- and medium-specific thresholds that are considered protective of adverse effects on organisms. The thresholds are typically derived in clinical trials of dose-response relationships, using species that are the most sensitive to effects or at the base of the food web in an ecosystem. It is, therefore, inferred that critical ecological attributes of these communities (e.g., productivity, species richness, etc.) are not adversely affected if the maximum detected chemical concentrations do not exceed the corresponding chemical-specific toxicity benchmarks (USEPA, 1999). This evaluation conservatively assumes that concentrations detected in groundwater are equal to those in surface water of Union Ship Canal and does not account for dilution/attenuation of COPECs before and upon being discharged to surface water.

7.4 Identification of Chemicals of Potential Ecological Concern

The two environmental media that have been sampled and may be potential sources of risk for ecological receptors at and/or in the immediate vicinity of the Site are shallow soil/fill from Parcel 4 and groundwater from Parcels 3 and 4.

7.4.1 Shallow Soil/Fill (0-4 feet bgs)

Soil/fill samples are available from 20 soil boring locations, 11 test pits, and the filter cake/flue ash pile. For the purposes of the FWIA, only shallow soil/fill samples collected from depths less than four feet below ground surface (feet bgs) are evaluated. This assumes that the majority of wildlife species (including burrowing wildlife) have contact with only the topmost four feet of soil.

Soil/fill sample locations are depicted on Figures 3-1 and 3-2. Surface soil/fill samples (0-2 feet bgs) were collected for the Site investigation and analyzed for polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and Target Analyte List (TAL) metals plus cyanide analytes. Subsurface soil/fill samples (> 2 feet bgs) were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), PCBs and pesticides, and TAL metals. Only five subsurface soil/fill samples were collected from depths less than four feet bgs and are included in the shallow soil/fill database for the FWIA. One surface soil/fill sample (SB-403A) was characterized as flue ash only after sample collection; therefore, it is evaluated as a filter cake/flue ash sample and not representative of surface soil/fill throughout the Site.

The analytical results of 24 (19 surface + 5 subsurface) shallow soil/fill samples are summarized, with frequency of detection and ranges of detected concentrations for each chemical, in Table 7-1. The results of duplicate samples were averaged with those of the

TABLE 7-1
Selection of COPECs in Shallow Soil/Fill Samples
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations	Ecological Screening Level for Soil (1)	Source	Urban Background Concentrations (2)(3)
Volatile Organic Compounds - (ug/kg)					
2-Butanone	2 / 5	23 JB - 120 J	89,600	b	NA
Acetone	1 / 5	330	2,500	b	NA
Benzene	1 / 5	3.4 J	255	b	NA
Cyclohexane	1 / 5	**130**	NA		NA
Ethylbenzene	2 / 5	4.2 J - 31 J	5,160	b	NA
Methylcyclohexane	1 / 5	**230**	NA		NA
Methylene Chloride	1 / 5	30 JB	4,050	b	NA
Toluene	3 / 5	5.6 J - 34	5,450	b	NA
m,p-Xylenes	1 / 5	260	NA		NA
o-Xylene	1 / 5	58	NA		NA
Total xylenes	1 / 5	318	10,000	b	NA
Polycyclic Aromatic Hydrocarbons - (ug/kg)					
Acenaphthene	4 / 24	90 J - 2,300 J	682,000	b	NA
Anthracene	6 / 24	79 J - 1,400 J	1,480,000	b	NA
Benzo(a)anthracene	14 / 24	70 J - **9,200**	5,210	b	169 - 59,000
Benzo(a)pyrene	15 / 24	64 J - **21,000**	1,520	b	165 - 220
Benzo(b)fluoranthene	17 / 24	51 J - 20,000	59,800	b	15,000 - 62,000
Benzo(g,h,i)perylene	11 / 24	96 J - 16,000	119,000	b	900 - 47,000
Benzo(k)fluoranthene	6 / 24	97 J - 5,800	158,000	b	300 - 26,000
1,1-Biphenyl	1 / 5	**82** J	NA		NA
Chrysene	13 / 24	130 J - **9,800**	4,730	b	251 - 640
Dibenz(a,h)anthracene	3 / 24	70 J - 930 J	18,400	b	NA
Fluoranthene	14 / 24	72 J - 10,000	122,000	b	200 - 166,000
Fluorene	1 / 24	560 J	122,000	b	NA
Indeno(1,2,3-cd)pyrene	11 / 24	68 J - 13,000	109,000	b	8,000 - 61,000
2-Methylnaphthalene	1 / 5	210 J	3,240	b	NA
4-Nitrophenol	1 / 5	140 J	5,120	b	NA
Naphthalene	2 / 24	**230** J - **390** J	99	b	NA
Phenanthrene	13 / 24	120 J - 5,300	45,700	b	NA
Pyrene	15 / 24	100 J - 10,000	78,500	b	145 - 147,000
PolyChlorinated Biphenyls - (ug/kg)					
Aroclor-1254	4 / 24	**43** P - **99** P	0.332 (4)	b	NA

TABLE 7-1

Selection of COPECs in Shallow Soil/Fill Samples
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

Metals (mg/kg)					
Aluminum	24 / 24	**1,640** - **11,500**	NA		33,000
Antimony	18 / 24	**5.33** J - **262**	0.27	a	< 1 - 8.8 (8)
Arsenic	24 / 24	1.9 - **27**	18	a	3 -12 (7)
Barium	24 / 24	15 J - 240	330	a	15 - 600
Beryllium	24 / 24	0.12 J - 1.5	21	a	0 - 1.75
Cadmium	14 / 24	0.07 J - **6.9**	0.36	a	0.1 - 1
Calcium*	24 / 24	820 - 203,000 D	NA		130 - 35,000
Chromium	24 / 24	4 - **196**	26 (6)	a	1.5 - 40 (7)
Cobalt	24 / 24	0.49 J - 13	13 (5)	a	2.5 - 60 (7)
Copper	24 / 24	3.0 - **348**	5.4 (5)	b	1 - 50
Iron*	24 / 24	4,720 - 217,000 D	NA		2,000 - 550,000
Lead	23 / 24	6.8 - **6,300**	11	a	200 - 500
Magnesium*	24 / 24	231 J - 38,200	NA		100 - 5,000
Manganese	23 / 24	**51.2** - **11,100** D	NA		50 - 5,000
Mercury	21 / 24	0.03 - **0.57**	0.1 (5)	a	0.001 - 0.2
Nickel	23 / 24	0.84 J - **72**	13.6	b	0.5 - 25
Potassium*	24 / 24	194 J - 2,405	NA		8,500 - 43,000 (7)
Selenium	14 / 24	**0.45** J - **5.2**	0.0276 (5)	b	0.1 - 3.9
Silver	17 / 24	0.77 J - **37**	4.04 (5)	b	ND - 5.0 (9)
Sodium*	23 / 24	35 J - 555 J	NA		6,000 - 8,000
Thallium	5 / 24	**0.58** J - **4.0**	0.0569 (5)	b	NA
Vanadium	24 / 24	3.5 J - **48**	7.8	a	1 - 300
Zinc	23 / 24	**6.8** - **1,040**	6.62	b	9 - 50
Other (mg/kg)					
Cyanide	17 / 24	0.94 - **17**	1.3 (5)	b	NA

Notes

Boldface indicates concentration is greater than ecological screening level and chemical is selected as COPEC.

NA = Not Available

J - The concentration given is an approximate value.

B - The analyte was found in the laboratory blank as well as the sample.

D - Indicates result from secondary dilution run.

P - PCBs present with quantification estimated due to percent difference greater thatn 40 between the two columns of the dual column analysis.

(1) Ecological screening value is lowest USEPA EcoSSL, where available, or is USEPA Region 5 ESL.

(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000

(3) PAH background concentrations are from the Agency for Toxic Substances and Disease Registry, 1995

(4) Screening value is for total PCBs.

(5) Screening value is for total metal or for total cyanide.

(6) Screening value is for Cr III.

(7) NYSDEC TAGM 4046, Dec. 2000, New York State background

(8) Value for eastern USA soils, Dragun and Chiasson, 1991

(9) Value for soils of the conterminous USA, Dragun and Chiasson, 1991

a = USEPA EcoSSL = Ecological Soil Screening Level for Soil

b = USEPA Region 5 ESL = Ecological Screening Level for Soil

* = Essential nutrient.

original samples. In addition, Table 7-2 presents the individual results from a surface soil/fill sample collected and designated “blue fill.” This sample is evaluated separately based on its unique physical appearance and potentially unique chemical composition.

Eleven test pits were excavated in the debris disposal area (eight pits) and the area along the easternmost edge of the parcel (three pits). The test pit locations are illustrated on Figure 3-1. Samples collected from the debris disposal area were submitted for TCLP pesticides analysis, and samples collected along the eastern perimeter were submitted for PCB analyses. No pesticides or PCBs were detected in these samples; therefore, these samples are not evaluated further.

Five samples were collected from the filter cake/flue ash (flue ash) pile located in the southwestern corner of Parcel 4. These samples were only analyzed for lead, based on an elevated lead detection in a historic sample from this material. The flue ash lead results, along with the analytical results from Sample SB-403A, are summarized with frequency of detection and range of detected concentrations in Table 7-3.

The NYSDEC currently has no ecological screening criteria for soil. The selected screening values for COPEC identification in shallow soil/fill, blue fill, and flue ash are the USEPA (2006a) Ecological Soil Screening Levels (EcoSSLs). The EcoSSLs are “contaminant concentrations that are protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil” (USEPA, 2006a). The EcoSSLs for terrestrial plants and invertebrates were derived directly from an evaluation of plant and soil invertebrate toxicity tests from published scientific literature. Avian and mammalian wildlife EcoSSLs were derived via back-calculation from the USEPA threshold for ecological risk (i.e., a hazard quotient of 1), using generic food-chain models and toxicity data available from the literature. A hazard quotient of 1 indicates unity between the predicted COPEC dose and a toxicity reference value that is equivalent to an experimentally derived no-observed-adverse-effect level (NOAEL) in a test organism. The EcoSSL chosen to identify COPECs is the lowest of all available chemical-specific EcoSSLs for the four different receptor classes (*i.e.*, plants, soil invertebrates, avian wildlife, and mammalian wildlife). However, at present time, of the detected chemicals in soil, EcoSSLs are only available for some of the detected metals. Therefore, the USEPA Region 5 Ecological Screening Levels (ESLs) for soil (USEPA, 2006b) are used as a second source of screening values.

TABLE 7-2

Selection of COPECs in Blue Fill Sample
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Blue Fill Sample Result		Ecological Screening Level for Soil (1)	Source	Urban Background Concentrations (2)(3)
Semi-volatile Organic Compounds (ug/kg)					
Acenaphthene	980	J	682,000	b	NA
Benzo(a)anthracene	1,300	J	5,210	b	169 - 59,000
Benzo(a)pyrene	780	J	1,520	b	165 - 220
Benzo(b)fluoranthene	1,300	J	59,800	b	15,000 - 62,000
Dibenz(a,h)anthracene	1,500	J	18,400	b	NA
Fluoranthene	3,200		122,000	b	200 - 166,000
Naphthalene	**3,200**		99	b	NA
Pentachlorophenol	**16,000**		119	b	NA
Phenanthrene	3,400		45,700	b	NA
Pyrene	2,000	J	78,500	b	145 - 147,000
Metals (mg/kg)					
Aluminum	**40.3**		NA		33,000
Antimony	**10**	J	0.27	a	< 1 - 8.8 (8)
Arsenic	17.1		18	a	3 -12 (7)
Barium	18.3	J	330	a	15 - 600
Beryllium	0.186	J	21	a	0 - 1.75
Calcium*	18,600		NA		130 - 35,000
Chromium	4.93		26 (5)	a	1.5 - 40 (7)
Copper	2.44	J	5.4 (4)	b	130 - 35,000
Iron*	10,100		NA		2,000 - 550,000
Lead	**27.5**		11	a	200 - 500
Magnesium*	173	J	NA		100 - 5,000
Manganese	**77.2**		NA		50 - 5,000
Mercury	**2.7**		0.1 (4)	b	0.001 - 0.2
Potassium*	425	J	NA		8,500 - 43,000 (7)
Selenium	**1.46**	J	0.0276 (4)	b	0.1 - 3.9
Silver	0.278	J	4.04 (4)	b	ND - 5.0 (6)
Sodium*	208	J	NA		6,000 - 8,000
Zinc	**17.4**		6.62	b	9 - 50
Other (mg/kg)					
Cyanide	**918**		1.3 (4)	b	NA
Amenable cyanide	**19.4**		1.3 (4)	b	NA

Notes

Boldface indicates concentration is greater than ecological screening level and chemical is selected as COPEC.

