REMEDIAL INVESTIGATION REPORT
(Revision 1)

Buffalo Color Corporation Area ABCE Site
NYSDEC Site No. 915184
Buffalo, New York

Prepared for:

HONEYWELL INTERNATIONAL INC.

Morristown, New Jersey

August 28, 2008

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FORMER BUFFALO COLOR CORPORATION AREA ABCE SITE
NYSDEC SITE NO. 915184
BUFFALO, NEW YORK

Prepared for:

HONEYWELL INTERNATIONAL INC.

Morristown, New Jersey

John M. Scrabis
Senior Principal Engineer

William J. Weber, P.E.
Principal Engineer

MACTEC Engineering and Consulting, Inc.
Pittsburgh, Pennsylvania

August 28, 2008

MACTEC Project 3410070582

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1.0 INTRODUCTION

MACTEC Engineering and Consulting, Inc. (MACTEC) has prepared this Remedial Investigation (RI) Report on behalf of Honeywell International Inc. (Honeywell) for the Buffalo Color Corporation (BCC) Area ABCE Site (Site). The RI activities and corresponding Alternatives Analysis Report (AAR) were completed in accordance with the approved Scope of Work (SOW) and the existing Consent Order (No. B9-0707-05-10) between Honeywell and the New York State Department of Environmental Conservation (NYSDEC). The work was performed in accordance with MACTEC's RI/FS Work Plan dated September 29, 2006, which was approved by NYSDEC for implementation via letter dated December 19, 2006, a copy of which is included in Appendix A. Per agreement with NYSDEC, the corresponding AAR (which satisfies the Feasibility Study [FS] requirement of the Order) has been submitted as a separate document.

This version of the RI Report (Revision 1) replaces in its entirety the original version of the RI report dated September 28, 2007. This report addresses comments issued by NYSDEC in a letter to Honeywell dated November 14, 2007 and subsequent meetings and correspondence.

Honeywell is working with South Buffalo Development LLC (SBD) to remediate and redevelop the Site under the New York State Brownfield Cleanup Program (BCP). SBD has submitted three applications to enter Areas A, B, C and E of the Site into the BCP. This plan was not in place when NYSDEC prepared the RI Report review comments presented in its November 14, 2007 letter. SBD's conceptual plan calls for demolition of the former BCC facility and redevelopment of the Site for commercial/industrial use. The demolition and redevelopment plans are contingent on acceptance of the Site into the BCP, negotiation of a mutually acceptable remedy, and the execution of a definitive agreement between SBD and Honeywell.

1.1 SITE DESCRIPTION

The Site is located on the south side of the City of Buffalo, in Erie County, New York. The physical address of the Site office building, which is located on Area B, is 100 Lee Street. The Site occupies approximately 47 acres near and adjacent to the Buffalo River (Figure 1). The Site, with a few exceptions discussed below, is currently owned by BCC.

1.1.1 Physical Setting and Local Land Use

The present layout of the four areas of the Site (Areas A, B, C, and E) are shown on Figure 2 (Site Layout). These areas are described as follows:

- Area A is the located on the southern end of the Site. The property is fenced and is accessible by vehicle via gated entrances along South Park Avenue. It includes various former production buildings, several aboveground storage tank (AST) farms, and an office/maintenance building. It is bounded by South Park Avenue to the north, the Buffalo River to the east, an inactive rail line to the south (beyond which is Area D, which is not part of the Site for the purposes of the RI/FS), and railroad tracks to the west.

- Area B is located to the north of Area A, across South Park Avenue. Area B is fenced and is accessible by vehicle via a gated entrance along Lee Street. Area B includes the former BCC office building located at 100 Lee Street and surrounding asphalt parking area. Area B is bounded by a rail spur and Area C to the north, Lee Street to the east, South Park Avenue to the south, and railroad tracks to the west. The western portion of Area B (approximately 2.5 acres) will be owned and controlled by SBD. Area B is bounded by a rail spur and Area C to the north, Lee Street to the east, South Park Avenue to the south, and railroad tracks to the west.

- Area C is located on the northwestern corner of the Site. It is fenced and accessible by vehicle from gated entrances along Lee Street. Area C includes the former powerhouse building and former ice house. A large AST, formerly used for storage of fuel oil, is located on the western side of the property. Area C is bounded by Elk Street to the north (across which is the Honeywell Buffalo Research Laboratory facility), Lee Street to the east, a rail spur and Area B to the south, and railroad tracks to the west.

- Area E is the largest of the four areas and is located on the northeastern side of the Site. Area E includes various former production buildings, maintenance sheds, a former laboratory, the former wastewater treatment plant (including surface impoundments) and a large AST farm. Much of the eastern half of Area E is vacant and grass-covered. Area E is bounded by Elk Street to the north, Orlando Street to the east (across which are industrial/commercial properties, including the former Exxon Mobil refinery and bulk petroleum terminal), and Prenatt Street to the south (a paper street that includes a rail spur and across which is the PVS Chemical facility). Former BCC Building 322 and surrounding property totaling about 9.1 acres is under new ownership and will not be redeveloped by SBD.

The Site is located in an area of heavy industrial development that dates to the mid-1800s. Contaminated soil and/or groundwater is known or suspected to exist on many of the surrounding properties. Area D was formerly the location of plant production and waste disposal operations. Remedial action for Area D was completed under a Consent Order in the 1990s in accordance with NYSDEC requirements. The former Exxon Mobil refinery and bulk petroleum terminal located east of Area E reportedly has groundwater contamination which includes the presence of light non-aqueous phase liquids (LNAPL). NYSDEC has indicated that the Exxon Mobil facility is being addressed under the New York State Brownfield Program. The nearest residential areas are about 150 feet north and east of the Site, across Elk and Orlando Streets.

1.1.2 Site Utilities

Potable water is provided to the Site and surrounding area by the City of Buffalo. Site sewage and wastewater is conveyed off site via a network of underground sewer lines to the Buffalo Sewer Authority (BSA) wastewater treatment plant. A portion of site stormwater is conveyed via underground storm sewer lines to two outfalls located along the Buffalo River as described in Section 1.1.3. Figure 3 shows the locations of known Site underground sewer and storm sewer lines.

Electric and gas service are also available to the site from local utilities. However, these services have been shut off for the Buffalo Color plant except for the office building at 100 Lee Street on Area B, and the warehouse building located on Area E near Elk Street and the groundwater extraction system on Area A.

1.1.3 Topography and Surface Drainage

Regionally, the ground surface is generally flat and has a gentle slope to the west toward Lake Erie. The Site is also generally flat, with ground surface elevations typically between 584 and 586 feet above mean sea level (MSL). Surface runoff at the Site is conveyed to the facility's underground storm sewer lines. The storm sewers discharge to the Buffalo River via two main outfalls: Outfall 006 is located on Area A and Outfall 011 runs from Area E south across the adjacent PVS chemical property. Shallow groundwater is recharged by rainfall or snow-melt that does not otherwise run off to surface water. Figure 2 shows existing ground surface conditions for Area ABCE. As depicted on Figure 2, nearly 60 percent of the facility is covered by paved areas or existing structures.

The Site is situated within the Lake Erie and Niagara River drainage basin. The Buffalo River is the predominant surface drainage near the Site. The river is approximately 8 miles in length and is classified as a Class C waterway suitable for secondary contact recreation. The area surrounding the river has been heavily used since the 1800s. Recent environmental studies performed by others have reportedly identified impacted biota (e.g. fish with mouth tumors) within the river. The Buffalo River generally flows from east to west and eventually drains into Lake Erie several miles west of the Site, although periodic flow reversals occur due to Lake Erie seiche conditions. The Buffalo River has a reported median summer low monthly flow of 48 cubic feet per second (cfs) but, during the spring, runoff conditions may exhibit monthly flows as high as 1,200 cfs. Historically, the banks of the Buffalo River have been altered for industrial development. Fill has been placed in several areas of the Site for this purpose. The river is presently used on a limited basis for commercial shipping. The Buffalo River is not used as a drinking water source. Lake Erie (the receiving water body) is used as a drinking water source for various U.S. and Canadian population centers. A Remedial Action Plan (RAP) has been developed for the river jointly by the U.S. EPA Great Lakes National Program Office, NYSDEC, the Buffalo Niagara Riverkeeper, and other governmental and non-governmental organizations to facilitate the restoration of the river. The RAP and related information is available online at http://www.bnriverkeeper.org/programs/tributary/buffalo_river/Buffalo_river.htm.

1.1.4 Regional Geology and Hydrogeology

Significant analysis of regional geology and hydrogeology is contained in prior reports prepared for the Site and Area D (Engineering Science, Inc., 1989; Remcor, Inc. 1995; Golder Associates 1997). Where appropriate, such prior analysis is restated below.

The BCC facility is located within the Erie-Ontario Lowland physiographic province of New York State. The Erie-Ontario Lowland is underlain by layers of sedimentary bedrock which are largely covered with unconsolidated deposits. The bedrock consists mainly of shale, limestone, and dolomite. The bedrock units are comprised of fine-grained sediments deposited in seas during the Silurian and Devonian Periods, and are bedded or layered.

The Onondaga Limestone is the uppermost bedrock unit at the Site. The upper portion of the Onondaga Limestone was subjected to glacial scouring and weathering and is characterized as a hard, gray, finely crystalline, massively bedded, stylolitic and cherty limestone. The limestone is typically heavily jointed and exhibits a high degree of secondary porosity. The regional dip of the bedrock is gently south-southwest at approximately 1 percent (40 feet per mile).

In the vicinity of the Site, the unconsolidated deposits overlying bedrock are mostly glacial deposits formed during Pleistocene time about 10,000 to 15,000 years ago, when a continental ice sheet covered the region. The glacial deposits consist of glacial till, which is a nonsorted mixture of clay, silt, sand and stones deposited directly from the ice sheet; lake deposits, which are bedded clay, silt, and sand that settled out in lakes fed by the melting ice;and sand and gravel deposits associated with glacial streams. The glacial sand and gravel deposits may be either ice-contact or outwash types. Other unconsolidated deposits are alluvium consisting of sand and gravel laid down by rivers and streams during recent geologic time. The unconsolidated deposits generally are less than 50 feet thick in the vicinity of the Site, excluding fill materials.

Groundwater can be found locally in both the unconsolidated deposits and the limestone bedrock of the region. The unconsolidated deposits exhibit a wide range of permeability and can yield varying quantities of water, or none at all. Groundwater within the bedrock is transmitted through fractures such as horizontal and vertical joints, which are widened by dissolution processes. The availability of groundwater in the bedrock can vary widely based on the occurrence of fractures and the size of the solution openings. Additional information regarding the aquifers present at the Site is provided in Section 2.2.2.