Bluefill sample depth is approximately 1 foot bgs.

J - The concentration given is an approximate value.
(1) Ecological screening value is lowest USEPA EcoSSL, where available, or is USEPA Region 5 ESL.
(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000
(3) PAH background concentrations are from the Agency for Toxic Substances and Disease Registry, 1995
(4) Screening value is for total metal or for total cyanide.

(5) Screening value is for Cr III.

(6) Value for soils of the conterminous USA, Dragun and Chiasson, 1991

(7) NYSDEC TAGM 4046, Dec. 2000, New York State background

(8) Value for eastern USA soils, Dragun and Chiasson, 1991

a = USEPA EcoSSL = Ecological Soil Screening Level for Soil

b = USEPA Region 5 ESL = Ecological Screening Level for Soil

* = Essential nutrient

TABLE 7-3

Selection of COPECs in Filter Cake/Flue Ash Samples
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations		Ecological Screening Level for Soil (1)	Source	Urban Background Concentrations (2)(3)
Polycyclic Aromatic Hydrocarbons - (ug/kg)						
Benzo(b)fluoranthene	1 / 1	56	J	59,800	b	15,000 - 62,000
Fluoranthene	1 / 1	80	J	122,000	b	200 - 166,000
Phenanthrene	1 / 1	78	J	45,700	b	NA
Pyrene	1 / 1	78	J	78,500	b	145 - 147,000
Polychlorinated Biphenyls - (ug/kg)						
Aroclor-1254	1 / 1	**41**		0.332 (4)	b	NA
Metals (mg/kg)						
Aluminum	1 / 1	**5,320**		NA		33,000
Antimony	1 / 1	**137**		0.27	a	< 1 - 8.8 (8)
Arsenic	1 / 1	14.3		18	a	3 -12 (7)
Barium	1 / 1	64.3		330	a	15 - 600
Beryllium	1 / 1	1.1		21	a	0 - 1.75
Cadmium	1 / 1	**6.89**		0.36	a	0.1 - 1
Calcium*	1 / 1	25,800		NA		130 - 35,000
Chromium	1 / 1	**184**		26 (6)	a	1.5 - 40 (7)
Cobalt	1 / 1	7.24		13 (5)	a	2.5 - 60 (7)
Copper	1 / 1	**239**		5.4 (5)	b	1 - 50
Iron*	1 / 1	190,000	D	NA		2,000 - 550,000
Lead	6 / 6	**1,470 - 11,000**		11	a	200 - 500
Magnesium*	1 / 1	5,950		NA		100 - 5,000
Manganese	1 / 1	**2,810**		NA		50 - 5,000
Mercury	1 / 1	**0.165**		0.1 (5)	a	0.001 - 0.2
Nickel	1 / 1	**48.7**		13.6	b	0.5 - 25
Potassium*	1 / 1	693		NA		8,500 - 43,000 (7)
Selenium	1 / 1	**12.6**		0.0276 (5)	b	0.1 - 3.9
Sodium*	1 / 1	441	J	NA		6,000 - 8,000
Thallium	1 / 1	**4.98**		0.0569 (5)	b	NA
Vanadium	1 / 1	**20.6**		7.8	a	1 - 300
Other (mg/kg)						
Cyanide	1 / 1	**4.35**		1.3	b	NA

Notes

Boldface indicates concentration is greater than ecological screening level and chemical is selected as COPEC.

Dataset includes five flue ash samples (0.5-1.5 ft bgs) analyzed for lead only and 1 surface soil sample (0-0.5 ft bgs) analyzed for PAHs, PCBs, TAL metals, and cyanide.

J - The concentration given is an approximate value.

D - Indicates result from secondary dilution run.

(1) Ecological screening value is lowest USEPA EcoSSL, where available, or is USEPA Region 5 ESL.

(2) Eastern USA Background, NYSDEC TAGM 4046, Dec. 2000

(3) PAH background concentrations are from the Agency for Toxic Substances and Disease Registry, 1995

(4) Screening value is for total PCBs.

(5) Screening value is for total metal or for total cyanide.

(6) Screening value is for Cr III.

(7) NYSDEC TAGM 4046, Dec. 2000, New York State background

(8) Value for eastern USA soils, Dragun and Chiasson, 1991

a = USEPA EcoSSL = Ecological Soil Screening Level for Soil

b = USEPA Region 5 ESL = Ecological Screening Level for Soil

* = Essential nutrient.

The USEPA Region 5 ESLs for soil were also derived for four receptor classes and are based entirely on receptor-specific values derived from adjusted Toxicity Reference Values. ESLs for plant and invertebrate receptors were based on a review of existing toxicologic information, while ESLs for mammalian herbivores and mammalian carnivores were derived from a simple food chain model, using representative receptor species' parameters and available TRVs. All TRVs were adjusted with uncertainty factors to be equivalent to a chronic NOAEL for the selected receptor. The final ESL per chemical in soil represents the lowest of the receptor-specific ESLs.

COPECs are selected in Tables 7-1 through 7-3 where the maximum detected concentrations exceed available soil benchmarks and where no benchmark is available for a particular constituent. Despite the lack of ecological screening values available, the essential nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) are not selected as COPECs. Where available, urban background concentrations from NYSDEC TAGM #4046 (NYSDEC, 2000) and the toxicological profile for PAHs (ATSDR, 1995) are presented in Tables 7-1 through 7-3 for comparison purposes only.

7.4.2 Groundwater

Groundwater data are available from samples collected in February 2006 from twelve monitoring wells on or in proximity to BLCP Parcel 4. Monitoring well locations are depicted on Figure 2-1 and are summarized below:

- ABB MW-103 and MW-401 through MW-407 are located on Parcel 4.
- ABB MW-101, MW-305, MW-306, and MW-307 are located on BLCP Parcel 3, between Parcel 4 and Union Ship Canal.

Groundwater samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs, and TAL metals plus cyanide analytes. No pesticides or PCBs were detected in any groundwater samples. Table 7-4 presents a groundwater data summary, with frequencies of detection and ranges of detected concentrations.

The NYSDEC Surface Water Quality Standards for chronic aquatic life effects in Class C waterways and the Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao, 1996) were used to select COPECs in groundwater. The ORNL benchmarks serve

TABLE 7-4

Selection of COPECs in Groundwater Samples
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations	Ecological Screening Level for Soil [1]	Source and Notes
Volatile Organic Compounds (ug/L)				
Acetone	2 / 12	23 J - 210	1,500	b; Tier II secondary chronic value
Benzene	3 / 12	0.55 J - 1.25 J	210	a
2-Butanone	4 / 12	4.7 JB - 110 JB	14,000	b; Tier II secondary chronic value
Carbon Disulfide	2 / 12	**3.4** J - **5.8**	0.92	b; Tier II secondary chronic value
4-Methyl-2-Pentanone	1 / 12	2 J	170	b; Tier II secondary chronic value
Tetrachloroethene	7 / 12	1.6 JB - 70 JB	98	b; Tier II secondary chronic value
Toluene	7 / 12	0.84 J - 1.1 J	100	a
1,1,1-Trichloroethane	1 / 12	0.41 J	11	b; Tier II secondary chronic value
Semi-volatile Organic Compounds (ug/L)				
Acenaphthene	1 / 12	**6.7 J**	5.3	a
Anthracene	1 / 12	1.7 J	3.8	a
bis(2-Ethylhexyl)phthalate	12 / 12	**2.3** JB - **6.7**	0.6	a
Carbazole	1 / 12	**16**	NA	
Dibenzofuran	1 / 12	**4 J**	3.7	b; Tier II secondary chronic value
2,4-Dichlorophenol	1 / 12	5.2 J	110	b; chronic NAWQC for phenol
2,4-Dimethylphenol	1 / 12	1.4 J	110	b; chronic NAWQC for phenol
Fluoranthene	1 / 12	2 J	6.16	b; chronic NAWQC
Fluorene	1 / 12	**6.6 J**	0.54	a
2-Methylnaphthalene	1 / 12	1.2 J	4.7	a
3&4-Methylphenols	1 / 12	3.6 J	110	b; chronic NAWQC for phenol
Naphthalene	6 / 12	1.5 J - 7.2	13	a
Pentachlorophenol	1 / 12	5.6 J	110	b; chronic NAWQC for phenol
Phenanthrene	1 / 12	3.6 J	5	a
Phenol	4 / 12	1.3 J - 16	110	b; chronic NAWQC for phenol
2,4,6-Trichlorophenol	1 / 12	1.5 J	110	b; chronic NAWQC for phenol

TABLE 7-4

Selection of COPECs in Groundwater Samples
Buffalo Lakeside Commerce Park, Parcel 4
Buffalo, New York

	Frequency of Detection	Range of Detected Concentrations	Ecological Screening Level for Soil (1)	Source and Notes
Metals (ug/L)				
Aluminum	12 / 12	**101** J - **26,300**	100	a*
Antimony	4 / 12	7.5 J - 25 J	30	b; Tier II secondary chronic value
Arsenic	7 / 12	13.9 - **617**	150	a; dissolved form
Barium	12 / 12	**12.3** J - **497**	4	b; Tier II secondary chronic value
Beryllium	6 / 12	0.07 - 4.8 J	1,100	a*; 100 ppm hardness
Cadmium	1 / 12	0.56 J	2.09	a; 100 ppm hardness
Calcium	12 / 12	13,300 - **199,000**	116,000	b; lowest chronic value for daphnids
Chromium	7 / 12	1.7 J - 47.6	74.11	a; 100 ppm hardness
Cobalt	8 / 12	0.43 J - **10.2 J**	5	a*
Copper	12 / 12	5.40 J - **217**	8.96	a; 100 ppm hardness
Iron	12 / 12	**342** - **58,300**	300	a*
Lead	7 / 12	**4.4** J - **224**	3.8	a; 100 ppm hardness
Magnesium	11 / 12	378 J - **88,600**	82,000	b; lowest chronic value for daphnids
Manganese	12 / 12	1.0 J - **3,560**	120	b; Tier II secondary chronic value
Mercury	4 / 12	0.090 J - 0.31	0.77	a; dissolved form
Nickel	8 / 12	2.0 J - **289**	52.01	a; 100 ppm hardness
Potassium	11 / 12	1,840 J - **1,220,000 DL**	53,000	b; lowest chronic value for daphnids
Selenium	9 / 12	2.2 J - **29**	4.6	a; dissolved form
Silver	2 / 12	**1.8** J - **2.6 J**	0.1	a*; applies to ionic silver
Sodium	12 / 12	11,300 - 557,000	680,000	b; lowest chronic value for daphnids
Thallium	1 / 12	**10.3**	8	a*
Vanadium	10 / 12	4.4 J - **478**	14	a*
Zinc	12 / 12	28.6 J - **747**	83	a; 100 ppm hardness
Other (ug/L)				
Cyanide	11 / 12	**35** - **5,710**	5.2	a; as free cyanide

Notes

Boldface indicates concentration is greater than ecological screening level and chemical is selected as COPEC.

DL - Indicates result from secondary dilution run.

J - Organics: Indicates and estimated value. Inorganics: The reported value is less than CRDL, but greater than the IDL.

B - Indicates analyte was found in the blank as well as the sample result.

(1) Screening value is NYSDEC Surface Water Quality Standard, where available, or is ORNL benchmark.

a = NYS Ambient Water Quality Standards and Guidance Values

* = For waters of the Great Lakes System, the DEC will substitute a guidance value for the aquatic Type standard if so determined under Section 702.15 (c) and (d) of this title.

b = Suter and Tsao, 1996

as a hierarchical source of chronic National Ambient Water Quality Criteria, Tier II Values derived for the Great Lakes Water Quality Initiative, and the lowest chronic values for selected aquatic receptor groups (e.g., fish, daphids, etc.). Table 7-4 lists the source of each surface water quality criterion used to select COPECs in groundwater and lists the basis for each ORNL benchmark value. This is a conservative comparison of groundwater data to surface water quality standards, given that it accounts for no dilution/attenuation of COPECs that may migrate off-site and discharge to Union Ship Canal.