1.1.5 Current Local Groundwater Use

As noted in Section 1.1.2, potable water is provided to the Site and surrounding area by the City of Buffalo. As described in the RCRA Facility Investigation (RFI) report (Golder 1997), no drinking water wells were identified within four miles of the Site, and the City has an ordinance restricting the use of wells. The Exxon Mobil facility located immediately east of Area E reportedly extracts groundwater from the uppermost aquifer (herein referred to as the Shallow Aquifer) at a rate of 50 to 300 gallons per minute (gpm) as part of a groundwater control system and discharges the extracted groundwater to the BSA. A groundwater extraction system is in place at Area D to control the water level behind the slurry wall installed as part of the remedial efforts at Area D. The Area D system is operated very infrequently (typically only several days per year because the remedial cap has effectively reduced infiltration of precipitation); the Area D water is also discharged to the BSA. A groundwater extraction system has also been installed at Area A as part of Interim Corrective Measures for the site; this is described in detail in Section 3.0.

1.1.6 Sensitive Receptors

The RFI report (Golder 1997) provides information regarding potential receptors. No sensitive receptors, including endangered or threatened species, were identified in the vicinity of the Site.

1.2 SITE HISTORY

MACTEC obtained information regarding the history of the Site through review of previous reports, historical maps (including Sanborn fire insurance maps), aerial photographs, BCC plant records, and other available documents. This information was supplemented through interviews with former BCC employees and others with knowledge of the Site history. Figure 4 includes locations of concern based on the historical information gathered by MACTEC.

During its time of operation, the plant reportedly produced in excess of 1,000 different dyes and organic chemicals based primarily on aniline and various aniline derivatives. Beginning in 1977 until manufacturing operations ceased in 2003, the operations at BCC mainly involved production of Indigo dye, alkylanilines, anydrides, and dye intermediates.

Chemical manufacturing at the Site commenced in 1879 by the Schoellkopf Aniline and Dye Company (Schoellkopf). In 1916, Schoellkopf merged with several other companies to form National Aniline Chemical Company (NACCO). NACCO subsequently merged with four other companies to create Allied Chemical Corporation (Allied Chemical) in 1920. In 1977, Allied Chemical sold the property, the dye-making facilities and the right to produce certain dyes and intermediates to BCC. At the time of the sale, the plant was divided into eight areas designated with the letters A, B, C, D, E, F, G, and H. BCC purchased the manufacturing areas A through E, while Allied Chemical retained the acid plant (sold to PVS in 1981), the research and development facility on Area F (the present location of the Honeywell Buffalo Research Laboratory), and the parking lots on Areas G (Elk Street) and H (Smith Street).

Area A is the oldest section of the plant and is the location of the original Schoellkopf facility constructed in 1879. Area A appears on the 1889 Sanborn map, which indicates Site usage involving aniline, carbolic acid (phenol), benzene, nitrobenzol (nitrobenzene), and nitric acid. The 1900 Sanborn Map indicates departments making direct, azo, and sulfur dyes in Area A, as well as nigrosine and eosine. Benzene and tar stills/tanks are also shown on the early Sanborn maps. Demolition activities completed since the late 1960s have involved Area A departments called aniline, sulfur colors, wool colors, CSA, and Harmon products. The Indigo Department, which was moved into Area A in 1923, most recently occupied the half-dozen Area A buildings which date from the 1917 era, as well as several newer structures built in the 1970s and 1980s.

Area B is shown as the location of residential properties on the earliest Sanborn Map. The former production facilities at Area B were constructed in 1916-1917. The industrial development of Area B appears fully completed on the 1917 Sanborn map. The azo and direct dye operations were apparently moved from Area A to Area B into what became known as the Acid and Direct Dyes (A&D) Department. Operations labeled as Phenyl Acid, H Acid, and Warehousing Departments are also shown on the 1917 Sanborn Map. All of these structures, which covered virtually all of Area B, were demolished in the 1970s and 1980s. The entire area is now covered with grass, parking lots, the existing office building (now owned by others) at 100 Lee Street, and various smaller ancillary buildings.

On Area C, the building cornerstone and the identification plates on some of the heavy equipment still standing in the powerhouse reportedly carry the date of 1917. Coal piles can be seen behind the powerhouse in a 1951 aerial photograph of the area and on the Sanborn maps. This section of the plant is shown as a lumber yard on the 1900 Sanborn Map. In addition to the powerhouse and a large icehouse, the 1940 Sanborn Map shows departments called Phthalic Anhydride and Anthraquinone that covered the northern side of the property. The boilers in the powerhouse were reportedly converted from coal to No. 6 fuel oil in 1970. The Area C buildings located on the northern side of the property, which housed chemical processing departments, were razed in the 1970s. Today, the powerhouse, some maintenance shops, a large fuel oil AST, and the icehouse building remain standing on Area C.

Area E was the last of the four areas developed for chemical production. The 1900 and 1940 Sanborn Maps show the west side along Lee Street to contain lumber yards, while the 1889, 1900, 1940, and 1950 Sanborn Maps show the southeast side near Orlando Street to be occupied by various oil and energy companies. The 1950 Sanborn Map depicts the Dye Plant's three main operating buildings in Area E. A permit for a river outfall was issued to Allied Chemical in 1947 for a new line serving Area E and these three buildings. The 1950 Sanborn Map also shows the presence of the horizontal tank farm along the southern edge of Area E. A wastewater treatment plant, including Lagoons 1 and 2, were built on the eastern side of Area E in 1971, while Lagoon 3 was added five years later. The lagoons were closed in accordance with NYSDEC requirements (see Section 2.1) and the wastewater treatment plant was phased out and closed by 1989. The treatment plant buildings remain on Area E today.

In 2005, BCC filed for Chapter 11 bankruptcy protection. The bankruptcy proceeding was subsequently converted to a Chapter 7 proceeding. During the bankruptcy proceedings, some of the facility's production equipment was sold and removed from the site. In addition, the office building located at 100 Lee Street on Area A and the warehouse building located near Elk Street on Area E, along with land around those buildings, were sold to other parties. Except for these two buildings, BCC remains the owner of the Site. Agreements are in place to preserve Honeywell's access rights to the land for the purposes of environmental investigation and remediation activities.

1.3 AREA OF INVESTIGATION

The RI addresses Areas A, B, C, and E (Figure 2). Specific areas of concern within each of the four areas are discussed in Section 4.1.

1.4 OBJECTIVE OF REMEDIAL INVESTIGATION

The objectives of the RI and the corresponding AAR are to (i) supplement the results of the NYSDEC-approved RFI, (ii) complete an investigation of the Site in accordance with the Consent Order and the approved SOW, and (iii) evaluate and identify final remedial alternatives that will facilitate SBD's proposed commercial and/or industrial redevelopment of the Site.

1.5 PROJECT ORGANIZATION

Listed below are the key project personnel and their office/primary telephone numbers. The complete contact information for these individuals (address, phone, email address, etc.).

NYSDEC Region 9

Mr. Martin Doster, Regional Hazardous Waste Remediation Engineer, (716) 851-7220
Ms. Linda Ross, Project Manager, (716) 851-7220

Honeywell

Mr. John Morris, Remediation Portfolio Director, (973) 455-4003

MACTEC

Mr. John Scrabis, Senior Principal Engineer, (412) 279-6661
Mr. Wayne Swinehart, Project Scientist, (716) 504-0308

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

Since 1984, various environmental investigations and closure of RCRA-regulated units have been completed at the Site. The following sections discuss these previous activities.

2.1 CHRONOLOGICAL HISTORY OF SITE INVESTIGATION AND RCRA CLOSURE ACTIVITIES

The following is a chronological summary of the documented previous site investigation and RCRA closure activities:

- **1984-1988** – Three former Area E surface impoundments (Lagoons 1, 2 and 3) were operated at the BCC facility beginning in the early 1970s. The lagoons reportedly received wastewater from dye manufacturing processes. The approximate locations of the former lagoons are shown on Figure 4. A RCRA Part A Permit for operation of these impoundments was filed in 1980 by BCC and the three lagoons were closed between 1984 and 1988 in accordance with closure plans approved by the NYSDEC. The closure activities involved the removal of approximately 4,000 cubic yards of sludge and clay liner materials. Because the impoundments were not clean–closed, BCC was required to obtain a RCRA Post-Closure Permit. Hazardous constituents were detected in the groundwater in monitoring wells located along the hydraulically-downgradient (southern) edge of the closed lagoons. A RCRA Facility Assessment (RFA) was finalized by NYSDEC in 1991 to identify releases from identified solid waste management units (SWMUs) at the Site. The RFA included visual site inspections performed by NYSDEC in 1986 and by NYSDEC and the United States Environmental Protection Agency (USEPA) in 1988. The revised RFA (April 1991) updated the status and initial investigation requirements for eight SWMUs. The final 6 NYCRR Part 373 Post Closure Permit issued to BCC on February 10, 1995 required BCC to monitor and maintain these former impoundment areas.

- **1989** – A deep well was used on Area E between 1957 and 1963 for disposal of ammonium sulfate wastewater. The approximate location of the deep well is shown on Figure 4. The well was installed and used at a depth of 180 feet from 1957 to 1960. The well depth was extended to 744 feet in 1960. A closure plan was submitted to NYSDEC in December 1988 and approved by NYSDEC in March 1989. The well was plugged by BCC in accordance with the approved closure plan in April 1989. No further action was required by NYSDEC.

- **1990** – A former waste drum and container storage area located on Area E was investigated in April 1990 in accordance with a NYSDEC-approved sampling plan. The work was documented in a BCC submittal to NYSDEC dated December 20, 1990. No further action was required by NYSDEC under a 1995 Part 373 permit.

- **1995** – NYSDEC issued a RCRA Part 373 Post Closure Permit. The permit required the completion of a RCRA Facility Investigation (RFI) for the entire site. No investigation was required for the then-current 90-day hazardous waste storage area since no releases had been documented for that area. The permit also required the cleaning of Building 320 (located on Area E) prior to demolition of the building. Building 320 remains on the Site as of the date of this report.

- **1997 -** Elemental mercury associated with a broken sewer line was encountered during installation of piping associated with the Area D treatment building on the southern side of Area A. Section 2.17.2 of the Certification Report (2000) for Area D, page 2-18, indicates that the mercury contamination was identified in 1997. The report indicates that free mercury was found in shallow soil in the vicinity of a former building foundation. According to the report, the free mercury was vacuumed up and disposed under the cap in Area D, soils with mercury were also excavated and placed under the Area D cap, and uncontaminated soils were used to backfill the area. According to NYSDEC, the mercury appeared to result from a broken sewer pipe that was encountered approximately 6 feet below the ground surface. NYSDEC indicates this location to be north of the treatment building and southeast of Building 85 (Figure 4).

- **1997 to 1999** – The initial RFI was completed and the RFI report issued by Golder Associates (Golder) in 1997. In December 1998, an RFI addendum was issued by Golder Associates to document two supplemental investigations that addressed NYSDEC-identified data gaps. A total of 36 monitoring wells and 13 piezometers were installed on Areas ABCE and on the adjacent PVS chemical property during the RFI process. Approximately 160 soil samples were collected during the RFI process for field screening or laboratory testing. The RFI report (including subsequent addendums) was approved by NYSDEC via letter dated March 19, 1999.