COPECs are selected in Table 7-4 where the maximum detected concentrations exceed the lower of the available surface water quality criteria or where no criterion is available for a particular constituent.

7.5 Ecological Risk Characterization

An evaluation of the potential for ecological risk as a result of potential exposure to COPECs in soil and groundwater is facilitated via the comparison of the maximum detected concentration for each chemical to the screening toxicity values used to select COPECs. Given that in some cases, uncertainty factors of an order of magnitude or more are built into the screening toxicity values, special consideration is given to those COPECs with maximum detected concentrations within ten times of the screening value.

7.5.1 Potential for Ecological Risk due to COPECs in Shallow Soil/Fill, Blue Fill, and Filter Cake/Flue Ash

Shallow Soil/Fill (0-4 ft bgs)

The following chemicals are identified as COPECs in shallow soil/fill, based on maximum detected concentrations greater than the corresponding ecological screening values:

- SVOCs – benzo(a)anthracene, benzo(a)pyrene, chrysene, and naphthalene;
- PCBs – Aroclor 1254;

- Metals – antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc.
- Other – cyanide.

The following chemicals are COPECs based on the lack of available ecological screening values:

- VOCs – cyclohexane and methylcyclohexane;
- SVOCs – 1,1-biphenyl;
- Metals – aluminum and manganese.

While there are no ecological screening values available for the individual xylenes isomers, they are not selected as COPECs, because the sum of the detected concentrations of m,p-xylenes and o-xylenes is less than the ecological screening level for total xylenes.

The comparison of the maximum detected concentrations to the selected screening values indicates there is the potential for ecological risk as a result of exposure of terrestrial vegetation and wildlife receptors to COPECs in shallow soil/fill, in the absence of Site remediation. However, the maximum detected concentration of benzo(a)anthracene is within the range of urban background concentrations reported in ATSDR, 1995. The maximum detected concentrations of aluminum and vanadium are within the ranges of background concentrations reported in NYSDEC TAGM #4046. The maximum detected concentrations of the following COPECs are within one order of magnitude of the corresponding ecological screening values: benzo(a)anthracene, chrysene, naphthalene, arsenic, chromium, mercury, nickel, silver, and vanadium. In addition, the frequencies of detection of the PCB congeners and naphthalene are relatively low. Four out of the five soil sample locations where PCBs were detected are near the northern boundary of the Site.

Blue Fill

The following chemicals are COPECs in the blue fill sample, based on maximum detected concentrations greater than the corresponding ecological screening values:

- SVOCs – naphthalene and pentachlorophenol;
- Metals - antimony, lead, mercury, selenium and zinc.
- Other – cyanide.

The following chemicals are COPECs based on the lack of available ecological screening values:

- Metals – aluminum and manganese.

The comparison of the maximum detected concentrations to the selected screening values indicates there is the potential for ecological risk as a result of exposure of terrestrial vegetation and wildlife receptors to COPECs in blue fill, in the absence of Site remediation. The subsurface footprint of the blue fill material may be as great as 50 x 75 feet, and it was approximately 4-6" thick in the area sampled. However, it is thought to be limited to the central-southern boundary of the Site. Therefore, the potential for ecological risks may be limited to terrestrial vegetation and wildlife with localized home ranges, such as soil invertebrates, small mammals, and burrowing mammals. In addition, the maximum detected concentrations of lead, manganese, selenium, and zinc are within the ranges of background concentrations reported in NYSDEC TAGM #4046. The maximum detected concentrations of lead and zinc are also within one order of magnitude of the ecological screening values.

Filter Cake/Flue Ash

The five flue ash samples were analyzed only for lead. Sample SB-403A is a surface soil/fill sample and was analyzed for PAHs, PCBs, and metals plus cyanide.

The following chemicals are COPECs in the filter cake/flue ash pile, based on maximum detected concentrations greater than the corresponding ecological screening values:

- PCBs – Aroclor 1254;
- Metals – antimony, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium and vanadium.
- Other – cyanide.

The following chemicals are COPECs based on the lack of available ecological screening values:

- Metals – aluminum and manganese.

The comparison of the maximum detected concentrations to the selected screening values indicates there is the potential for ecological risk as a result of exposure of terrestrial vegetation and wildlife receptors to COPECs in filter cake/flue ash, in the absence of Site remediation. The subsurface footprint of the flue ash pile may extend further north and northeast than is visible. However, the extent of the flue ash pile is thought to be limited to the western corner of the Site. The potential for ecological risks may therefore be limited to terrestrial vegetation and wildlife with localized home ranges, such as soil invertebrates, small mammals, and burrowing mammals. In addition, the maximum detected concentrations of aluminum, manganese, mercury, and vanadium are within the ranges of background concentrations reported in NYSDEC TAGM #4046. The maximum detected concentrations of chromium, mercury, nickel, vanadium, and cyanide are also within one order of magnitude of the ecological screening values.

7.5.2 Potential for Ecological Risk due to COPECs in Groundwater

Based on the comparison of February 2006 groundwater data to surface water quality criteria, the following chemicals are identified as COPECs:

- VOCs – carbon disulfide;
- SVOCs – acenaphthene, bis(2-ethylhexyl)phthalate, dibenzofuran, and fluorene;
- Metals – aluminum, arsenic, barium, calcium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, thallium, vanadium, and zinc.
- Other – cyanide.

Carbazole is also identified as a COPEC based on the lack of available ecological screening values.

This qualitative evaluation includes groundwater data from monitoring wells located south of Parcel 4, on the adjacent BLCP Parcel 3. The maximum detected cyanide concentration on Table 7-4 (5,710 µg/L) is from MW-307, on Parcel 3. The maximum detected concentration of cyanide in groundwater from wells on Parcel 4 was detected in MW-406 (6,390 µg/L; duplicate = 1,380 µg/L), which is near the blue fill material.

The evaluation of the potential for ecological risk to aquatic receptors as a result of exposure to COPECs in groundwater is a conservative comparison, in that it accounts for no dilution/attenuation of chemicals. In addition, maximum detected concentrations of the following groundwater COPEC are within one order of magnitude of the surface water quality criteria: carbon disulfide, arsenic, calcium, cobalt, nickel, selenium, and zinc. However, the distance from the southern boundary of Parcel 4 to Union Ship Canal is approximately 200 feet, and the maximum detected concentrations of some COPECs are elevated compared to the surface water quality criteria.

7.6 Uncertainty Analysis

Uncertainty is inherent in the process of conducting qualitative risk assessments. Environmental sampling and analysis are prone to uncertainty, as are the available toxicity data used to characterize risk. Uncertainty associated with the environmental sampling is generally related to the limitations of the sampling program in terms of the number and distribution of samples. Uncertainty in the laboratory analysis of the samples is generally related to systematic or random errors.

The methodologies used in this screening-level ecological risk assessment rely on conservative assumptions, and therefore, the potential for exposure and risk is overestimated. These assumptions include:

- Terrestrial receptors forage exclusively within the Site boundaries and are exposed to the COPEC present in soil on a daily basis. This is unlikely given the existence of potential wildlife habitat in the immediate vicinity of the Site.
- The COPEC concentrations in soil at the Site represent the concentration of COPEC in the receptor populations' food source (vegetation, invertebrates, or other wildlife). This is unlikely because plants do not readily take up all COPEC in a 1:1 ratio.

- The receptor populations' entire food source is impacted at the maximum detected concentrations of each COPEC. This is unlikely since the COPEC were not detected at maximum concentrations across the entire Site.

- Assumes aquatic receptors in the Union Ship Canal would be exposed to concentrations equal to those in groundwater, without consideration of dilution/attenuation of COPECs before and upon being discharged to surface water.

Other sources of uncertainty in the ecological risk assessment include those associated with the screening level toxicity values used to select COPECs. In some cases, screening-level benchmark values were derived from data using laboratory animals under controlled experimental conditions. Differences in toxicity may exist between laboratory animals and wildlife. Additionally, the toxicity benchmark values can range by orders of magnitude for the same chemical, depending on the species used and the type of test conducted. Using benchmarks from multiple sources, depending on their availability, limits the comparability of risk estimates for different chemicals' exposure to a single receptor.

The lack of toxicity values for some COPECs limits the risk estimates and contributes to immeasurable uncertainty in either direction. The following chemicals were selected as COPECs based on a lack of toxicity values; therefore, the potential for ecological risk as a result of exposure to these COPECs cannot be determined:

- Shallow soil/fill – cyclohexane, methylcyclohexane, 1,1'-biphenyl, aluminum, manganese.

- Blue fill – aluminum and manganese.

- Filter cake/flue ash – aluminum and manganese.

- Groundwater – carbazole.

7.7 Summary

The majority of the BLCP Parcel 4 Site can be characterized as an urban vacant lot that provides some terrestrial wildlife habitat. Various non-native substrate types (i.e., fill/sand, slag, and rubble) result in vegetative cover types that are characteristic of anthropogenically disturbed sites, either because dominant species are invasive (e.g., common reed) or are typical of primary succession (e.g., quaking aspen). A large successional northern hardwood stand on the eastern portion of the Site may provide adequate food and cover for some large mammals, small mammals, songbirds, and reptiles.

Complete exposure pathways exist for terrestrial vegetation and wildlife receptors that may directly contact shallow soil/fill or ingest dietary sources that have bioaccumulated soil COPECs. There is an additional exposure pathway for aquatic receptors to contact COPECs in groundwater that discharges to surface water of Union Ship Canal, located approximately 200 feet south of Parcel 4.

7.7.1 Potential for Ecological Risk due to COPECs in Shallow Soil/Fill

Shallow Soil/Fill (0-4 ft bgs)

COPECs in shallow soil/fill that are present at maximum concentrations greater than both the ecological screening values and reported background concentrations, or for which no screening values are available, include:

- VOCs – cyclohexane and methylcyclohexane;
- SVOCs – benzo(a)pyrene, 1,1-biphenyl, chrysene, and naphthalene;
- PCBs – Aroclor 1254;
- Metals – antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc.
- Other – cyanide.

Blue Fill

COPECs in blue fill that are present at maximum concentrations greater than both the ecological screening values and reported background concentrations, or for which no screening values are available, include:

- SVOCs – naphthalene and pentachlorophenol;

- Metals – aluminum, antimony, and mercury.
- Other – cyanide.

Filter cake/flue ash

COPECs in filter cake/flue ash that are present at maximum concentrations greater than both the ecological screening values and reported background concentrations include:

- PCBs – Aroclor 1254;
- Metals – antimony, cadmium, chromium, copper, lead, nickel, selenium, and thallium.
- Other – cyanide.

This analysis indicates there is the potential for adverse ecological health effects as a result of potential exposure to COPECs identified in shallow soil/fill on the Site. The footprint of the blue fill is limited to the central-southern boundary of the Site, and the footprint of the filter cake/flue ash pile is thought to be limited to the western corner of the Site. Therefore, the potential for ecological risks as a result of exposure to COPECs in blue fill and flue ash may be limited to terrestrial vegetation and wildlife with localized home ranges, such as soil invertebrates, small mammals, and burrowing mammals. In addition, the planned redevelopment of the Site will result in the entirety of Parcel 4 being covered with pavement, clean fill and landscaped vegetation, and commercial/office buildings. Redevelopment will thereby limit the direct contact exposure of terrestrial vegetation and wildlife to COPECs in soil, limit uptake into the food web, and effectively eliminate the potential for ecological risks that were identified for shallow soil/fill.

7.7.2 Potential for Ecological Risk due to COPECs in Groundwater

The following were identified as COPECs based on the comparison of maximum detected concentrations from February 2006 groundwater data to surface water quality criteria, or because no criteria were available:

- VOCs – carbon disulfide;

- SVOCs – acenaphthene, bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, and fluorene;
- Metals – aluminum, arsenic, barium, calcium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, thallium, vanadium, and zinc.
- Other – cyanide.