- **2006** – As described in detail in Section 3.0, interim corrective measures (ICM) were implemented at the Site in 2006. During the ICM construction activities, soil samples were collected from the southern end of Area A for laboratory testing as follows:

    - MACTEC collected two samples of soil that exhibited blue/purple from the river bank on the southeastern corner of Area A prior to placement of a protective erosion mattress. The samples were analyzed for metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Arsenic and various polynuclear aromatic hydrocarbons (PAHs) were found in the samples at levels that exceed the 6NYCRR Part 375 Commercial Soil Cleanup Objectives (SCOs). No VOCs were identified in the soil samples above the Commercial SCOs. The results of the sampling were transmitted from MACTEC to NYSDEC via email on June 2, 2006.

    - Samples were collected by NYSDEC from stained soils observed within a trench on the south side of Area A. The trench had been excavated for installation of underground piping for the Area A groundwater migration control system. The samples were analyzed for VOCs, SVOCs and metals. No VOCs were identified at levels of concern. Arsenic and PAHs were reported at concentrations that exceeded the Commercial SCOs. The results of this sampling event were presented in a report prepared by NYSDEC dated August 2006. A copy of the NYSDEC trench sampling report is included in Appendix A.

The specific areas for which no further action determinations have been made by NYSDEC (i.e., the former Area E deep well, the former Area E container storage area, and the former 90-day hazardous waste storage area) were not investigated further under the RI/FS. The RFI completed by Golder in 1997-1998 represents the most relevant and comprehensive investigation conducted at the Site to date, and the objective of this RI/FS is to supplement that investigation. Other investigations were conducted prior to the RFI. The results of the prior investigations are discussed in greater detail below.

2.2 SUMMARY OF PREVIOUS INVESTIGATION RESULTS

The following sections describe the results of previous investigations, including the 1997-1998 RFI completed by Golder.

2.2.1 Site Geology

Approximately 36 monitoring wells, 13 piezometers, and 24 soil borings were installed during the RFI. Other wells, piezometers, and test borings were installed during investigations that pre-dated the RFI. The locations of these borings, wells, and piezometers are shown on RI/FS Work Plan Figures 2 through 9 provided in Appendix B.

The previous investigations identified a number of subsurface zones that have contrasting hydrogeologic properties. In order of increasing depth, these include:

- Fill: This unconsolidated material is found over the majority of the surface of the site. It typically consists of clay, silt, crushed stone gravel, bricks, and miscellaneous building demolition debris. The fill thickness ranges from less than 1 foot to 20 feet, with the maximum thickness occurring near the Buffalo River.

- Alluvium: This unit consists of unconsolidated materials, mostly fine to very coarse sands, and likely represents the historical deposits from the Buffalo River. These materials have a moderately high conductivity (i.e., transmit water fairly easily). The thickness of this unit varies from approximately 0 feet to 21 feet, with the maximum thickness located near the Buffalo River.

- Clay and Silt Tills (Upper Tills): This unit is unconsolidated fine-grained clay and silt tills. The thickness ranges from 0 to 10 feet. This unit underlies the majority of Areas B, C and E as well as portions of Area A.

- Glaciolacustrine Clay: This unit is primarily clay, with occasional fine sands. This unit underlies the entire site. Thickness ranges from 24 to 36 feet. Grain size analysis shows that this unit is comprised almost entirely of clay sized particles. These materials have a relatively low conductivity and the unit is an aquitard between the Shallow and Confined Aquifers (see Section 2.2.2.).

- Basal Till: This unit is a mixture of sand, silt, gravel and minor amount of clay. This unit was found in all deep borings, and was encountered immediately above the bedrock. Thickness ranged from 2 to 5 feet.

- Onondaga Limestone: This bedrock unit was described as fractured and weathered, dark gray limestone. Only the upper few feet of this unit were penetrated during prior drilling activities. The bedrock surface slopes gently to the south, at a rate of approximately 1.2 feet per 100 feet.

2.2.2 Site Hydrogeology

Two aquifers have been identified at the site. The first aquifer encountered, designated the Shallow Aquifer, is a saturated unconfined system within the fill and sediments above the glaciolacustrine clay unit. The second aquifer, designated the Confined Aquifer, occurs within the basal till and weathered upper surface of the bedrock. Golder concluded in the RFI report that the thick, low conductivity glaciolacustrine clay unit acts as an aquitard, separating these aquifers and providing a confining layer for the deeper aquifer.

Appendix B includes copies RI/FS Work Plan Figure 5, which presents groundwater contours for the Shallow Aquifer based on data collected in August 1998, which are typical of those measured historically. Groundwater flow in the Shallow Aquifer during the RFI was generally towards the Buffalo River. However, it was concluded that subsurface utilities and other manmade features influence local flow conditions. Figure 3 shows the location of known subsurface sewer lines. Gravity sewer lines and associated backfill are below the water at various locations and were found to act as groundwater discharge points because depressions in the water table surface at the Site coincided with the location of utilities. Such a depression was found during the RFI in most of the area between Area E and the PVS site. A similar depression was identified between Area B and Area C. A groundwater mound in the PVS site was also identified that could be due in part to groundwater discharge to utilities located to the north and west, possibly accentuated by some local increased recharge at the PVS site (e.g., leaking water lines).

RI/FS Work Plan Figure 6 (Appendix B) shows the groundwater contours for the Confined Aquifer based on data collected in July 1997 and are typical of those measured historically. During the RFI, the water levels for the Confined Aquifer were measured in 12 monitoring wells screened within the Basal Till unit (four of which were installed during the RFI and eight of which were installed prior to the RFI). The groundwater in the Confined Aquifer exists under apparent confined conditions within the Basal Till unit and upper portion of the Onondoga Limestone beneath the base of the glaciolacustrine clay. During the RFI, the Confined Aquifer contours were interpreted by Golder to indicate a groundwater divide on the eastern side of Area E. Groundwater flow is shown within the Confined Aquifer as to the east and west of the divide area, parallel to the Buffalo River. Golder reported that gradient in the Confined Aquifer ranged from 0 to 0.008 ft/ft on two separate occasions in 1997.

2.2.3 Soil

During the RFI, Golder collected approximately 160 soil samples from Areas A, B, C and E. Of those samples, 54 were screening samples (i.e., samples analyzed at the laboratory using a screening method) and 23 were confirmatory soil samples (i.e., samples analyzed by the laboratory using USEPA SW-846 Methods) which were collected during Phase I of the RFI. During Phase II, 32 screening soil samples, 4 confirmatory soil samples, and 6 surface soil samples were collected. Grain size and total organic carbon testing were also conducted on selected soil samples.

The screening samples were analyzed for a Site-specific list of VOCs to help identify areas of contaminated soils. The vast majority of the laboratory-screened soil samples did not have detected concentrations of VOCs. RFI screening samples that exceeded potentially applicable reference values from the NYSDEC Technical Administrative Guidance Memorandum (TAGM) #4046 Soil Cleanup Objectives (SCO) guidance document, which have since been replaced by the SCOs established under 6NYCRR Part 375, are identified on RI/FS Work Plan Figure 7 provided in Appendix B.

The RFI confirmatory samples and the six surface (0-2 feet) soil samples were analyzed in the laboratory for Target Compound List (TCL) VOCs, TCL SVOCs, Target Analyte List (TAL) metals, polychlorinated biphenyls (PCBs), hexavalent chromium, and total cyanide. Confirmatory and surface RFI soil samples with results that exceeded the TAGM #4046 SCOs are shown on a figure provided on RI/FS Work Plan Figure 7 in Appendix B. The figure shows the location and depth of the RFI soil samples as well as the concentrations of the contaminants that exceeded the TAGM #4046 SCOs.

2.2.4 Groundwater

The RFI confirmed that Site-related groundwater contamination is present in the Shallow Aquifer. RI/FS Work Plan Figure 8 in Appendix B summarizes the detected groundwater contaminants that were found at concentrations that exceeded the New York Class GA groundwater standards. In the Shallow Aquifer, groundwater concentrations above the standards were noted for various

VOCs (specifically chlorobenzene and related compounds), SVOCs (specifically aniline and PAHs), and metals.

In the Confined Aquifer, the primary contaminants detected during the RFI were benzene, chlorobenzene, and aniline. Detected concentrations were in the low part per billion range. Data collected by Golder indicated that a downward gradient exists between the Shallow Aquifer and the Confined Aquifer. Thus, the Confined Aquifer could be affected by contaminants present in the Shallow Aquifer if there an effective aquitard was not present. However, because the Confined Aquifer is not used as a source of potable water, and because of the much lower range of contaminant concentrations identified in the Confined Aquifer, Golder concluded in the NYSDEC-approved RFI report that potential impacts to human health or the environment associated with the Confined Aquifer are negligible.

At the request of NYSDEC, MACTEC evaluated the results for RFI borings PRB-1M, PRB-2M, PRB-3M, and PRB-4M to determine if elevated contaminant concentrations were found in these borings and if permanent monitoring wells should be installed at these locations. According to the RFI Report (Golder, 1997), these borings were shallow borings advanced to the upper saturated zone. Soil and groundwater samples collected from these locations contained concentrations of various substances above potentially applicable NY standards, criteria or guidance. Borings PRB-1M through PRB-3M were advanced on Area A. Boring PRB-4M was advanced on the southern side of Area E (east of the main AST farm). Soil sample results summarized in RFI Table 15 indicate that aniline (2.9 mg/kg) was detected in the PRB-1M soil sample and chlorobenzene (26 mg/kg) and aniline (8.5 mg/kg) were detected in the PRB-3M soil sample. No VOCs were detected at levels of concern in the PRB-2M soil sample. Various metals were detected in these samples at concentrations that were consistent with those found at other locations on Area A. The soil samples were collected from the upper 2 to 4 feet. Groundwater samples collected from the Area A PRB borings, as summarized on RFI Table 20, contained similar substances, along with other organic substances, at levels that exceed the NY Class GA standards but that are consistent with concentrations found throughout the Area A shallow groundwater. The soil sample collected from Area E boring PRB-4M did not contain VOCs or SVOCs at levels of concern, and metals concentrations were consistent with those found throughout the Site. The groundwater sample collected from PRB-4M contained trace VOCs and had concentrations of metals consistent with groundwater concentrations throughout Area E. In summary:

- The soil and groundwater concentrations identified in the referenced RFI borings are consistent with concentrations identified at other sample locations (including the RI samples as described herein);

- Monitoring wells and piezometers already exist near and downgradient of the referenced boring locations; and

- Remedial measures specified in the AAR will adequately address soil and groundwater contamination on Areas A and E, including the referenced RFI boring locations.

For these reasons, no additional monitoring wells were installed at the referenced RFI boring locations during the RI program.

2.3 CONSTITUENTS OF CONCERN

Extensive research into the various chemicals historically used and produced at the Buffalo Color plant was completed during the previous RCRA investigations and documented at length in the various RCRA reports, including the 1995 Current Conditions Report. Honeywell believes this information to be accurate. To develop the RI scope of work, MACTEC reviewed the historic chemical usage information, along with other historical records. Many of the substances that were used and produced at the site are substances that would immediately break down if and when released into the environment (i.e., acids, caustics), are not hazardous (i.e., glucose, food-grade dyes), or were not used in appreciable quantities (i.e., chemicals used in the plant research laboratories). Based on the results of the RFI and other investigations, the following substances were identified as potential constituents of concern (COCs) for soil and groundwater at the Site for the purposes of the RI:

<u>Soil</u>

- VOCs: chlorobenzene and degradation products, nitrobenzene, 1,2,4-trichlorobenzene

- SVOCs: aniline and PAHs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzofuran

<u>Metals</u>

- Inorganics: metals including arsenic, cadmium, chromium, lead, mercury, selenium and cyanide

<u>Groundwater</u>

- VOCs: chlorobenzene and degradation products, benzene, toluene, ethylbenzene and xylene (BTEX), and others

- SVOCs: aniline and related compounds, dichlorobenzene and trichlorobenzene compounds, total phenolics, and others

- Metals: arsenic, cadmium, manganese, iron, lead, mercury, and others

- Inorganics: primarily sulfate/sulfide and chloride

3.0 INTERIM CORRECTIVE MEASURES

In 1999, Parsons Engineering Science completed aquifer testing at Area A and, in October 1999, issued a report titled “Pumping Test and Groundwater Modeling for Area A”. The Parsons report concluded that extraction wells could be used to maintain an inward hydraulic gradient and minimize the potential for Area A groundwater in the shallow aquifer to migrate to the Buffalo River.

In January of 2000, Golder issued a Corrective Measures Study (CMS) report for interim measures that specified a proposed scope for the interim remedy at the Site, including the use of a groundwater extraction system at Area A. The CMS was approved by the NYSDEC in July 2000. On August 5, 2003, Conestoga Rovers Associates (CRA) issued a work plan titled “Proposed Scope of Work/Work Plan for Interim Corrective Measure, Buffalo Color Area ABCE, Buffalo, New York”. The plan was approved in a letter from the NYSDEC dated January 9, 2004.

Due to Buffalo Color’s financial condition, Honeywell negotiated with the NYSDEC to implement the ICM. An Order on Consent with an effective date of April 4, 2005 was entered between Honeywell and the NYSDEC for implementation of the ICM. The specified ICM scope of work included the following tasks, which were included in the approved CMS:

1. Area A Groundwater Extraction System (Migration Control System – MCS);
2. Area BCE Groundwater Control (passive control via existing sewer network);
3. Institutional Controls;
4. Groundwater Monitoring;
5. Repair Sheet Piling Breach (Area E) via injection grouting; and
6. Area A River Bank Erosion Control (protective mat on river bank).

In August 2005, MACTEC issued the 100 Percent Basis of Design report for the proposed ICM. The design was approved by the NYSDEC in a letter dated November 18, 2005. In April 2006, the contracts for ICM construction were issued by Honeywell. Construction began in May 2006 and, by October 2006, the sheet pile breach was repaired, the Area A river bank erosion protection mat was installed, and the Area A MCS was substantially complete.

Soil samples collected from the riverbank prior to placement of the erosion protection mattress at Area A indicated that levels of certain metals and SVOCs exceeded the Protection of Ecological Resources SCOs. The erosion mattress addresses the potential for erosion of impacted river bank materials to enter the river and the potential for direct contact by wildlife. Future remediation of the river under the Buffalo River RAP could require modification of the erosion mattress system. Since a hydraulic barrier wall will be part of the Area A uplands remedy as described in the AAR, impacted soils on the river side of the new wall will likely be evaluated as part of a potential river remedy.

Startup of the Area A MCS occurred in October 2006. Shortly after startup, plugging of the discharge lines due to rapid buildup of scale prevented simultaneous pumping at all five extraction wells (EW-1 through EW-5). In late 2006 and into the Spring of 2007, MACTEC conducted various laboratory and field/operational tests involving pumping at selected extraction well locations to determine the cause of the piping scale. It was concluded that the scale buildup occurred when groundwater with widely varying chemistry and pH levels was mixed together in the discharge piping. Beginning in April 2007, continuous pumping of groundwater was initiated at extraction well EW-1, which is not affected by high-pH groundwater. This well has the highest chlorobenzene concentrations of the five extraction wells; thus, the groundwater pumped from EW-1 was discharged to the on-Site treatment system building (which was originally constructed to treat effluent from the Area D groundwater extraction system), where it passes through carbon filters prior to discharge to the BSA via the Area A low lift station. Operation of EW-1 has resulted in mass removal of chlorobenzene-impacted groundwater.

To address the piping scale associated with the rest of the Area A MCS, MACTEC determined that installation of dedicated HDPE discharge piping was necessary to keep the high pH groundwater at EW-3 and EW-4 separate from the groundwater extracted at other locations. Thus, installation of new HDPE piping was required to convey the groundwater from extractions wells EW-3/EW-4 and extraction well EW-5 directly to the Area A low lift station. Construction of the new HDPE piping was initiated in July 2007 and was completed in November 2007.

In December 2007, pumping was initiated at the remaining extraction wells (EW-2 through EW-5). Since that time, pumping has generally continued at all five extraction wells. Discharge from EW-1 and EW-2 is pretreated to reduce chlorobenzene levels via the on-Site groundwater treatment system prior to discharge to the Area A low-lift station. The effluent from wells EW-3, EW-4 an EW-5 is currently discharged to the low-lift station without pretreatment.

From January 2008 to April 2008, MACTEC utilized data collected via submersible transducers and operations data from the Area A MCS to evaluate the effectiveness of the extraction system at preventing migration of contaminated groundwater to the Buffalo River. The results of this study are documented in the technical report provided in Appendix A of the AAR. Based on the results, MACTEC concluded that enhancement of the MCS via installation of additional extraction wells would likely be required if groundwater extraction were to be utilized as the stand-alone final remedy for the Area A shallow groundwater.

During 2008, groundwater monitoring will be conducted in accordance with the NYSDEC-approved Operations, Maintenance and Monitoring (OM&M) Work Plan (MACTEC, 2006), with results provided in a separate report to be issued to NYSDEC during the first quarter of 2009.

A Final Engineering Report (FER) is being prepared and will be issued under separate cover to document the construction of the ICM.

4.0 DATA GAP ANALYSIS

In order to develop the RI/FS sampling and analysis plan, it was necessary for MACTEC to complete a data gap analysis. The analysis involved a review of previous reports and project documents, review of historical maps, review of historic aerial photographs, and site visits. In addition, certain of the BCC environmental files and plant drawings maintained at the former BCC office building at 100 Lee Street were reviewed by MACTEC. MACTEC also interviewed former BCC personnel and others knowledgeable about the Site, including Mr. Gordon Bolles. Mr. Bolles began working at the Site in 1979 and had numerous job titles with BCC, including Engineer, Area A Production Manager, and BCC Environmental Manager.

4.1 IDENTIFIED DATA GAPS AND AREAS OF CONCERN

Based on the above activities, MACTEC identified the following data gaps that were addressed during the RI/FS process.

4.1.1 Area A

<u>Former Aniline Plant:</u> As shown in Appendix B, the RFI data indicated that the aniline concentrations in the Shallow Aquifer groundwater at Area A were highest in the central portion of the parcel. In the case of MW-26, during the RFI it was noted that the groundwater in the well was deep purple, which coincides with the groundwater sample from that location having the highest aniline concentration on Area A. The former aniline plant (Figure 4) was located near MW-26 on the central portion of Area A. Thus, a source of the aniline in groundwater is potentially located in the vicinity of the former aniline plant.

<u>Former Crude Stock/Drum Storage Area:</u> Sanborn maps indicate that the northwestern corner of Area A was formerly used for the storage of crude stock and then later as a drum storage area.

<u>Former Underground Storage Tanks (USTs):</u> The 1940 and 1950 Sanborn maps indicate that several USTs were used for storage of alcohols on the western side of Area A (Figure 4). The 1917 Sanborn map indicates that fuel oil USTs were located on the southern side of Area A. No

documentation has been found to indicate if the USTs were removed. Mr. Bolles had no knowledge of any USTs on the Site.

<u>Previous Buildings and Aboveground Storage Tanks (ASTs):</u> As shown on historical maps and aerial photographs, process buildings and storage tanks were at one time located over the majority of Area A. Previous ASTs existed on the south side of the property and along the western property line near the railroad tracks.

<u>Electrical Transformers:</u> Mr. Bolles indicated that PCB transformers may have been located at one time in the substations located on the south side of the existing Area A complex.

<u>Existing Buildings and ASTs:</u> The existing buildings on Area A are located on the central portion of the parcel. The buildings have concrete floors. Potential sources of subsurface contamination associated with the existing buildings include tanks and chemical handling areas, sumps/pits, floor drains/underground drains, and the various AST farms that surround the buildings (Figure 2).

<u>Separate Phase Liquids:</u> During the ICM construction process, separate-phase liquids (SPL) were encountered at Area A within extraction well EW-5 (2 inches) and in piezometers PZ-110 (1 inch) and PZ-103 (< 0.5 inch) after well development. Subsequent sampling and analyses completed by MACTEC in August 2006, the results of which were provided to NYSDEC Region 9, indicated that the material is a petroleum-based substance (likely weathered fuel oil) with significant concentrations of toluene, ethylbenzene, xylene, naphthalene, phenol, and polynuclear aromatic hydrocarbons (PAHs). No indications of SPL were reported during the RFI and other previous investigation work at Area A, nor was SPL identified in the Area A wells and piezometers during previous investigations.

4.1.2 Area B

<u>Former Production Areas</u>: By the 1940s, the vast majority of Area B contained buildings used for chemical handling and dye production. By 1986, only the main office building remained with the balance of the area covered by an asphalt parking lot.

<u>Former Drum Storage Yard:</u> The 1950 Sanborn map indicated that a drum storage yard was located on the northwestern corner of Area B (Figure 4).

Office Building Indoor Air: NYSDEC has indicated that, because the office building located at 100 Lee Street was recently sold by BCC and it will continue to be used as an office building, the potential for impact to indoor air within the building must be evaluated in accordance with state guidance. The evaluation will include collection of building sub-slab vapor samples at this location.

4.1.3 Area C

Former Production Areas: The Sanborn maps indicate that at one time most of Area C contained buildings. The southern side of Area C was the location of an ice house and a boiler house, both of which are still present on the Site. The northern side of Area C contained buildings that housed operations involving phthalic anhydride and quinone, a solvent tank house, condensers and other operations. The buildings on the northern side of Area C have since been demolished and the area is presently vacant. As shown in Appendix B, relatively few soil samples were collected from Area C during the RFI.

Fuel Oil ASTs: A large storage tank (VT-3) is located on the western side of Area C (Figure 4). The tank was previously used for the storage of No. 6 fuel oil, which was used to fuel the boilers in the adjacent boiler house. A second, smaller AST formerly used for storage of No. 2 fuel oil is located to the south of Tank VT-3.

Former Naphthalene Tank Area: The 1950 Sanborn map indicated that ASTs used for the storage of naphthalene were located on the western side of the site to the east of fuel oil tank VT-3 (Figure 4).