The evaluation of the potential for ecological risks as a result of exposure to COPECs in groundwater that may discharge to surface water accounts for no dilution/attenuation of detected chemicals in groundwater. Conclusions regarding the potential for ecological risk are also limited to the simplistic comparison of maximum detected concentrations to toxicity screening values. A more robust determination of the potential for ecological risk would require further investigation as to the potential toxicity of COPEC concentrations on organisms, populations, and communities potentially present in Union Ship Canal. However, consideration should be given to the Site's location within a currently urban and historically industrial area of Buffalo, New York. In reality, the discharge of COPECs in groundwater from the Site is most likely a relatively minor contributor to the potential for risks to aquatic receptors in surface water of Union Ship Canal.

Site Reuse Plan

SECTION **8**

The Buffalo Lakeside Commerce Park (BLCP) is one of the largest brownfield redevelopment projects in New York State. The BLCP is planned on 275 contiguous acres of property located at the southwest corner of the City of Buffalo, adjacent to the outer harbor. As of 2007, the City owns Parcel 3 which is planned for park development with the BUDC owning the remainder of the BLCP land planned for redevelopment. Two lots have already been developed and are operational manufacturing facilities (Certainteed and Cobey). The objective of the project is to renew economic activity within the City by utilizing the existing available land and infrastructure. The BLCP is planned for manufacturing, light industrial, and office uses and will include 55 acres of green space (recreational, canal, and wetland) around the canal to enhance the commerce park. Parcels 1 and 2 are being remediated and redeveloped under voluntary cleanup agreements. The first occupant of the BLCP, the Certainteed manufacturing facility, is located at the eastern end of Parcel 1 and began operations in 2005. The second occupant of the BLCP, the Cobey manufacturing facility, began operations in 2006 at the western end of Parcel 1.

New roads and utilities have been installed to service Parcels 1 and 2 and design of roads to service Parcel 4 is underway.

Parcel 3, which includes the Union Ship Canal and a 200 foot buffer around the canal, is planned for park development, including walking/bike trails and fishing access.

Parcel 4 is planned for remediation and redevelopment under the NYSDEC ERP similar to Parcels 1 and 2.

Figure 8-1 is a color concept plan of the BLCP illustrating the potential for future locations of tenant buildings, roads, buffer areas, and green space.

Buffalo Lakeside Commerce Park

LEGEND

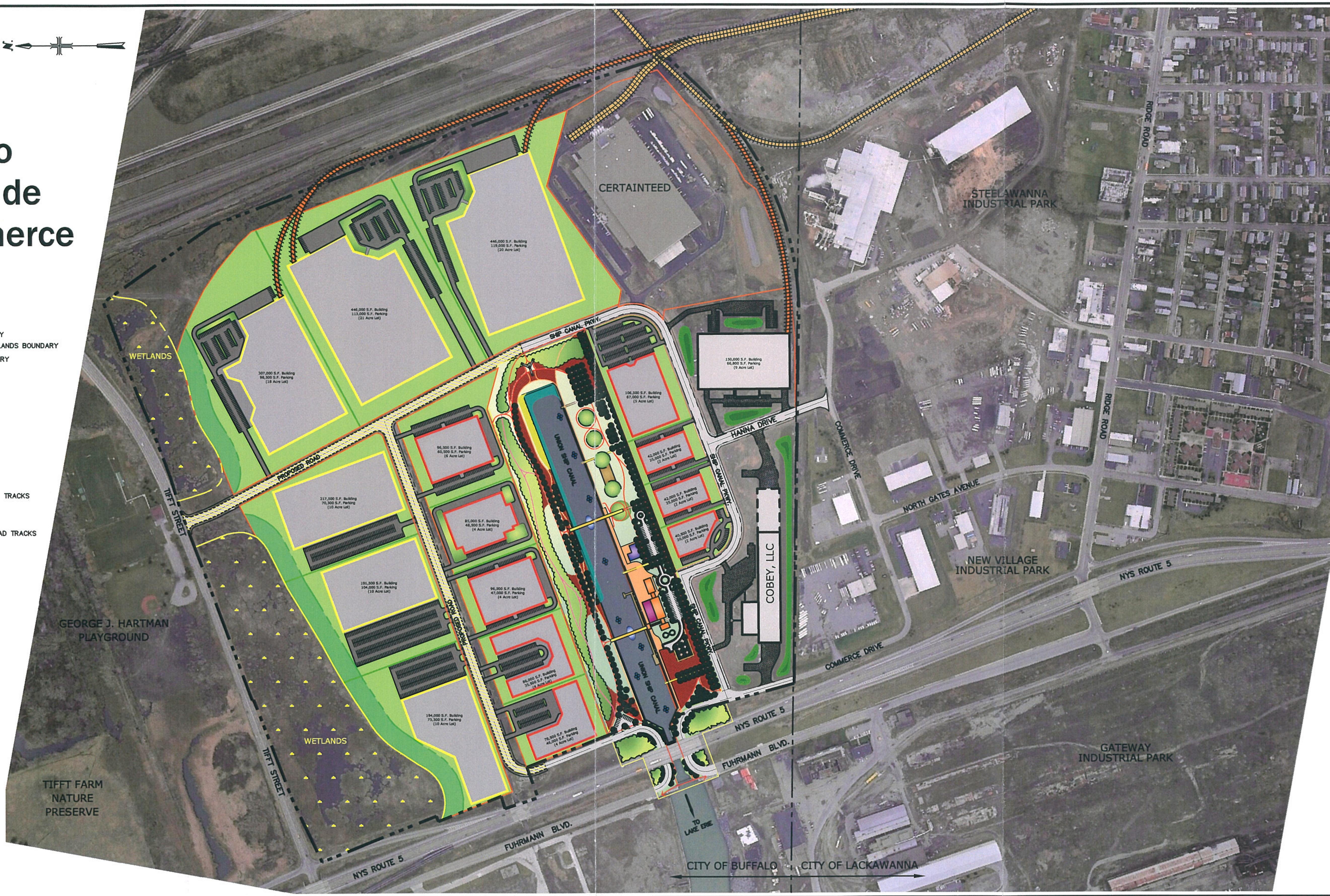
- PROJECT BOUNDARY
- APPROXIMATE WETLANDS BOUNDARY
- PROPERTY BOUNDARY
- EXISTING ROAD
- PROPOSED ROAD
- WETLAND AREAS
- EXISTING RAILROAD TRACKS
- PROPOSED RAILROAD TRACKS
- PROPOSED INNER RING BUILDING
- PROPOSED OUTER RING BUILDING
- 100' WETLANDS BUFFER ZONE
- LOT LINE

TOTAL AVAILABLE SPACE:

2,625,500 S.F. Building
1,019,400 S.F. Parking
(129 Acres)

BUDC

ECIDA



User: WELSHANS Spec: PIRNIE STANDARD File: F:\Projects\4080004\CADD\4080F008-1.DWG Scale: 1:1 Date: 05/12/2006 Time: 08:26 Layout: Layout1

MALCOLM PIRNIE

05/06 4080F008-1

BUFFALO LAKESIDE COMMERCE PARK
PARCEL 4

BUFFALO, NEW YORK

FIGURE 8-1

CONCEPT PLAN

MALCOLM PIRNIE

Conclusions and Recommendations

SECTION 9

9.1 Conclusions

The Site investigation of Parcel 4 of the Buffalo Lakeside Commerce Park (Site) provided an environmental characterization of surface and subsurface soil/fill, solid waste, and groundwater sufficient to evaluate their potential risk to human health and the environment. A summary of conclusions is provided below:

9.1.1 Hydrogeology

- Geologic Units

The Site is covered with soil/fill material that varies in composition and thickness. The soil/fill is underlain by natural deposits of peat, clay, and till over shale bedrock. Most of the soil/fill encountered consisted of disturbed soil, and other natural materials mixed with slag, ash, crushed stone, concrete, scrap iron, brick, and wood. This fill unit was present at all 20 soil boring locations. The thickness of the soil/fill ranges from four to 26 feet. A large (3.5 acres) pile of black filter cake/flue ash remains on the western end of the Site and a relatively small buried mass of blue fill (woodchips) was encountered at the center of the southern Site boundary and extends onto Parcel 3.

The uppermost natural unit, where present, is a thin (< 1 foot) layer of peat which was encountered at less than half of the drilling locations. Under the peat layer is silty-clay, of which the maximum thickness encountered was 23 feet and ranging in thickness between 15 and 23 feet. Encountered at three locations beneath the silty clay was glacial till. Where present, the till was directly above the bedrock and was composed of gray clay with sand, gravel, and shale rock fragments. Thickness of the till ranged from 0.2 to 1.1 feet.

Bedrock was observed to be dark gray shale, reportedly of the Levanna member of the Middle Devonian Skaneateles Formation. Depth to bedrock ranged from approximately 24 to 28 feet below grade. Bedrock surface elevations were mapped to show a general slope toward the east/southeast at a slope of 0.32 feet vertical per 100 feet horizontal.

- Groundwater Flow

The water table was measured at depths of one to seven feet below grade. Mapped groundwater surface elevations indicate that, at the time of measurement, the groundwater was generally flowing to the south toward the Union Ship Canal. Based on the equipotential map of the groundwater, it appears that the canal wall influences the groundwater elevations to the north of the canal. Specifically, the canal wall to the south of the western half of the Site appears to impede direct discharge to the canal here thus causing the groundwater to flow parallel to the canal wall in an easterly direction until it can discharge to the canal along the eastern end where the wall is much lower or missing.

9.1.2 Environmental Media

9.1.2.1 Surface Soil

Evaluation of analytical results of on-site surface soil samples indicates that there are PAHs and metals in the soil/fill at concentrations above 6 NYCRR Subpart 375-6 Soil Cleanup Objectives (SCOs), December 2006 and typical urban background levels. PAHs at such levels are not uncommon in urban settings even without fill material present. Low concentrations of PCBs were detected in four of the 19 samples, all PCB detections were below the Subpart 375-6 SCO of 1 Mg/Kg.

9.1.2.2 Subsurface Soil/Fill

Evaluation of analytical results of subsurface soil/fill samples indicates that there are PAHs and metals in the soil/fill at concentrations above the Subpart 375-6 SCOs and typical urban background levels. PAHs at such levels are not uncommon in urban settings even without fill material present. Trace levels of VOCs, pesticides, and PCBs were sporadically detected in the subsurface soil/fill samples at concentrations below the Subpart 375-6 SCO values.

9.1.2.3 Flue Ash and Blue Fill

Samples of the flue ash contained elevated concentrations of lead. One of the six samples collected of the flue ash failed the TCLP lead analysis thus characterizing it as a hazardous waste. The blue fill material contained several PAHs and metals above Subpart 375-6 SCO values. The concentration of cyanide in the blue fill was 918 mg/kg, well above the SCO of 27 mg/kg and approximately two orders of magnitude higher than other soil/fill samples collected at the Site.

9.1.2.4 Groundwater

Twelve groundwater samples were collected from monitoring wells on and near the Site. No pesticides or PCBs and only low concentrations of some VOCs and SVOCs were detected in the groundwater samples. Several metals, some common nutrients, were present at concentrations above groundwater standards. Most were present at concentrations similar to that found elsewhere on the BLCP. Two notable exceptions are the presence of elevated cyanide in two wells and elevated pH (>12) in five wells located at the western end of the Site.

9.1.3 Human Health Evaluation

The qualitative human health evaluation indicates that under the current and future scenario (assuming no Site redevelopment and no remediation), exposure to constituents of potential concern (COPC) present in surface soil, flue ash, and blue fill is likely for the recreationist/trespasser.

Under the future scenario (assuming completion of the planned redevelopment but without remediation), exposure to COPC in surface soil/fill, subsurface soil/fill, flue ash, and blue fill is likely for future construction/utility workers.

9.1.4 Fish and Wildlife Impact Analysis

The Site is an urban vacant lot that provides some terrestrial wildlife habitat. The fill material overburden results in vegetation that is characteristic of anthropogenically disturbed areas. Complete exposure pathways exist for terrestrial vegetation and wildlife receptors that may directly contact shallow (0-4 feet) soil/fill or ingest dietary sources that have bioaccumulated soil COPECs. However, the extent of the flue ash and blue fill is limited thus limiting potential risks to terrestrial vegetation and wildlife with localized home ranges. In addition, the planned redevelopment of the Site will result in the entire Site being covered with buildings, pavement, or clean soil thus effectively eliminating the potential for ecological risks identified for shallow soil/fill.