4.1.4 Area E

Existing Storage Tanks: Various storage tank farms and individual chemical storage tanks are present on Area E. The main AST farm is located on the southwestern side of Area E (south of the plant area) and includes tanks previously used for storage of chemicals such as formaldehyde, aniline, methanol, ethanol, butadiene, and other substances. Another tank farm is located to the northeast of the main AST farm and includes tanks that stored DEA and MEA. Both tank farms are equipped with concrete secondary containment. Individual storage tanks are also located outside the western wall of Building 320; these ASTs reportedly stored nitrobenzene and other substances.

<u>Existing Buildings:</u> Existing buildings on Area E include Building 312 (alkyl anilines and anhydrides), Building 316 (Red 40 – food dye), Building 320 (food colors, bromine, benzidine, and arsenic press), Building 322 (warehouse and laboratory – recently sold), and various maintenance buildings. Potential sources of subsurface contamination associated with the existing buildings include process vessels, tanks, chemical handling areas, sumps/pits, and floor drains/underground drains.

<u>Former Drum Storage Area:</u> According to Mr. Bolles, a large drum storage area was previously located to the east of Building 320.

<u>Former Tidewater Oil Company:</u> According to the 1940 Sanborn map, the Tidewater Oil Company was located on the southeastern side of Area E (Figure 4). This facility was also shown on previous Sanborn maps under different names. The facility included a large gasoline AST and various oil ASTs.

<u>Monitoring Well R-14:</u> Monitoring well R-14, located on the southeastern side of Area E (immediately east of the former Tidewater Oil Company and in the vicinity of the former BCC wastewater lagoons that were closed in 1989) was the subject of a NYSDEC Spill Report dated March 22, 2001. According to the report, BCC reported the presence of petroleum in the well. The report indicated the petroleum had previously been discovered in the same well in 1996. BCC indicated that no storage of petroleum products by BCC occurred at the location of well R-14. NYSDEC has indicated that the occurrence of free-phase petroleum in R-14 must be investigated during the RI/FS.

<u>Electrical Transformers/Substations:</u> According to the 1950 Sanborn map and Mr. Bolles, a former Niagara Mohawk electrical substation was located on the southwestern corner of Area E (Figure 4). Another substation is located on the northwestern corner of Area E. Mr. Bolles indicated that PCB transformers may have been used previously at those locations.

<u>Former Lagoons 1, 2 and 3:</u> As described in Section 2.1, these three former wastewater lagoons were closed in accordance with RCRA requirements and approved by NYSDEC between 1984 and 1988. The lagoons were drained, sludge was removed, and the areas were backfilled with soil and capped/revegetated. However, residual soil and shallow groundwater contamination

associated with these former lagoons is expected to remain based on the sampling data associated with the lagoon closure work and subsequent investigations.

4.1.5 Site Wide Features

Underground Sewer Lines: As shown on Figure 3, there is an extensive network of underground sewer lines (both sanitary and storm) located on the property. The sanitary sewers discharge to the Buffalo Sewer Authority. As described in various project documents, including the CMS report (Golder, 2000) and the 100 Percent Basis of Design document (MACTEC, 2005), there is evidence that groundwater infiltrates the sanitary sewer lines. The underground storm sewer lines located on Area A discharge to the Buffalo River via Outfall 006. The underground storm sewer lines located on Areas B, C and E discharge to the Buffalo River via Outfall 011 located on PVS property. The discharges were authorized under State Pollutant Discharge Elimination System (SPDES) permits issued to BCC, which require BCC to perform monthly monitoring. During 2005, by which time plant operations had ceased, samples of effluent collected by BCC at Outfall 011 were found to contain levels of total recoverable phenolics (TRP) at concentrations that exceeded the maximum allowable concentrations under the SPDES permit. Flow rates at Outfall 011 during these sampling events were approximately 40,000 gallons per day. Since filing bankruptcy, BCC has not continued with the required SPDES monitoring for Outfalls 006 and 011. Although the SPDES permits and associated monitoring requirements are not Honeywell's responsibility, Honeywell agreed to investigate this issue during the RI/FS to determine if infrastructure issues associated with facility storm sewer lines resulting in infiltration of contaminated groundwater.

Confined Aquifer: As described above, the Confined Aquifer exists at the site above the bedrock and below the glaciolacustrine clay. In the Confined Aquifer, contaminants were detected during the RFI at concentrations that were significantly lower than those identified in the Shallow Aquifer. Golder concluded in the RFI report that potential impacts to human health or the environment associated with the Confined Aquifer are negligible, and MACTEC agrees with this conclusion. However, NYSDEC requested that further evaluation of the Confined Aquifer be performed as part of the RI process. As explained below, the results of this RI support Golder's conclusion.

5.0 SAMPLING AND ANALYSIS METHODS

The initial RI sampling and analysis was completed in accordance with the RI/FS Work Plan (Revision 1 dated September 29, 2006) and are described in Sections 5.1 through 5.4. Based on the results of the initial RI activities, a Supplemental Investigation (Section 5.5) and a Background Study (Section 5.6) were also completed for the Site. NYSDEC representatives were on Site periodically to observe the RI field activities. These activities are described in detail below.

5.1 SITE SOIL (SURFACE AND SUBSURFACE)

5.1.1 Soil Borings

From January 2, 2007 through January 11, 2007, MACTEC advanced 92 soil borings across the Site to characterize Site soils. The boring locations were selected to evaluate the data gaps and areas of concern described in Section 4.1 and also to obtain spatial coverage across the Site. The rationale for the specific boring locations is summarized on Table 1. The boring locations are depicted on Figure 5.

MACTEC retained SJB Services, Inc. of Hamburg, New York to advance the test borings with direct-push drilling equipment (Geoprobe™). Thirty-three (31) direct-push borings were advanced on Area A (borings TB-A1 through TB-A31), fourteen (14) borings were advanced on Area B (borings TB-B1 through TB-B14), thirteen (13) borings were advanced on Area C (borings TB-C1 through TB-C13), and thirty-two (32) borings were advanced on Area E (borings TB-E1 through TB-E32). Two soil borings (TB-A32 and TB-A33) were also advanced on Area A using a conventional rotary drill rig as described in Section 5.1.2.

Soil samples were collected continuously during drilling with a 4-feet long stainless steel sampler fitted with an inner disposable clear plastic sample tube. The borings were advanced into the first zone of saturation or sampler refusal, whichever occurred first. Upon retrieving the plastic sample tube, the tube was cut open and screened with a photoionization detector (PID). MACTEC inspected the samples for evidence of contamination such as odor, discoloration, staining, or SPL and described the soil using the Unified Soil Classification System (USCS). Boring logs were prepared for each test boring and include USCS descriptions, PID readings, and other pertinent information. Copies of the boring logs are provided in Appendix C.

A total of 174 soil samples were collected from the borings for analytical laboratory testing. At the majority of boring locations, one soil sample was collected from the upper 2 inches of soil to evaluate surface conditions in accordance with the NYSDEC Draft DER-10 manual ("Technical Guidance for Site Investigation and Remediation") and one soil sample was collected from an interval below a depth of 2 inches and above the top of the first water-bearing zone to evaluate subsurface soil conditions. When possible, the subsurface samples were collected from unsaturated intervals that exhibited evidence of contamination (i.e., elevated PID reading, discoloration, staining, etc.). When no direct evidence of subsurface contamination in unsaturated soils was encountered at a particular boring location, the subsurface sample was collected from immediately above the first water-bearing zone. Except for the subsurface soil samples collected from borings TB-A32 and TB-A33 (which were advanced near suspected former UST locations), no saturated soil samples were analyzed.

The soil samples were managed, packaged, and shipped with chain-of-custody forms to STL Buffalo, a New York-licensed laboratory approved for use by Honeywell. The soil samples were analyzed for

- TCL VOCs by USEPA Method 8260;
- TCL SVOCs (including aniline) by Method 8270;
- TAL metals the EPA 6000/7000 series of methods; and
- Total cyanide by EPA Method 9012A.

The VOC portion of each soil sample was collected with Encore™ samplers in accordance with EPA Method 5035. The laboratory also reported tentatively identified compounds (TICs) for VOCs and SVOCs in accordance with the USEPA Contract Laboratory Program (CLP). Samples collected in the vicinity of electrical substations/transformers on Area E were also analyzed for PCBs by EPA Method 8081.

Drill cuttings were used to backfill the borings upon completion of drilling. The locations of each boring were recorded using a hand-held global positioning system (GPS) unit. The GPS coordinates were then converted to state plane coordinates and plotted on the Site plans included in this report and the AAR.

5.1.2 Test Pits

As noted in Section 4.1.1, fuel oil and alcohol USTs were identified on historic Sanborn maps at two locations on Area A. No records have been identified to indicate if the USTs were removed or if they were closed in place. The approximate locations of the USTs were located by MACTEC in the field based on the scaled locations determined from the Sanborn maps and existing reference points. MACTEC retained SJB to use a rubber-tired backhoe to excavate two test pits at the former fuel oil UST locations (TP-A1 and TP-A2) and two test pits at the former alcohol UST location (TP-A3 and TP-A4). The test pit excavations occurred on January 9, 2007. Surface soil samples were collected from test pits TP-A1, TP-A2 and TP-A4. Subsurface soil samples were collected from a depth interval of 3 to 4 feet below ground surface from test pits TP-A2 and TP-A4. A MACTEC field geologist/engineer visually inspected each excavation. No USTs were encountered in any test pit. However, obstructions believed to be concrete slabs were encountered at depths ranging from 1 to 8 feet at each test pit location.

To further investigate the suspected former UST locations, MACTEC directed SJB to advance test borings TB-A32 and TB-A33 immediately downgradient from the reported UST locations. The borings were advanced with a conventional rotary drill rig using hollow stem augers. Soil samples were collected via split barrel samplers for field screening and visual inspection by MACTEC. One subsurface soil sample was collected from each boring to evaluate subsurface conditions. The borings were advanced to a depth of 15 feet below ground surface. Copies of the borings logs are included in Appendix C.

The soil samples collected from the fuel oil UST location (TP-A1, TP-A2 and TB-A32) were analyzed for the same parameters as listed above for the soil borings, plus the fuel oil parameters specified in the STARS #1 “Petroleum Contaminated Soil Guidance Policy”. The samples collected from the alcohol UST location (TP-A3, TP-A4, TB-A33) were analyzed for the same parameters as the soil borings, plus alcohols (including methanol and ethanol) in accordance with EPA Method 8015.

5.2 SITE GROUNDWATER

A detailed groundwater monitoring plan is provided in the Final Operations, Maintenance & Monitoring (OM&M) Plan prepared by MACTEC for the ICM at Areas ABCE (March 2006). In discussions with NYSDEC, it was agreed that the initial groundwater monitoring performed under the OM&M plan would be incorporated into the RI/FS.

Prior to sampling, MACTEC completed a well inventory to verify the location and condition of each well selected for monitoring. Table 2 identifies the wells and piezometers that were included in the RI sampling activities. Wells RFI-39, RFI-42, and RFI-45 were either damaged or could not be located, as noted on Table 2.

The groundwater sampling and water level measurement program specified in the OM&M Plan is subdivided between Areas A, B and C/E. The initial groundwater monitoring and sampling event to support the RI was completed in January 2007, and the following sections describe the groundwater monitoring activities by area.

5.2.1 Area A

Groundwater samples were collected in January 2007 from the five Area A MCS extraction wells (none of which were pumping at the time of sampling), four existing Shallow Aquifer wells (W6-R-R, RFI-22, RFI-24 and RFI-25) and five new monitoring wells (ICM-101 through ICM-105). ICM-101 was installed as part of the ICM as a Shallow Aquifer background well for Area A about midway along the west property line. Wells ICM-102 through ICM-104 are located in areas between the extraction wells. The Confined Aquifer wells RFI-16 and RFI-23D were also sampled. Water levels were recorded in each of these wells, along with selected other wells and piezometers located at Area A.

In February 2007, depth-discrete samples were collected from extraction well EW-1 and nearby piezometer PZ-102. The samples were collected using a peristaltic pump to evaluate chlorobenzene concentrations at depths above, at, and below the pump intake depth under static conditions (i.e., when the extraction wells were not in operation).

During the Area A groundwater monitoring and sampling activities, monitoring wells and piezometers were inspected for the presence of SPL. An electronic interface probe was used to gauge the thickness of SPL, where present.

5.2.2 Area B

In January of 2007, groundwater samples were collected from Area B Shallow Aquifer wells RFI-18, RFI-27, RFI-28, RFI-30, RFI-35 and RFI-45. A groundwater sample was also collected from Confined Aquifer well RFI-19D. Water levels were measured in each of these wells along with piezometer PS-07.

5.2.3 Areas C and E

In January 2007, water level measurements and collection of groundwater samples were performed at Shallow Aquifer wells RFI-17, RFI-20, RFI-29, RFI-31, RFI-32, RFI-33, RFI-36, RFI-39, RFI-42, RFI-43, RFI-51, RFI-PZ-17, RFI-PZ-18 and RFI-PZ-19 and Confined Aquifer wells RFI-21D, R-01 and R-04.

Water levels were measured in these wells and in piezometers PS-01-N, PS-01-S, PS-02-N, PS-02-S, PS-03-N, PS-03-S, PS-04, PS-05, PS-06, and PS-13, monitoring well R-15, piezometer PZ-119, and in new piezometers PZ-120-S and PZ-120-N, which were installed on the immediate south and north side, respectively, of the gravity sewer along Prenatt Street to verify that grouting of the breach in the wooden "sheet pile" (performed as part of the ICM described in Section 3.0) has eliminated the funneling of groundwater through the former breach.

5.2.4 Groundwater Sampling Methodology

Low-flow groundwater sampling techniques were employed during the January 2007 grounwater monitoring event, as specified in the RI/FS Work Plan. All wells, including the Area A extraction wells, were sampled using peristaltic pumps with dedicated tubing. The tubing was secured to the well casing or cap during sampling to prevent disturbance of any sediments in the well. Pumping rates were kept at less than 300 milliliters per minute during purging and sampling.

The inorganics and metals portions of the groundwater samples were collected when groundwater turbidty was below 50 Nephelometric Turbidity Units (NTUs). The use of low-flow sampling techniques helped to minimize turbidity levels in the samples. Purge water was containerized and discharged to the onsite sanitary sewer system or allowed to infiltrate in the immediate area of the well.

5.2.5 Groundwater Analytical Protocols

The groundwater analytical data was generated using USEPA SW-846 analytical procedures (USEPA, 1997). Groundwater analytical methods and parameters are summarized below:

- VOCs by Method 8260B with reporting of TICs per CLP guidelines
- SVOCs by Method 8270C with reporting of TICs per CLP guidelines
- TAL Metals by Method 6010B including mercury by Methods 7470A and 7471A
- Total Cyanide by Method 9012A
- Sulfide by Method 376.1
- Sulfate by Method 300.0
- Chloride by Method 300.0
- Nitrate/Nitrite by Method 353.2

Container size and type, preservative, and holding time requirements for groundwater samples were consistent with SW-846 and NYSDEC requirements. Groundwater samples were labeled and transported to the laboratory with chain of custody documentation in accordance with NYSDEC and Honeywell requirements. Quality assurance/quality control requirements for groundwater samples are specified in the Quality Assurance Project Plan (QAPP) provided as part of the RI/FS Work Plan.

5.3 SOIL GAS SAMPLING AT AREA B

As noted previously, the office building located at 100 Lee Street was recently sold by BCC and is under new ownership. As of the date of this report, there were no full time occupants of the building, but the building may be used in the future as commercial office space. Based on this future use scenario, NYSDEC indicated that the indoor air pathway for the office building must be addressed. On July 7, 2007, MACTEC collected two sub-slab soil vapor samples within the building via temporary sample points to evaluate the soil vapor intrusion pathway, as specified in the RI/FS Work Plan. The sample points were designated SV-B01-0707 and SV-B02-0707 and were located on the northern and southern ends of the office building as shown on Figure 6. Prior to sample collection, a checklist was completed to describe building conditions that might affect the vapor intrusion pathway; a copy of the completed checklist is provided in Appendix D. The subslab vapor samples were collected by drilling a ¼-inch hole into the concrete and inserting tubing connected to a one-liter flow-regulated Summa™ canister into the hole. The annular space around the tubing was sealed using pure bees wax. Prior to sampling, purging of the sub-slab interval was performed by withdrawing 100 cubic centimeters (cc) of air using a disposable 10 cc syringe. Samples were collected by opening the valve on the Summa™ canister and withdrawing a representative air sample at a rate of 0.2 liter per minute over a period of 60 minutes in accordance with EPA Method TO-15.

The Summa canisters were labeled and submitted with chain of custody documentation to STL for VOC analyses by EPA Method TO-15.

5.4 SITE WIDE AOCS

As noted in Section 4.1.5, two site-wide AOCs were to be addressed during the RI/FS: the underground storm sewer network associated with Outfalls 006 and 011 and the Confined Aquifer.

5.4.1 Site Sewers

Honeywell conducted sampling of solid material present within the plant sanitary and storm sewers from accessible locations on Areas ABCE. As noted in Section 4.1.5, the facility sanitary sewer lines discharge to the Buffalo Sewer Authority system and the storm sewers discharge to the Buffalo River via Outfalls 006 (Area A) and 011 (Area E). The samples of solid materials collected from Site sewers during the RI were managed, packaged, shipped to the laboratory, and analyzed for the same parameters and test methods as the RI soil samples, as described in Section 5.1.1. Prior to sampling, MACTEC reviewed utility location plans and conducted a site walk with Mr. Bolles to identify manholes, storm sewer intakes, sewer cleanouts, and/or sumps where sludge or sediment was visible and accessible within the facility storm sewer and sanitary sewer systems. Due to safety concerns, no confined space entry work was performed to collect these samples. A total of seven (7) samples of solid material were collected with a long-handled scoop from locations where solid material was identified within the facility sewer lines. The sample locations and types (storm sewer or sanitary sewer) are identified on Figure 3. Following is a summary of the sample locations by identification number and location:

- SED-A01-0107: Area A, manhole at juncture of 12-inch, 24-inch and 30-inch storm sewer lines
- SED-A02-0107: Area A, manhole at juncture of 6-inch and 12-inch sanitary sewer pipes
- SED-B01-0107: Area B, manhole at 36-inch storm sewer line
- SED-C01-0107: Area C, manhole at 18-inch sanitary sewer line along railroad tracks adjacent to southern side of Area C
- SED-C03-0107: Area C, manhole at juncture of 12-inch and 24-inch sanitary sewer lines
- SED-E01-0107: Area E, manhole at juncture of 15-inch, 21-inch and 24-inch sanitary sewer lines
- SED-E02-0107: Area E, manhole at 24-inch sanitary sewer line

To evaluate the potential for infrastructure issues with the facility storm sewer lines to lead to the infiltration of groundwater, MACTEC completed the following steps:

1. MACTEC evaluated construction records regarding the Site storm sewer system and compared storm sewer invert elevations to groundwater elevations to determine where infiltration may be occurring.

2. At selected groundwater wells located near the identified areas of potential infiltration, total recoverable phenolics were included as an analytical parameter for the groundwater samples collected from those wells during the RI groundwater monitoring event.

3. Effluent samples were collected at Outfalls 006 and 011 on March 1, 2007 following a period of at least 72 hours after the last known precipitation event. The effluent samples were collected with clean tubing and a peristaltic pump via manholes. The samples were analyzed for the parameters specified in the BCC SPDES permits, including total recoverable phenolics. The effluent flow at each outfall was estimated at the time of sampling based on visual observations.

4. A comparison was made of the results of the effluent sample values to concentrations identified in the nearby monitoring wells to determine if groundwater infiltration may be occurring.

The results of the site sewer evaluation are presented in Section 7.0.

5.4.2 Confined Aquifer

Wells installed in the Confined Aquifer are included in the groundwater monitoring program described in Section 5.2. MACTEC has also consulted available reference materials, including regional geologic and hydrogeologic reports, to gather data regarding the extent, uses, and discharge point(s) associated with the Confined Aquifer. This information, along with the groundwater sampling data, has been used to identify and evaluate potentially complete exposure pathways associated with the Confined Aquifer as described in Sections 6.0 and 7.0.

5.5 SUPPLEMENTAL INVESTIGATION ACTIVITIES

The results of the initial RI activities were discussed with NYSDEC in a meeting between Honeywell and NYSDEC representatives at the NYSDEC Region 9 office in Buffalo on March 28, 2007. Based on the results of the initial RI work, MACTEC proposed the completion of additional site investigation work in a Supplemental Investigation (SI) Work Plan letter to NYSDEC dated April 24, 2007. NYSDEC issued comments to the SI Work Plan via a letter to Honeywell dated April 30, 2007. MACTEC responded to the comments in a letter to NYSDEC dated May 14, 2007, and NYSDEC subsequently approved the completion of the SI work via a letter to Honeywell dated May 30, 2007. Copies of each of the referenced letters are included in Appendix A. The specific SI activities completed by MACTEC are described in the following sections.

5.5.1 Hexavalent Chromium Sampling

On July 5, 2007, direct-push drilling techniques were used to collect soil samples from the RI soil sample points that contained the highest reported total chromium levels. The sample locations are as follows (reported total chromium concentrations in milligrams per kilogram are shown in parentheses for each sample):

- TB-A16-SURFACE (4,130 mg/kg)
- TB-A31-0405 (28,500 mg/kg)
- TB-C11-0203 (3,420 mg/kg)

A direct-push boring was advanced immediately adjacent to the original RI boring location and soil samples were collected from the same depth interval as the listed RI samples. Drilling, sample inspection, field documentation and quality assurance/quality control (QA/QC) procedures were completed as described in the RI/FS Work Plan. The samples were submitted to STL Buffalo (the same laboratory used for the initial RI work) where they were analyzed for hexavalent chromium in accordance with USEPA SW-846 Methods.