A second potential exposure pathway exists for aquatic receptors who could contact COPECs in groundwater that discharges to surface water in the Union Ship Canal. However, the risk evaluation does not account for dilution/attenuation that would likely take place between the Site and the canal. Also, considering the Site’s location within a historically industrial area of Buffalo, discharge of COPECs in groundwater from the Site is likely a relatively minor contributor to the potential risks to aquatic receptors in surface water of the Union Ship Canal.

9.2 Recommendations

Results of this and previous environmental studies confirm that the Site is suitable for re-development as a commercial/industrial park provided that certain remedial actions and precautions are taken to limit exposure to elevated concentrations of PAHs and metals that are present in the on-site soil/fill and waste materials.

Based on the findings of the Site Investigation and the results of the qualitative human health evaluation and the fish and wildlife impact analysis, the following recommendations are offered for the BLCP Parcel 4 Site:

- Additional delineation of the blue fill material in the vicinity of MW-406 will be performed as a task element of planned remedial design activities.
- Isolation/remediation and/or removal of the blue fill to remove the potential for exposure to elevated concentrations of cyanide.
- Further delineation of the filter cake/flue ash material footprint along the existing north, east and west perimeters within the Parcel 4 boundary will be completed as a task element of planned remedial design activities.
- Isolation/remediation and/or removal of the filter cake/flue ash to remove the potential for exposure to elevated concentrations of lead.

- Additional delineation of lead impacted surface soils in the vicinity of SB-407A and PAH impacted surface soils identified at MW-407A will be completed as a task element of planned remedial design activities.

- Excavation, sorting and removal of the elevated debris disposal pile

- Placement and maintenance of a cover over the entire Site surface to minimize the potential for exposure to PAHs and metals present within the on-site soil/fill material.

- Development and implementation of a soil/fill management plan for dealing with excavated fill material during development activities and when digging as required to maintain or enhance utilities following completion of Site redevelopment. The soil/fill management plan should include health and safety requirements and excavated soil handling/disposal requirements.

- Installation of a vapor barrier as part of the slab foundation of future buildings to essentially eliminate the future potential for exposure to organic vapors within the buildings air space.

- Removal of surface debris.

- Implementation of an Environmental Easement that runs with the property in perpetuity and:

    - Requires the implementation of the provisions of a Remedial Work Plan

    - Restricts future Site use to commercial and/or industrial.

    - Restricts the use of groundwater to uses that do not result on human contact or consumption of Site groundwater.

Relevant to the findings of the qualitative human health evaluation and the fish and wildlife impact analysis, the actions recommended above are sufficient to protect human health and the environment at the Site from the potential health risks identified.

Remedial Alternatives Analysis

SECTION 10

Based on the results of the site investigation and the findings of both the qualitative human health evaluation and the Fish and Wildlife Impact Analysis, potential risks have been identified to current and future on-site receptors who could be exposed to constituents of potential concern (COPCs) present in the on-site soil/fill and various waste materials.

The following site media are recommended for remediation:

- Blue Fill Material
- Filer Cake/Flue Ash Pile
- Debris Disposal Pile
- Isolated Lead and PAH “hot spots”
- Miscellaneous Solid Waste Piles
- General On-site Soil/Fill Material

Of the six media above that are recommended for remediation, all but the general soil/fill material are distinct waste materials or waste mixtures are at or near the surface, and of defined aerial extent. These waste materials are recommended for removal and off-site disposal. In the case of the debris disposal pile; excavation, segregation, limited removal and regrading is recommended. However, the general on-site soil/fill is present at a much greater volume than the four waste materials and at thicknesses greater than 25 feet. Therefore, complete removal of this soil/fill would be very costly and other options must be considered.

As such, the remedial alternatives analysis provided on this Section focuses on the on-site soil/fill material and presents a full analysis of remedial alternatives, evaluation of each alternative, and a description and justification of the recommended remedial approach for this material only.

For the four waste materials requiring remediation, an estimate of cost to remove and dispose of each is provided. The removal of these distinct waste materials could be performed as an interim remedial measure (IRM) prior to and independent of the overall Site remedy that addresses the on-site soil/fill material.

10.1 Descriptions and Cost Estimates of Removal and Disposal of the on-site Waste Materials – "Source Removal"

10.1.1 Blue Fill Material

Prior to implementing the remedial alternative designed for the blue fill area, additional investigation will be performed to further characterize surface and near surface soil/fill and groundwater in the vicinity of sample location MW-406. The recommended remedial alternative for the blue fill material is complete excavation and offsite disposal of the estimated 100 cubic yards (140 tons) of material followed by backfilling with clean soil. The cost of this alternative varies substantially depending on whether the material is hazardous or non-hazardous. The estimated cost of this remedial action ranges from $19,000 to $57,000. Table 10-1 provides a detailed breakdown of work items, assumptions, and costs for this remedy.

10.1.2 Filter Cake/Flue Ash

Pending additional characterization of the filter cake/flue ash area along the north, east and west perimeter(s) within the Parcel 4 boundary, an assumed volume of the filter cake/flue ash is estimated to be between 45,000 and 55,000 cubic yards. Based on limited sampling, approximately 20 percent of the ash is assumed to contain lead at hazardous concentrations. Several remedial options were considered for this material with a goal of meeting three primary objectives: mitigating health risks, optimizing usability of the land for future development, and affordability. Seven remedial options

Table 10-1

REMEDIAL COST ESTIMATE
BLCP - Parcel 4
Blue Fill
Removal and Off-Site Disposal

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
1	Additional delineation and characterization of blue fill	1	LS	$2,000	$2,000
2	Excavation transport and disposal of non-haz blue fill	140	ton	$60	$8,400
2	Excavation transport and disposal of hazardous Blue fill	140	ton	$250	$35,000
	(Assumed volume is 100 CY)				$0
3	Cost for clean soil backfill including placement	140	ton	$20	$2,800
	Sub-Total if non-hazardous				$13,200
	Sub-Total if Hazardous				$39,800
4	Engineering and Contingency if non haz (35% of sub-total)	35% of subtotal	sum		$4,620
4	Engineering and Contingency if haz. (35% of sub-total)	35% of subtotal	sum		$13,930
5	H&S and General Requirements if non Haz (10%)	10% of subtotal	sum		$1,320
5	H&S and General Requirements if Haz (10%)	10% of subtotal	sum		$3,980
Total if non-hazardous					**$19,140**
Total if Hazardous					**$57,710**

Assumptions/Notes:

Estimated volume is 100 cubic yards (140 tons) of material

Backfill with clean soil.

Cost varies substantially depending on whether the material is determined hazardous or non-hazardous.

were evaluated, each a different combination of stabilization, removal, and/or covering of the filter cake/flue ash. The seven remedial options included:

Option 1 - Removal of the hot spots, regrading, and covering in place

Option 1A - Stabilization of hot spots, regrading, and covering in place

Option 2 - Removal of hot spots, removal of 50% of remaining volume, and covering in place

Option 2A - Stabilization of hot spots, removal of 50% of remaining volume, and covering in place

Option 3 - Removal of the entire volume (hazardous and non-hazardous) and regrading

Option 3A - Stabilization of hot spots, and removal of entire volume, and regrading

Option 4 - Stabilization and removal of the entire volume and regrading

The estimated costs for these alternatives ranged between $600,000 and $ 5.5 million.

Although all seven options would mitigate health risks, only options 3, 3A, and 4 included complete removal of the filter cake/flue ash and thus would result in full use of the Site for redevelopment after removal. Based on relative cost, the recommended remedial option for the filter cake/flue ash pile is Option 3A, treatment of hot spots followed by complete removal, off-site disposal, and regrading. Under the recommended remedial option, the hot spots would be stabilized on site to reduce the concentrations of leachable lead to levels that are considered non-hazardous prior to removal and off-site disposal. The estimated cost of this remedial action ranges from $4.3 million to $5.2 million depending on the actual volume of the ash. Table 10-2 provides a detailed breakdown of work items, assumptions, and costs for this remedy based on the estimated maximum volume of ash of 55,000 cubic yards.

10.1.3 Debris Disposal Pile

The recommended remedial option for the debris disposal pile will require excavation and sorting of the debris pile to separate various solid waste materials from reusable

Table 10-2

REMEDIAL COST ESTIMATE
BLCP - Parcel 4
Flue Ash

Stabilization of Hot Spots, Removal of Entire Volume and Covering with Backfill

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
1	Bench Study	1	LS	$5,000	$5,000
2	Pilot Study	1	LS	$50,000	$50,000
3	Delineation of Ash and quantification of volume (haz/nonhaz)	1	LS	$20,000	$20,000
5	Purchase/delivery of Ecobond to treat 20% of ash w/ 2% conc.	220	tons	$500	$110,000
6	Analytical confirmation of post treatment lead concentrations	4	samples	$100	$400
7	Excavation, transport, disposal of entire ash volume (non-haz)	55000	CY	$60	$3,300,000
10	Placement of 2 feet backfill cover from other areas on site	12000	CY	$8	$96,000
11	Sub-Total				$3,581,400
12	Engineering and Contingency	35% of Subtotal	sum		$1,253,490
13	Health & Safety and General Requirements (10%)	10 % of subtotal	sum		$358,140
	Total				**$5,193,030**

Assumptions/Notes:

- Total volume of ash pile is approx. 55,000 cy
- 20% of volume (11,000 cy) is assumed to be hazardous and therefore would be treated to non-hazardous concentrations, removed, and disposed off site as non- hazardous waste.
- Each cubic yard of ash weighs approx.1 ton.
- Stabilization of the hazardous ash will be achived using Ecobond ® or similar product, assuming a 2% treatment rate, bench scale testing and in-field pilot testing will be required to confirm treatment rate as part of design.

soil/fill material. Excavated solid waste material(s) that exhibit contamination or suspected evidence of contamination through screening (observations or elevated PID measurements) will be segregated, sampled and classified for reuse or disposal. One composite soil sample will be collected for each 100 cubic yards of solid waste. The composite sample will be collected in the manner described in the Standard Operating Procedures (SOPs) included in the Soil/Fill Management Plan from five locations within each stockpile. PID measurements will be recorded for each of the five composite sample locations, and one grab sample and one duplicate sample will be collected from the location with the highest PID measurement of the five composite locations. The samples will be analyzed by a NYSDOH ELAP-certified laboratory for Target Compound List (TCL) semi volatile organic compounds (SVOCs), and TAL metals using current NYSDEC Analytical Services Protocols (ASP). Additionally, the grab sample will be analyzed for TCL volatile organic compounds (VOCs).

Excavated soil/fill that exhibits no evidence of contamination (staining or elevated PID measurements) will also require characterization prior to re-use as sub-grade or backfill at the site. Characterization samples will be collected and analyzed at a frequency of not less than one sample per 1,000 cubic yards of soil/fill. The characterization samples will be collected in accordance with the protocols described above; the sampling efforts shall require the collection of discrete samples for VOCs and composite samples collected from five locations for the remaining analytes.

After the sorting process, the solid wastes that are not planned for on-site reuse will be transported to a permitted solid waste disposal facility and the reusable soil/fill staged on site for site redevelopment activities. The estimated cost of this remedial alternative is $758,000. Table 10-3 provides a detailed breakdown of work items, assumptions, and costs for this remedy.

10.1.4 Isolated Lead and PAH “hot spots”

The recommended remedial alternative for the isolated lead and PAH “hot spots” associated with sample locations SB-407 and MW-407, will require additional delineation with complete excavation and off-site disposal of an estimated 50 cubic yards (70 tons) of material followed by backfilling with clean soil. The estimated cost of this

Table 10-3

REMEDIAL COST ESTIMATE
BLCP - Parcel 4
Debris Disposal Pile

Excavate, Sort, and Spread on Site

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
1	Excavation, sorting, and leveling of the pile.	50,000	CY	$10	$500,000
2	Sample collection and analyses of reusable soil/fill	50	ea.	$400	$20,000
3	Sample collection and analyses of disposable soil/fill	1	ea.	$400	$400
4	Removal and disposal of C&D wastes	50	tons	$60	$3,000
5	Sub-Total				$523,400
6	Engineering and Contingency	35% of Subtotal	sum		$183,190
7	Health & Safety and General Requirements (10%)	10 % of subtotal	sum		$52,340
Total					**$758,930**

Assumptions/Notes:

Estimated volume of debris disposal pile is 50,000 yd3

Estimated volume of solid waste in the DD pile is 100 yd^3.

remedial action is $11,000. Table 10-4 provides a detailed breakdown of work items, assumptions, and costs for this remedy.