5.5.2 Soil and Groundwater Evaluation – Chlorobenzene Areas

MACTEC retained Columbia Technologies, LLC of Baltimore, Maryland to complete Membrane Interface Probing (MIP) at locations on Areas A, C and E where part per million levels of chlorobenzene were found in Site groundwater. The MIP approach utilized direct-push (i.e., Geoprobe Systems, Inc.) equipment to advance a SmartMIP™ tool equipped with an Electron Capture Device (ECD), Photoionization Detector (PID), and Flame Ionization Detector (FID). The MIP work was started on June 25, 2007 and completed on July 3, 2007. MIP has been used on various projects in New York and is recognized by federal and state agencies throughout the country as an effective site characterization approach. The data was generated in real time and analyzed in the field as the work proceeded. Data reports and maps were uploaded to the Columbia Technologies' web site on a daily basis for remote viewing by MACTEC as necessary. Logs and diagrams were produced onsite that displayed the data in both horizontal and vertical layouts to confirm sample locations and adjust them as necessary to assess the impacted areas. Twenty (20) MIP borings were advanced on Area A, seven (7) MIP borings were advanced on Area C, and nine (9) MIP borings were advanced on Area E. The MIP borings were advanced into the saturated zone to evaluate VOC concentrations with depth. The purpose of the MIP investigation was to further identify potential source areas and to further evaluate the horizontal and vertical extent of constituents at each location.

Soil samples were collected from unsaturated soils via direct push drilling equipment from 10 MIP boring locations for laboratory testing. The laboratory samples were used to compare MIP results versus actual VOC concentrations in soil. The soil samples were submitted to STL Buffalo for analyses for TCL VOCs. Soil sample handling, sample inspection, field documentation and QA/QC procedures were consistent with the RI/FS Work Plan.

Upon completion of the MIP work, Columbia Technologies produced separate reports for Areas A, C and E that describe the work methods and presents the MIP data. Charts and color-coded maps and figures (including 3-D figures) are included in the Columbia Technologies' MIP reports. Complete copies of the reports are provided in Appendix E.

5.5.3 Additional Soil Sampling – Boring TB-A15 Vicinity

Soil samples collected during the initial RI work from boring TB-A15 had elevated aniline concentrations (100 mg/kg in the surface soil sample and 16 mg/kg in the subsurface soil sample as discussed further in Section 6.0) when compared to other soil samples collected on the site. On July 5, 2007, MACTEC advanced six direct-push borings in the vicinity of boring TB-A15 to evaluate the extent of the elevated aniline levels. The borings were designated TB-A15A through TB-A15F. The boring locations were spaced between TB-A15 and the closest other RI boring locations which did not have significant aniline concentrations in soil. The boring locations are shown on Figure 5. At each boring location, MACTEC collected surface samples from 0 to 2 inches in depth and subsurface soil samples above the first water bearing zone. Boring logs for the TB-A15 delineation borings are included in Appendix C. Drilling, sample inspection, field documentation and quality assurance/quality control (QA/QC) procedures were consistent with the RI/FS Work Plan. The samples were submitted to STL Buffalo, where they were analyzed for SVOCs (including aniline and TICs) in accordance with the USEPA SW-846 Methods specified in the Work Plan.

5.6 BACKGROUND STUDY

The analytical results for soil samples collected during the initial RI activities identified concentrations of arsenic and polynuclear aromatic hydrocarbons (PAHs) that exceed the 6NYCRR Part 375 SCOs at almost all locations across the Site. These results occur in a pattern that does not appear to reflect site-related spills or releases and reported concentrations were at levels within potential urban background ranges. Based on correspondence with NYSDEC, it was determined that a Background Study was appropriate to determine if the concentrations of arsenic and PAHs in the majority of the RI site surface soil samples are consistent with background levels. MACTEC issued a letter to NYSDEC dated June 18, 2007 that identified a proposed approach to complete the Background Study. NYSDEC provided comments on the proposed approach in a letter to Honeywell dated June 29, 2007. MACTEC presented draft responses to the NYSDEC comments via email, to which Honeywell responded via email with additional comments and questions. Ultimately, NYSDEC indicated in a telephone conversation with MACTEC on August 8, 2007 that NYSDEC would not provide formal approval of the Background Study approach, but that it was acceptable for Honeywell to complete the Background Study and present the results in the RI report. Copies of the various letters and email correspondence pertaining to the Background Study are provided in Appendix A.

To complete the Background Study, MACTEC followed current USEPA guidance (USEPA, ProUCL Version 4.0, Technical Guide, 2007) and the procedures used by NYSDEC to establish SCOs based on background concentrations as described in Chapter 9 and Appendix D of the Technical Support Document (TSD) (http://www.dec.ny.gov/chemical/34189.html). The USEPA guidance indicates that background evaluations and comparisons require the computations of Upper Prediction Limits (UPLs) and Upper Tolerance Limits (UTLs) to estimate background threshold values (BTVs). To be consistent with the NYSDEC methodology cited in the TSD, MACTEC used the distribution free (nonparametric statistical approach) in calculating the 98th percentile of the background sample results (at a confidence limit of 95%) for arsenic and PAHs. Rather than conducting a statistical comparison of the site and background datasets, the statistics are performed on the background dataset to determine what concentrations ranges can be expected for the background population. The UPLs and UTLs are used for screening of constituents of concern, to identify site areas of concern and "hot spots", and also to compare site concentrations with those of the background. The BTVs are used as not-to-exceed values on a sample by sample basis. Each RI data point for surface soil (i.e., soil samples collected within the upper two feet) has been compared against the calculated BTVs as described in Section 6.0.

To complete the background study and to ensure that an appropriate background data set of a reasonable size is obtained to characterize a background area including computation of upper limits (e.g., estimates of BTVs or not-to-exceed values), MACTEC collected 15 soil samples from off-site background locations on August 10, 2007. The samples were designated BS01-Surface through BS15-Surface. GPS coordinates were obtained for each sample point and the sample locations are depicted on Figure 7. The samples were collected from public rights-of-way and City-owned properties (sidewalk areas, utility easements, etc.) in the vicinity of the Buffalo Color site. The sample locations were at least 2 meters (approximately 6 feet) from the roadways and sidewalks, as directed by NYSDEC. The sample locations were reviewed with Ms. Linda Ross of NYSDEC for concurrence prior to sample collection.

The background soil samples were collected with hand shovel from the upper two inches of soil, as directed by NYSDEC. Care was taken to ensure that the samples did not include pavement, trash, or materials with evidence of contamination (such as discernable odor or staining). The background soil samples were submitted to the STL Buffalo laboratory, where they were analyzed for PAHs via EPA Method 8270C and arsenic via the EPA Method 6010 series. The background soil samples were labeled, handled, analyzed, and validated in accordance with the procedures and QA/QC requirements described in the RI/FS Work Plan dated September 29, 2006.

6.0 RESULTS

The following sections describe the results of the Remedial Investigation completed for the BCC Areas ABCE Site. Copies of the STL analytical reports for the RI work are provided on the compact disc in Appendix F.

6.1 SITE GEOLOGY AND HYDROGEOLOGY

Boring logs have been prepared for the RI borings, copies of which are provided in Appendix C. The information obtained during the RI regarding site geology and hydrogeology is generally consistent with that found during the RFI and prior investigations (as summarized in Section 2.2).

The RI boring logs have been used to supplement the cross sections prepared during the RFI (Golder, 1997-1998). The updated cross sections are provided as Figures 8. Copies of cross sections prepared during the RFI by Golder are included in Appendix A.

Groundwater levels were measured at the site wells and piezometers in January 2007 prior to collection of groundwater samples. The water levels and associated groundwater elevations are summarized in Table 2. The groundwater elevations were used by MACTEC to prepare groundwater contour maps.

Figure 9 depicts groundwater contours based on RI groundwater level measurements for the wells/piezometers screened within the fill unit. Figure 10 depicts groundwater contours based on RI groundwater level measurements for the wells/piezometers screened within the underlying alluvial and glacial materials. These contours are consistent with those determined during the previous RFI work. There are variations in groundwater elevation between the wells/piezometers screened within the fill unit versus those screened within the alluvial and glacial deposits, though it is clear that both zones are part of the Shallow Aquifer. These variations are likely due to differences in hydraulic conductivity, surface infiltration rates, and man-made influences such as underground utility lines. In general, groundwater in the Shallow Aquifer flows toward the Buffalo River and discharges to the river under normal conditions. However, operation of the Area A groundwater extraction system (see Section 3.0) and the presence of subsurface utilities and other manmade features at the Site influence local flow conditions within the Shallow Aquifer. Figure 3 shows the location of known subsurface sewer lines. Portions of the sewer lines (and surrounding backfill materials) that are present below the water table often act as groundwater collection points, as described in Section 2.2.

Figure 11 shows the groundwater contours for the Confined Aquifer based on water level measurements obtained from wells screened within the basal till and upper bedrock units. As noted in Section 2.2, the groundwater in the Confined Aquifer exists under apparent confined conditions within the Basal Till unit and upper portion of the Onondoga Limestone beneath the base of the glaciolacustrine clay. As shown on Figure 11, there is high point located on the southeastern side of Area E based on water level measurements made in well R-07, which is screened within the confined unit. The high point was identified as a groundwater divide during the RFI and its occurrence may be due to a natural anomaly, surveying error, or man-made conditions (compromised well seal). In general, groundwater flow within the confined unit is to the west/southwest along the Buffalo River valley with the ultimate discharge point expected to be Lake Erie.

Golder reported that vertical gradients calculated between the Shallow and Confined Aquifers in 1997 ranged from -0.11 to -0.13 ft/ft, indicating a downward gradient. Downward gradients were confirmed during the RI as evidenced by the differences in elevation between the shallow and deep well combinations at RFI-20/RFI-21D, RFI-22/RFI-23D, and W6-R-R/RFI-16.

6.2 SITE SOIL (SURFACE AND SUBSURFACE)

Consistent with use of the Site for chemical dye manufacturing processes that occurred for over 100 years, the RI test borings encountered soils at certain locations that exhibited elevated PID readings, staining (typically blue or purple in color), odor, or other evidence of potential impact. These conditions are noted on the RI test boring logs provided in Appendix C. In many instances, these conditions were observed in saturated soils. In certain locations, these conditions were associated with unsaturated soils, in which case certain soil samples were collected for laboratory analyses in order to bias the sampling to address potential worst-case conditions. Specific soil samples collected from locations that exhibited evidence of potential contamination included:

<u>AREA A</u>

- TB-A03-0204 (elevated PID reading at water table – 4 ft.)
- TB-A12-SURFACE (elevated PID reading)

- TB-A14-0102 (blue staining)
- TB-A15-0102 (blue staining)
- TB-A19-0304 (elevated PID reading at water table – 4 ft.)

AREA B

- TB-B13-0607 (hydrocarbon-like odor noted at water table – 7 ft.)
- TB-B14-0304 (blue staining)

AREA C

- TB-C03-0304 (hydrocarbon-like odor at water table – 4 ft.)

AREA E

- TB-E01-SURFACE (purple staining)
- TB-E07-0304 (elevated PID reading)
- TB-E09-0304 (elevated PID reading)
- TB-E27-0708 (hydrocarbon odor)

Tables 3 through 6 summarize the analytical results (for detected substances only) for the initial RI soil samples collected from the test borings. These tables summarize the results by area and types of analytes and include the 6 NYCRR Part 375 SCOs for comparison. Surface (i.e., 0 to 2 inch) samples are identified via the word "SURFACE" at the end of the sample identification number. Subsurface sample depth intervals are identified via the last four digits of the sample identification number (i.e., sample TB-A01-0506 was collected from a depth of 5 to 6 feet below ground surface).