10.1.5 Miscellaneous Solid Waste Piles

The recommended remedial option for all of the solid waste that is randomly scattered on the surface of the site is removal and off-site disposal. The estimated cost of this remedy is $50,000. Table 10-5 provides a detailed breakdown of work items, assumptions, and costs for this remedy.

10.1.6 Pre-Remedial Design Tasks

As discussed above in sub-sections 10.1.1 to 10.1.5, the selected remedial options for the blue fill material, Ash/ filter cake, and the lead/PAH hot spot areas will require additional investigation and/or design costs. The remedial costs estimates shown on summary Table 10-6 have been supplemented to include the investigation and design costs described below. The additional investigation and design costs are estimated to be approx. $69,000.

Area of Investigation	**Remedial Action**
• Fire Brick	Excavation and sampling of representative fire brick and select suspect fill material from the Debris Disposal Pile
• Blue Fill	Further characterization and delineation of cyanide-impacted soil/fill and groundwater near MW-106 – one day of backhoe.
• Ash Stabilization	1. Additional delineation of perimeter along west, north and east sides within the Parcel 4 boundaries – two days backhoe. 2. Bench Study of stabilization compound performed by vendor.

Table 10-4

REMEDIAL COST ESTIMATE
BLCP - Parcel 4
Hot Spot Characterization
Removal and Off-Site Disposal

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
1	Additional delineation and characterization of hot spot fill	1	LS	$2,000	$2,000
2	Excavation transport and disposal of hot spot fill	70	ton	$60	$4,200
	(Assumed volume is 50 CY)				$0
3	Cost for clean soil backfill including placement	70	ton	$20	$1,400
	Sub-Total if non-hazardous				$7,600
4	Engineering and Contingency if non haz (35% of sub-total)	35% of subtotal	sum		$2,660
5	H&S and General Requirements if non Haz (10%)	10% of subtotal	sum		$760
Total if non-hazardous					**$11,020**

Assumptions/Notes:

Estimated volume is 50 cubic yards (70 tons) of material

Backfill with clean soil.

Cost varies substantially depending on whether the material is determined hazardous or non-hazardous.

Table 10-5

REMEDIAL COST ESTIMATE
BLCP - Parcel 4
Miscellaneous Solid Waste Piles

Removal and Off-Site Disposal

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
1	Removal and disposal of scrap tires	20	tons	$200	$4,000
2	Removal and disposal of the remainder of C&D wastes	500	tons	$60	$30,000
	Sub-Total				$34,000
3	Engineering and Contingency	35% of Subtotal	sum		$11,900
4	Health & Safety and General Requirements (10%)	10 % of subtotal	sum		$3,400
Total					**$49,300**

Assumptions/Notes:

Assumes 20 tons of tires and 500 tons of other non-hazardous solid waste debris

Table 10-6

SUMMARY OF REMEDIAL COST ESTIMATES
BLCP - Parcel 4

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	Additional Investigation and/or Design Costs	EST. TOTAL
Table 10-1 Blue Fill Removal and Off-Site Disposal (Option 3A)						
1	Additional delineation and characterization of blue fill	1	LS	$2,000	$2,000	$2,000
2	Excavation transport and disposal of non-haz blue fill	140	ton	$60		$8,400
2	Excavation transport and disposal of hazardous Blue fill	140	ton	$250		$35,000
	(Assumed volume is 100 CY)					$0
3	Cost for clean soil backfill including placement	140	ton	$20		$2,800
	Sub-Total if non-hazardous					$13,200
	Sub-Total if Hazardous					$39,800
4	Engineering and Contingency if non haz (35% of sub-total)	35% of subtotal	sum			$4,620
4	Engineering and Contingency if haz. (35% of sub-total)	35% of subtotal	sum			$13,930
5	H&S and General Requirements if non Haz (10%)	10% of subtotal	sum			$1,320
5	H&S and General Requirements if Haz (10%)	10% of subtotal	sum			$3,980
	Total if non-hazardous					**$19,140**
	Total if Hazardous				**$2,000**	**$57,710**
Table 10-2 Hot Spot Stabilization, Ash Removal and Backfill Cover						
1	Bench Study	1	LS	$5,000	$5,000	$5,000
2	Pilot Study	1	LS	$50,000	$50,000	$50,000
3	Delineation of Ash and quantification of volume (haz/nonhaz)	1	LS	$20,000		$20,000
5	Purchase/delivery of Ecobond to treat 20% of ash w/ 2% conc	220	tons	$500		$110,000
6	Analytical confirmation of post treatment lead concentrations	4	samples	$100		$400
7	Excavation, transport, disposal of entire ash volume (non-haz)	55000	CY	$60		$3,300,000
10	Placement of 2 feet backfill cover from other areas on site	12000	CY	$8		$96,000
11	Sub-Total					$3,581,400
12	Engineering and Contingency	35% of Subtotal	sum			$1,253,490
13	Health & Safety and General Requirements (10%)	10 % of subtotal	sum			$358,140
	Total				**$55,000**	**$5,193,030**
Table 10-3 Debris Disposal Pile Excavation, Sorting, Characterization and Reuse						
1	Excavation, sorting, and leveling of the pile.	50,000	CY	$10		$500,000
2	Sample collection and analyses of reusable soil/fill	50	ea.	$400	$400	$20,000
3	Sample collection and analyses of disposable soil/fill	1	ea.	$400	$400	$400
4	Removal and disposal of C&D wastes	50	tons	$60		$3,000
5	Sub-Total					$523,400
6	Engineering and Contingency	35% of Subtotal	sum			$183,190
7	Health & Safety and General Requirements (10%)	10 % of subtotal	sum			$52,340
	Total				**$800**	**$758,930**
Table 10-4 Lead and PAH "hot spot" Remediation						
1	Additional delineation and characterization of hot spot fill	1	LS	$2,000	$2,000	$2,000
2	Excavation transport and disposal of hot spot fill	70	ton	$60	$4,200	$4,200
	(Assumed volume is 50 CY)					$0
3	Cost for clean soil backfill including placement	70	ton	$20	$1,400	$1,400
	Sub-Total if non-hazardous				$7,600	$7,600
4	Engineering and Contingency if non haz (35% of sub-total)	35% of subtotal	sum		$2,660	$2,660
5	H&S and General Requirements if non Haz (10%)	10% of subtotal	sum		$760	$760
	Total if non-hazardous				**$11,020**	**$11,020**
Table 10-5 Miscellaneous Waste Removal and Offsite Disposal						
1	Removal and disposal of scrap tires	20	tons	$200		$4,000
2	Removal and disposal of the remainder of C&D wastes	500	tons	$60		$30,000
	Sub-Total					$34,000
3	Engineering and Contingency	35% of Subtotal	sum			$11,900
4	Health & Safety and General Requirements (10%)	10 % of subtotal	sum			$3,400
	Total					**$49,300**

Shaded tasks to be completed during pre-remedial design phase.

Area of Investigation	Remedial Action
	3. In field Pilot Study of stabilization compound – one week study.
• Lead/Hot Spot	Additional subsurface delineation – one day of backhoe.
• PAH Hot Spot	Additional subsurface delineation – one day of backhoe.

10.2 Remedial Objectives

Several remedial alternatives exist for the soil/fill material and therefore the objectives for the remedial alternatives analysis are to identify, evaluate, and recommend remedial alternative(s) that address the potential risks posed by the on-site soil/fill with the ultimate goal being a Site condition that allows for redevelopment. The evaluation assumes that the four distinct waste materials discussed in Section 10.1 will be remediated prior to and separate from the general soil/fill material, only those remedial alternatives that relate directly to the on-site soil/fill are evaluated in the following sections for possible implementation at the Site.

10.3 Identification of Remedial Alternatives

Remedies identified fall into one of two general categories; those that result in unrestricted use and those that result in restricted use of the Site.

Remedies that could result in unrestricted use of the Site include:

- Removal and off-site disposal of all on-site soil/fill and replacement with clean fill.
- In-situ or ex-situ treatment of the contaminated soil/fill.

Remedies that could result in the restricted use of the Site include:

- Institutional Controls
- Cover System with Institutional Controls
- Subsection 10.4 describes each remedial alternative as well as a No Action alternative.

10.4 Description of Remedial Alternatives

10.4.1 Unrestricted Use Remedies

Removal and Off-Site Disposal of the Soil/Fill Material

This alternative involves excavation and removal of all on-site soil/fill material and off-site transport and placement in an appropriately permitted secure landfill followed by replacement with clean fill. This alternative will be retained for detailed analysis.

Treatment Technologies

Treatment technologies potentially applicable for the contaminants associated with the Site include:

- solidification/stabilization,
- bioremediation,
- phytoremediation,
- chemical oxidation,
- electro kinetic separation
- soil flushing.

Each of these potentially applicable treatment technologies are described below:

Solidification/Stabilization (S/S) involves physically binding or enclosing the Site contaminants within a stabilized mass (solidification), or inducing chemical reactions between the stabilizing agent and the contaminants to reduce their mobility (stabilization). S/S can be applied in-situ or ex-situ. The target contaminant group for in-situ S/S is generally inorganics and thus would not address the PAHs. The In-Situ Vitrification (ISV) process can destroy or remove organics and immobilize most inorganics in contaminated soils, sludge, or other earthen materials. The process has been tested on a broad range of VOCs and SVOCs, other organics including dioxins and PCBs, and on most priority pollutant metals and radionuclides. However, future usage of the Site may "weather" the materials and affect their ability to maintain contaminant stability. Most vitrification processes result in a significant increase in volume (up to double the original volume). In addition, the solidified material may potentially hinder future Site uses. As a result S/S is considered not applicable for remediation of this Site and will not be included for further consideration.

Bioremediation/Bio-augmentation describes the activity of naturally occurring or inoculated microbes stimulated by circulating water-based solutions through the contaminated soils to enhance in-situ biological degradation of organic contaminants or immobilization of inorganic contaminants. Nutrients, oxygen, or other admixed materials may be used to enhance bioremediation and contaminant desorption from subsurface materials. The contaminant groups treated most often are PAHs, non-halogenated SVOCs (not including PAHs), and BTEX. Remediation of metals with microbial techniques is in the experimental stage, with limited data/guidance.

Bioleaching uses microorganisms to solubilize metal contaminants either by direct action of the bacteria, as a result of interactions with metabolic products, or both. Bioleaching can be used in-situ or ex-situ to aid the removal of metals from soil. Because of bioremediation's limited applicability for treating recalcitrant PAHs and metals, and the potential for the on-site metals concentrations to be toxic to the microorganisms, this treatment technology is not considered to be applicable for remediation of this Site and will not be given further consideration.

Phytoremediation is a process that uses plants to remove, transfer, stabilize, or destroy contaminants in soil, sediment, and groundwater. The mechanisms of phytoremediation include enhanced rhizosphere biodegradation, which takes place in soil or groundwater immediately surrounding plant roots; phytoextraction (also known as phytoaccumulation), the uptake of contaminants by plant roots and the translocation/accumulation of contaminants into plant shoots and leaves; phytodegradation, the metabolism of contaminants within plant tissues; and phytostabilization, the production of chemical compounds by plants to immobilize contaminants at the interface of roots and soil. Phytoremediation applies to all biological, chemical, and physical processes that are influenced by plants (including the rhizosphere) and that aid in cleanup of the contaminated substances. Plants can be used in Site remediation, both through the mineralization of toxic organic compounds and through the accumulation and concentration of heavy metals and other inorganic compounds from soil into aboveground shoots. Phytoremediation may be applicable for the remediation of metals, pesticides, solvents, explosives, crude oil, PAHs, and landfill leachates. Some plant species have the ability to store metals in their roots. As the roots become saturated with metal contaminants, they can be harvested. Hyper-accumulator plants may be able to remove and store significant amounts of metallic contaminants. Currently, trees are under investigation to determine their ability to remove organic contaminants from ground water, translocate and transpiration, and possibly metabolize them either to CO2 or plant tissue. The depth of the treatment zone varies based on the plants used in phytoremediation, but in most cases, it is limited to shallow soils. High concentrations of some contaminants can be toxic to plants. In addition, the process occurs seasonally. Since different planting materials would be required for each group of site contaminants, this process likely requires many seasons to remediate to non-risk concentrations.

Given the nature of the Site, selected plant species may not consistently remove materials from across the Site and with depth; contaminants may potentially be mobilized into groundwater. This treatment technology is not applicable for remediation of this Site and will not be given further consideration.

Chemical Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. This technology can be applied in-situ or ex-situ. In-situ chemical oxidation (ISCO) using permanganate for soil and groundwater treatment has been demonstrated at a number of sites for the following organics: chlorinated solvents (such as trichloroethylene [TCE]), naphthalene, and pyrene. Fenton’s Reagent can be used to treat a wide range of organic contaminants in soil and groundwater, including chlorinated solvents, petroleum hydrocarbons, semi-volatile organic compounds (SVOCs), and pesticides. ISCO has also been used to remediate polyaromatic hydrocarbons (PAHs), petroleum products, and ordnance compounds. Chemical treatment may be used to solubilize contaminants from the most contaminated fraction of the soil. Many processes manipulate the acid/base chemistry of the slurry to leach contaminants from the soil. Oxidizing and reducing agents (e.g., hydrogen peroxide, sodium borohydride) provide yet another option to aid in solubilization of metals since chemical oxidation/ reduction can convert metals to more soluble forms. Finally, surfactants may be used in extraction of the metals from soil. Because different chemicals would be required to treat each contaminant group, and application is limited by the ability of the oxidants to reach the contaminants, this treatment technology is not considered applicable for remediation of this Site and will not be given further consideration.

Electrokinetic Separation relies upon the application of a low-intensity direct current through the soil between ceramic electrodes that are divided into a cathode array and an anode array. This mobilizes charged species, causing ions and water to move toward the electrodes. Metal ions, ammonium ions, and positively charged organic compounds move toward the cathode. Anions such as chloride, cyanide, fluoride, nitrate, and negatively charged organic compounds move toward the anode. The current creates an acid front at the anode and a base front at the cathode. This generation of an in-situ acidic condition may help to mobilize sorbed metal contaminants for transport to the collection system at the cathode. Concentrated (migrated) contaminants are then removed for treatment or can be treated in treatment walls as they migrate. The polarity of the electrodes is reversed periodically, which reverses the direction of the contaminants back and forth through treatment zones. Electrokinetics has been used for decades in the oil recovery industry and to remove water from soils, but in-situ application of electrokinetics to remediate contaminated soil is new. Recently, attention has focused on developing in-situ electrokinetic techniques for the treatment of low permeability soils, which are resistant to remediation with traditional technologies because of their low hydraulic conductivity. Because of its limited effectiveness for non-polar organic contaminants, such as PAHs, this treatment technology will not be given further consideration for remediation of this Site.

In-Situ Soil Flushing is used to mobilize metals by leaching contaminants from soils so that they can be extracted without excavating the contaminated materials. An aqueous extracting solution is injected into or sprayed onto the contaminated area to mobilize the contaminants, usually by solubilization. After being contacted with the contaminated material, the extractant solution is collected using pump-and-treat methods for disposal or treatment and reuse. Common extracting agents include acids/bases, chelating agents, oxidizing/reducing agents and surfactant cosolvents. This process can be applied in-situ or ex-situ (soil washing). The target contaminant groups for soil washing are SVOCs, fuels, and heavy metals. The technology can be used on selected VOCs and pesticides.

The technology offers the ability for recovery of metals and can clean a wide range of organic and inorganic contaminants from coarse-grained soils. However, complex mixtures of contaminants in the soil (such as a mixture of metals, nonvolatile organics, and SVOCs) and heterogeneous contaminant compositions throughout the soil mixture make it difficult to formulate a single suitable washing solution that will consistently and reliably remove all of the different types of contaminants. There is additionally limited data regarding flushing for PAHs. For these reasons, this treatment technology is not considered applicable for remediation of this Site and will not be considered further.

10.4.2 Restricted Use Alternatives

In order to eliminate potential exposure risks associated with direct contact with Site soil/fill material, the entire Site can be covered as part of Site redevelopment. The cover system would be placed directly on top of the regraded on-site fill material and would include clean soil for outdoor vegetated areas, asphalt for roads and parking lots, or concrete for sidewalks, buildings and heavy use areas. A Soil/Fill Management Plan would be necessary in order to set guidelines for management of soil cover during activities that would breach the cover system. A proposed soil/fill management plan is provided in Appendix G and an Operation, Monitoring, and Maintenance (OM&M) Work Plan for implementation following remediation of the Site is included in Appendix H.

The proposed cover system has been designed to be protective of human health and the environment. The primary exposure pathway for contaminants at the Site (PAHs and metals in soil) is via direct contact. The proposed plan of covering the on-site soil/fill material will eliminate the potential for direct contact with soil/fill and is therefore protective of human health and the environment.

Exposure to soil/fill piles generated during construction activities will be precluded for on-site workers and trespassers through covering with management practices. Exposure to fill at the surface would also be precluded for future on-site workers through covering. The potential for exposure through invasive on-site construction activities would be managed by implementation of the protocols described in the Soil/Fill Management Plan, presented in Appendix G.

Preparation of Site Surface

The surface would be graded in accordance with the redevelopment project grading plan such that precipitation events would not cause the formation of standing water. Prior to placement of the cover soil, all protruding material would be removed from the ground surface. Burning would not be allowed.

The placement of the cover material may occur as portions of the Site are developed. The Site would be hydroseeded to limit dust generation from the soil/fill that has not yet been covered.

Soil

In areas that will not receive significant equipment or vehicular use, the minimum cover system will be composed of documented clean off-site soil tested in accordance with Section G.4 of the Soil/Fill Management Plan and found to contain constituent concentrations less than those specified in 6 NYCRR Subpart 375-6.7(d). The completed soil cover would be of a thickness required to maintain sufficient vegetative cover to prevent exposure to the on-site fill material. The minimum soil thickness would be 12 inches.

In areas in which trees and shrubs would be planted, bermed islands or greenspace would be of sufficient thickness to allow the excavation of only clean fill to a depth sufficient to plant the tree or shrub root ball. Unless additional soil is required for the plantings, the soil cover thickness would be 12 inches. The soil used to cover berms or mounds would contain sufficient organic material to allow the growth of trees and/or shrubs and would be of sufficient strength to support trees and/or shrubs at their maximum height. Fill materials containing lumps, pockets, or concentrations of silt or clay, rubble, debris, wood or other organic matter would not be acceptable. Fill containing unacceptable material would be removed and disposed appropriately.

Topsoil used for the final cover would meet the following general specifications:

1. Fertile, friable, natural loam surface soil, capable of sustaining plant growth, and free of clods of hard earth, plants or roots, sticks or other extraneous material harmful to plant growth. The topsoil will have the following characteristics:

a. pH 5.5 to pH 7.6.

b. Minimum organic content of 2.5 percent as determined by ignition loss.

c. Soluble salt content not greater than 500 ppm.

2. Before delivery, soil samples would be characterized to confirm conformance with the criteria specified in Sections 2.3 and 2.4 of the Soil/Fill Management Plan.

Grass seed used for final cover would be fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America. The entire ground surface disturbed by construction operations would be seeded with 100 lbs/acre of seed conforming to the following:

a.

Name of Grass	Application Rate (lbs/acre)	Purity (%)	Germination (%)
Perennial Ryegrass	10	95	85
Kentucky Bluegrass	20	85	75
Strong Creeping Red Fescue	20	95	80
Chewings Fescue	20	95	80
Hard Fescue	20	95	80
White Clover	10	98	75

b. Germination and purity percentages should equal or exceed the minimum seed standards listed. If it necessary to use seed with a germination percentage less than the minimum recommended above, the seeding rate would be increased accordingly to compensate for the lower germinations.

c. Weed seed content would be less than 0.25 percent and free of noxious weeds.

d. All seed would be rejected if the label lists any of the following grasses:

1) Sheep Fescue

2) Meadow Fescue

3) Canada Blue

4) Alta Fescue

5) Kentucky 31 Fescue
6) Bent Grass

3. In addition to the seed mixtures listed above, one bushel per acre of oats or rye seed would be sowed over the entire area, including drainage ditches, to provide a quick shade cover and to prevent erosion during turf establishment.

Asphalt

Where applicable, the cover system in areas that will become roads, sidewalks, and parking lots would consist of a minimum of two inches of asphalt. Asphalt would be placed over a minimum four-inch gravel subbase to provide stability for construction and to limit subsidence. Prior to placement of the subbase, all protruding material would be removed from the ground surface and the area regraded to a regular surface.

Concrete

Where applicable, the cover system in areas that will become slab-on-grade structures would consist of a minimum of two inches of concrete. The concrete would be placed on a minimum four-inch gravel subbase to provide stability for construction and to limit subsidence. Concrete may also be used instead of asphalt for roads, walkways, and parking lots. Prior to placement of the subbase, all protruding material would be removed from the ground surface and the area regraded to a sufficient regular surface.

This alternative will be retained for detailed analysis.

10.5 Remedial Evaluation Criteria

The criteria used to evaluate the selected remedial technologies include the following:

- Short-term effectiveness and impacts
- Long-term effectiveness and permanence
- Implementability
- Reduction of toxicity, mobility and volume
- Conformance to standards, criteria and guidance

- Overall Protectiveness
- Cost

The issues considered for each criteria are discussed below.

Short term Effectiveness and Impacts - The effectiveness of alternatives in protecting human health and the environment during construction and implementation of the remedial action is evaluated by this criterion. Short-term effectiveness is assessed by protection of the community, protection of workers, environmental impacts, and time until protection is achieved.

Long Term Effectiveness and Permanence - This criterion evaluates the long-term protection of human health and the environment at the completion of the remedial action. Effectiveness is assessed with respect to the magnitude of residual risks; adequacy of controls, if any, in managing residuals or untreated wastes that remain at the Site; reliability of controls against possible failure, and potential to provide continued protection.

Reduction of Toxicity, Mobility, and Volume - This evaluation criterion prioritizes those remedial actions that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances. This criterion is satisfied when the treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

Implementability - This assessment criterion evaluates the technical and administrative feasibility of implementing alternatives and the availability of services and materials.

Compliance with Standards, Criteria, and Guidelines - This threshold addresses whether or not a remedy will meet regulatory environmental limits.

Overall Protection of Human Health and the Environment - This is a threshold assessment, which addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled. This evaluation allows for consideration of whether an alternative poses any unacceptable short term or cross-media impacts.

Cost -The estimated capital and operation and maintenance (O&M) costs.

These criteria serve to provide a basis of comparison and allow for ranking of the alternatives by preference and acceptability.

10.6 Evaluation of Remedial Alternatives

Potential remedial alternatives that could reasonably be implemented for the Site are identified and evaluated in this section. The four remedial alternatives identified for detailed evaluation are:

- Alternative #1 – No Action
- Alternative #2 – Institutional Controls
- Alternative #3 – Cover System with Institutional Controls
- Alternative #4 – Removal and Off-Site Disposal of All Soil/Fill

Alternatives # 1 and # 2 also assume no action with regard to waste materials (blue fill, filter cake/flue ash, debris, and solid waste) as discussed in Section 10.1. Alternatives 3 and 4 assume that the proposed removal actions described for these materials will be implemented.

Alternative #1 – No Action

The No Action alternative would involve taking no action to remediate or restrict access and use of the Site. Although no cost would be incurred under the No Action alternative, the potential health risks would remain and the Site could not be redeveloped as planned.

Alternative #2 – Institutional Controls

Institutional controls could be implemented to reduce the potential for exposure to site chemicals of potential concern (COPCs). Institutional controls could include:

- Deed Restrictions – to control future site uses and activities and to restrict the use of site groundwater to non-potable uses.
- Annual groundwater monitoring and site inspections

- Restrictions to public access (fencing around the flue ash pile, concrete barriers at vehicle access points and warning signage).

Although minimal cost would be incurred under this alternative, the potential health risks would remain and the Site could not be redeveloped as planned. The estimated cost of this remedy is approximately $ 360,000. Table 10-7 provides a detailed breakdown of work items and costs for this remedy.

Alternative #3- Cover System with Institutional Controls

This alternative involves installing a cover system over the entire Site using either asphalt or concrete pavement or one foot of documented clean soil. Soil/fill material excavated during site redevelopment and maintenance would be managed using a soil/fill management plan. Institutional controls would also be implemented along with this alternative that would reduce the potential for exposure to site COPCs. Institutional controls could include deed Restrictions that would control future site uses, restrict the use of site groundwater, and require the implementation of a Soil/Fill Management Plan and an Operations Management and Monitoring Plan.

The short-term risks could be adequately managed through the use of personal protective equipment (PPE) and appropriate health and safety protocols. Short-term risk of exposure to site workers and trespassers during construction activities would be addressed through covering stockpiled soil/fill, temporary seeding of graded soil/fill areas and site security. Once the construction is complete and the Site is fully covered, the risk to on-site workers and the public will be eliminated and sustained through adequate protections and maintenance of the cover systems. Exposure risks to future construction workers would be adequately managed through the Soil/Fill Management protocols and appropriate health and safety protocols. Standard readily available construction equipment and techniques would be utilized. This alternative would reduce the mobility and volume of the contaminants, but not their toxicity. The SSAL's would be achieved through implementation of the Soil/Fill Management Plan, since no excavated fill or soils with concentrations in excess of the SSAL's would be returned to the Site. The resulting Site condition would not pose a potential risk to human health provided the cover systems are appropriately maintained. Table 10-8 presents an estimate of the capital cost of this alternative. The cost to implement this alternative is approximately $ 6.9 million, including approximately $6 million to remove the various waste materials (blue fill, flue

Table 10-7

REMEDIAL COST ESTIMATE
BLCP - Parcel 4

Institutional Controls

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
1	Negotiation of Deed Restrictions	1	sum	$5,000	$5,000
2	Annual Site Inspection and reporting (15 yrs)	1	15 yrs	$11,118	$11,118
	($1000 x present worth at 4% int.)				$0
3	Annual Groundwater monitoring (assume 12 wells)	1	15 yrs	$166,776	$166,776
	(40 field hrs/event, 15 samples for metals/SVOCs/pH				$0
	and report x 15 years at present worth using 4% int.				$0
4	Maintenance and repair of monitoring well network (15 yrs)	1	15 yrs	$11,118	$11,118
	($1000 per year X present worth at 4% interest)				
5	Chain link fence (1600' x 6')	1600	foot	$30	$48,000
6	Concrete Jersey Barriers (8 feet long)	8	each	$500	$4,000
7	Warning signs (one every 50 feet)	32	each	$50	$1,600
Subtotal					$247,612
8	Engineering and Contingency (35% of sub-total)	35% of subtotal	sum		$86,664
9	Health & Safety and General Requirements (10%)	10% of Subtotal	sum		$24,761
Total					**$359,037**

Assumptions:

Institutional controls could include:

Deed Restrictions to control future site uses, activities, and restrict groundwater to non-potable uses.

Annual inspection of well network and site cover system and monitoring of groundwater quality.

Restrict public access (fence around the flu ash pile, barriers at vehicle access points, warning signs).

Well maintenance assumes minor replacement of caps and locks, and painting as necessary

Table 10-8

REMEDIAL COST ESTIMATE
BLCP - Parcel 4

Cover System with Institutional Controls

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
	Removal of Blue Fill	1		$55,000	$55,000
	Removal of Filter cake/flu ash - Option 3A -max volume	1		$5,200,000	$5,200,000
	Sorting and removal of waste from Debris Disposal Pile	1		$730,000	$730,000
	Removal of Miscellaneous Waste Piles	1		$50,000	$50,000
	Sub-Total (Total cost of waste removal)				$6,035,000
1	Cut and mulch trees, spread mulch on site	15	acre	$2,500	$37,500
2	Demarcation layer of mesh fabric	20,000	SY	$0.10	$2,000
3	Import and Placement of clean soil (labor and material)	6500	CY	$20	$130,000
4	Negotiation of Deed Restrictions	1	Sum	$5,000	$5,000
5	Annual Site inspection and reporting (15 yrs)	1	15 yrs	$11,118	$11,118
	($1000 x present worth at 4% int.)				
6	annual groundwater monitoring (assume 12 wells)	1	15 yrs	$166,776	$166,776
	(40 field hrs/event, 15 samples for metals/SVOCs/pH				
	and report x 15 yrs at present worth using 4% interest				
7	Maintenance and repair of monitoring well network (15 yrs)	1	15 yrs	$11,118	$11,118
	($1000 per year x present worth at 4% interest)				
8	Maintenance and repair of cover system (15 yrs)	1	15 yrs	$222,360	$222,360
	($20,000 per year x present worth at 4% interest)				
9	Sub-Total				$585,872
10	Engineering and Contingency (35% of sub-total)	35% of subtotal	sum		$205,055
11	Health & Safety and General Requirements (10%)	10% of subtotal	sum		$58,587
	Sub-Total (Total cost of soil cover system)				$849,514
	Total				**$6,884,514**

Major Assumptions:

1. Site cover would be performed after removal of the following:
Blue fill
Filter cake/flu ash pile
Debris disposal pile
Other solid waste scattered throughout the site surface (tires, C&D etc.)
2. All on-site treed areas (approx. 15 acres) would be mulched and spread on the site surface.
3. Cover system includes demarcation layer + one foot of clean soil over 20% (4 acres) of the site.
The remaining 80% of the site will be covered with foundation slabs and paved areas, the costs for
which are not included in this estimate.
Deed Restrictions to control future site uses, activities, and restrict groundwater to non-potable uses.
Well maintenance assumes minor replacement of caps and locks and painting as necessary.
Cover system maintenance includes repair of ruts, erosion, settling, and reseeding.

ash, debris disposal pile, and miscellaneous waste piles) and approximately $250,000 for the actual soil cover system and approximately $650,000 for long-term inspection, monitoring, and maintenance of the cover system and groundwater monitoring well network. This cost estimate is based on the following major assumptions:

- Covering the site would be performed independently and after the following issues have been addressed:
  - Blue fill
  - Filter cake/flue ash pile
  - Debris disposal pile
  - Other solid waste scattered throughout the site surface (tires, C&D etc.)
- All on-site treed areas (approx. 15 acres) would be mulched and spread on the site surface.
- The cover system would consist of a demarcation layer (i.e. synthetic mesh) and one foot of clean soil over 20% (4 acres) of the site.
- The remaining 80% of the site would be covered with new building foundation slabs, roads, and parking areas, the costs for which are not included in this estimate but assumed to be part of the redevelopment costs.
- Annual inspection, sampling, and maintenance of a 12 well groundwater monitoring network for 15 years.
- Annual inspection and maintenance of the soil cover system for 15 years.
- The costs associated with soil/fill management as part of Site redevelopment are not included.

Alternative #4 - Removal and Off-Site Disposal of All Soil/Fill

This alternative involves excavation and removal of all on-site soil/fill material and off-site transport and placement in an appropriately permitted secure landfill. Although this alternative would remove the potential risks posed by the COPC in the soil/fill, this alternative is not feasible because of the prohibitive cost to remove and dispose of the large volume of the soil/fill, dewatering operations, backfill. The estimated cost of this remedy is $64 million, including $6 million to removal the various waste materials listed above and $58 million to removal the soil/fill. Table 10-9 provides a detailed breakdown of work items, assumptions, and costs for this remedy.

Table 10-9

REMEDIAL COST ESTIMATE
BLCP - Parcel 4

Removal and Off-Site Disposal of Soil/Fill

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB	EST. TOTAL
	Removal of Blue Fill	1		$55,000	$55,000
	Removal of Filter cake/flu ash - Option 3A -max volume	1		$5,200,000	$5,200,000
	Sorting and removal of waste from Debris Disposal Pile	1		$730,000	$730,000
	Removal of Miscellaneous Waste Piles	1		$50,000	$50,000
	Sub-Total (Total cost of waste removal)				$6,035,000
1	Excavation transport and off-site disposal of soil/fill	500000	CY	$60	$30,000,000
	(Assumed volume is 500,000 CY				
2	Cost for clean soil backfill including placement	500000	CY	$20	$10,000,000
	Sub-Total				$40,000,000
5	Engineering and Contingency (35% of sub-total)	35% of subtotal	sum		$14,000,000
6	Health & Safety and General Requirements (10%)	10% of subtotal	sum		$4,000,000
	Sub-Total (Total cost of soil/fill removal)				$58,000,000
Grand Total					**$64,035,000**

Assumptions:

The estimated volume of soil/fill at the site is approximately 500,000 CY

Does not include cost of dewatering and water management.

10.7 Comparative Analysis of Remedial Alternatives

This comparison evaluates the relative performance of the four alternatives considered for the general site soil/fill material with respect to the following seven evaluation criteria:

- Short-term effectiveness and impacts.
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume.
- Implementability.
- Compliance with standards, criteria, and guidelines.
- Overall protection of human health and the environment.
- Cost.

The advantages and disadvantages of the alternatives are identified so that trade-offs between the alternatives can be appropriately evaluated.

Short-term Effectiveness and Impacts –Alternatives #1 and #2 would not provide effective protection from exposure to COPCs to site users and construction workers while alternatives 3 and 4 would provide sufficient protection from exposure.

Long-term Effectiveness and Permanence – Alternatives #1 and #2 would not remove the contaminant source or provide any physical barriers to exposure to COPCs. Alternative #3 with long-term maintenance and management would be effective in long-term prevention of exposure to COPCs. Alternative #4 would remove the contamination from the Site and thus be considered a permanent remedy.

Reduction of Toxicity, Mobility, and Volume – Alternatives #1 and #2 would not affect the toxicity, mobility and volume of the contaminants on site. Alternative #3 would reduce the mobility of the contaminants by removing the direct contact pathway. Alternative #4 would remove the volume of contaminants by removing the soil/fill in which the contaminants are present. None of the four alternatives would reduce the toxicity of the contaminants.

Implementability – Alternatives #1, #2, and #3 are all readily implementable with standard construction equipment and techniques. Alternative #4 which would require significant excavation, dewatering and water management is not readily implementable.

Compliance with Standards, Criteria, and Guidelines –Only alternatives #3 and #4 would be expected to achieve compliance with SSAL's.

Overall Protection of Human Health and the Environment – Only alternatives #3, and #4 would provide sufficient protection of human health and ecological receptors.

Cost – Costs for Alternatives #1 through #3 are within the realm of affordability conditioned upon the availability of State and/or Federal funds.

10.8 Recommended Approach

10.8.1 Proposed Approach

Alternative #3 (Cover system with institutional controls) is the recommended remedial alternative for Parcel 4 conditioned on the availability of State and Federal funding. This alternative provides long-term effectiveness and overall protection to human health and the environment, at an attainable cost.

10.8.2 Soil/Fill Management Plan (SFMP)

During construction activities at the Site, excavation of selected areas of soil/fill material would be necessary for the construction of utility corridors. Excavation may also be necessary during the construction of footings for structures and for other activities. Although the site investigation has characterized the nature and extent of contamination, the nature of investigations does not allow for a 100 percent complete or accurate characterization. Therefore, it is possible that some quantity of undocumented contamination may be encountered during redevelopment activities.

Soil management protocols are necessary to limit the potential for exposure of on-site workers to contaminated fill material. The soil handling protocols will also be necessary for assisting with the determination of whether soil/fill removed during excavation activities may be reused on-site or must be disposed off-site. The Soil/Fill Management Protocols are included in Appendix G

10.8.3 Health and Safety

Invasive work performed at the Site will be performed in accordance with all applicable local, state, and federal regulations to protect worker health and safety. The Soil/Fill Management Protocols (Appendix G) describes recommended Health and Safety procedures for intrusive work activities at the Site.

All contractors performing redevelopment or maintenance activities involving intrusive work at the Site will be required to prepare a site-specific, activity-specific Health and Safety Plan. In order to facilitate the creation of an appropriate Health and Safety Plan by the contractor(s) performing work, the ranges of concentrations of contaminants detected in samples of site media collected during the site investigation are shown in Tables 5-1 through 5-3.

SECTION 11

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