It should be noted that SCOs are not provided in 6 NYCRR Part 375 for aniline and nitrobenzene, two substances identified as COCs for the Site. Per the guidance in 6 NYCRR Part 375, MACTEC calculated SCOs for these substances. The calculated SCOs are provided on the data summary tables. Copies of the detailed SCO calculations for aniline and nitrobenzene as completed by MACTEC are provided in Appendix G. NYSDEC issued a letter to Honeywell dated December 28, 2007 regarding the calculated SCOs for aniline and nitrobenzene. The letter acknowledged that the approach used by MACTEC to calculate the human health-based SCOs was generally consistent with the 6 NYCRR Part 375 Technical Support Document, but indicated that certain values used in the calculations required modification. The NYSDEC letter presented recalculated SCOs for aniline and nitrobenzene. A response letter has not yet been prepared by

Honeywell. The recalculated SCOs are not significantly different from the values calculated by MACTEC. Therefore, the recalculated aniline and nitrobenzene SCOs do not materially impact the extent of contamination identified in the RI and thus do not have any significant affect on the remedial alternatives evaluated in the AAR. Honeywell accepts the NYSDEC-calculated values for aniline and nitrobenzene. A copy of the December 28, 2007 letter from NYSDEC that presents the recalculated SCOs is included in Appendix G, and the soil analytical results summary tables (Tables 3 through 6 and Table 13) identify the NYSDEC-calculated values.

Figures 12 and 13 summarize the surface and subsurface sample results, respectively, that exceeded the Commercial SCOs. Figures 14 and 15 summarize the surface and subsurface soil sample results, respectively, that exceeded the Protection of Groundwater SCOs. These specific SCOs were used because the proposed future use scenario involves commercial and industrial use.

As shown on the referenced data summary tables and figures, the initial RI soil analytical results identified the following:

- Arsenic and PAHs were found consistently across the Site at levels that exceeded the SCOs. The results occur in a pattern that does not appear to reflect site-related spills or releases and these substances are known to be present as background contaminants throughout the state. However, there are certain sample locations where concentrations of arsenic and/or PAHs are markedly higher than surrounding samples (such as the PAH concentrations identified at boring locations TB-E21, TB-E22, TB-E23 and TB-E30) and do not appear to represent potential background conditions.

- Only certain metals (including arsenic and mercury) and SVOCs (primarily PAHs) were found in surface or subsurface unsaturated soil at levels that exceeded the Commercial SCOs.

- No VOCs were found in the surface Site soil above the Commercial SCOs. Only one subsurface sample at Area A and three subsurface samples on Area E had VOCs at concentrations that exceeded the Commercial SCOs.

- Given the generally lower values for Protection of Groundwater SCOs, there were more substances identified in the surface and subsurface soil samples that exceeded the

Protection of Groundwater SCOs. Substances that exceeded these SCOs consistently across the Site were various metals (including arsenic) and PAHs. Other substances in the soil samples at concentrations above the Protection of Groundwater SCOs occurred at specific sample locations primarily on Areas A and E and included aniline (an SVOC) and benzene, chlorobenzene, dichlorobenzenes, nitrobenzene, and other VOCs.

6.3 SITE GROUNDWATER

Table 7 summarizes the analytical results (for detected substances only) for the RI groundwater samples. Table 7 summarizes the results by area and analytes and includes for comparison the relevant Class GA (fresh groundwater) water quality standards as provided in 6 NYCRR Part 703.

Figures 16 and 17 provide visual summaries of the groundwater analytical results that exceeded the Class GA standards for samples collected from wells/piezometers screened in the Shallow Aquifer and the Confined Aquifer, respectively. The data obtained during the RI identified the following with respect to Site groundwater quality:

- Organics in Shallow Groundwater: There are three characterized areas where elevated concentrations of chlorobenzene (i.e. part per million levels) are present in the shallow groundwater. The largest of these areas is located on the central and southern portion of Area A (see Figure 16). The shallow groundwater in this area also contains aniline above the Class GA Standard at part per million levels. The second location where part per million levels of chlorobenzene were found in shallow groundwater was at Area C extending from monitoring well RFI-20 to the vicinity of well RFI-31 (Figure 16). The third location of elevated chlorobenze levels in shallow groundwater was in the vicinity of a former AST farm on the southwestern portion of Area E (Figure 16).

- Metals/Inorganics in Shallow Groundwater: Various metals and inorganic parameters were found at concentrations that exceed the NY Class GA standards across the site, including upgradient locations. As with the soil, it is suspected that naturally occurring regional background or anthropogenic conditions contribute to these concentrations. NYSDEC has questioned why the arsenic concentration in the RI groundwater sample collected from well RFI-51 (1.7 mg/L) was high in comparison to the arsenic concentrations found in other Site wells. MACTEC reviewed the RI well purging records and found that well RFI-51 had a turbidity value upon sample collection (84.5 NTUs) that was much higher than other nearby wells (which were typically less than 10 NTUs). This has remained true during the 2008 Quarterly groundwater monitoring events. Well RFI-51 is located off-Site near the PVS Chemicals property line (Figure 16). It has been observed that the bottom of the surface concrete collar for this well sticks up several inches above the ground surface, which indicates that the surface seal for the well may be compromised. Surface water infiltration may be occurring and resulting in excess turbidity in this well. Filtered samples have been collected from RFI-51 during the 2008 sampling events when the turbidity level could not be reduced below 50 NTUs. The results for the 2008 groundwater sampling events will be documented in the 2008 Annual OM&M report to be prepared during the first quarter of 2009. Additional information regarding the arsenic levels in well RFI-51 in relation to turbidity levels will be provided, along with recommendations for repair or replacement of well RFI-51 if appropriate.

- <u>LNAPL in Shallow Groundwater</u>: Based on the RI data, the LNAPL encountered on Area A in ICM extraction well EW-5 and piezometers PZ-103 and PZ-110 appears to be isolated to those locations. As shown on Table 2, separate-phase liquids were not identified in other nearby Area A wells and piezometers during the RI groundwater sampling event. Furthermore, no evidence of significant distribution of free-phase hydrocarbons was identified on Area A during completion of the RI test borings. At Area E, no LNAPL was identified in well R-14 during the RI sampling activities. However, during subsequent groundwater monitoring completed for the First, Second and Third Quarters of 2008, an accumulation of LNAPL was identified in well R-14. In the 1990s, well R-14 contained measurable LNAPL. The well is located on the southeastern corner of Area E in the general vicinity of the capped/closed wastewater lagoons (Figure 4). This is also in the vicinity of an area operated by a former oil company identified by Sanborn maps as having occupied the area in the late 1800s/early 1900s. There is no historic information to suggest that the lagoons managed appreciable quantities of oily or petroleum-impacted wastewaters. During the Third Quarter 2008 groundwater monitoring event, LNAPL was also identified in piezometer ICM-PZ-04S, which is located offsite and to the south of the BSA sewer line (Figure 16). This piezometer was installed during the 2006 ICM construction and had not previously been found with LNAPL. The LNAPL at both locations was reported by MACTEC field personnel to exhibit characteristics of oil/petroleum hydrocarbons. As described in Section 9.3.6 of the AAR, additional investigation of this area will be completed as part of the remedial design process to evaluate the extent of LNAPL and determine monitoring and remedial requirements.

- Confined Aquifer: During the RI, groundwater samples were collected from six wells screened in the Confined Aquifer. These wells span the site from Area A to Area E. Samples from these wells were found to contain several metals/inorganics and SVOCs at relatively low concentrations that slightly exceed the Class GA standards. No chlorobenzene or other VOCs were identified in any Confined Aquifer sample at levels that exceeded the Class GA standards.

6.4 SOIL GAS SAMPLING AT AREA B

The analytical results for the subslab soil gas samples collected from the Area B office building are summarized in Table 8 (detected substances only are shown). The complete STL analytical report for the soil gas samples is provided on the CD in Appendix F. As shown on Table 8, various organic substances were detected in the two subslab soil gas samples (SV-B01-0707 and SV-B02-0707). As described in Section 3.3.2 of the guidance document "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (NYSDOH, October 2006), there are presently no standards, criteria, or guidance values in New York State for concentrations of substances in subslab vapor samples. However, NYSDOH has provided indoor air guidelines for the following volatile chemicals:

- Carbon tetrachloride (Matrix 1)
- 1,1-Dichloroethene (Matrix 2)
- Cis-1,2-dichloroethene (Matrix 2)
- Tetrachloroethene (Matrix 2)
- 1,1,1-Trichloroethene (Matrix 2)
- Trichloroethene (Matrix 1)
- Vinyl chloride (Matrix 1)

As described in Section 3.4.2 of the NYSDOH guidance document and as modified in a NYSDOH letter to NYSDEC dated June 25, 2007, the matrices are used to determine actions necessary based on subslab vapor and indoor air concentrations of the volatile chemicals. As shown on Table 8, none of the listed substances were detected in the subslab vapor samples collected from the Area B office building.

6.5 SITE SEWERS AND OUTFALLS

Table 9 summarizes the detected constituents identified in the seven sewer solids samples collected during the RI. Table 10 summarizes the detected constituents identified in the effluent samples collected from Outfall 006 (sample SW006-0307) and Outfall 011 (sample SW011-0307) and includes the NY Class C surface water standards/guidance values for comparison. At the time of sampling, the flow rate at the Outfall 006 sampling point could not be estimated visually and the estimated flow at the Outfall 011 sampling point was 1 to 2 gpm. Table 9 compares (for informational purposes) the sewer sediment results to the Protection of Ecological Resources SCOs. As shown on Table 9, the results for various constituents in the storm sewer sediment samples, primarily metals, exceeded the Ecological SCOs. As shown on Table 10, only a few of the effluent sample analytes had detected concentrations that exceeded the Class C standards or guidance values. It is believed that the effluent that occurs at Outfalls 006 and 011 during dry periods is due in part to groundwater infiltration because portions of the storm sewer lines leading to the outfalls are below the water table.

6.6 SUPPLEMENTAL INVESTIGATION

The SI work was completed in July 2007. Results are discussed below.

6.6.1 Hexavalent chromium sampling

The hexavalent chromium (chromium VI) concentrations reported for the soil samples collected at TB-A16-SURFACE, TB-A31-0405, and TB-C11-0203 are provided in Table 11. Included on the table for comparison are the relevant SCOs for hexavalent chromium. All results were below the Residential SCO of 22 mg/kg, indicating that hexavalent chromium is not present at significant levels in the Site soil. Thus, the SCOs for trivalent chromium (chromium III) are used in tables that summarize the RI soil analytical data.

6.6.2 MIP Study

Complete copies of the reports prepared by Columbia Technologies for the MIP studies at Areas A, C and E are provided in Appendix E. The reports include a narrative description of the MIP investigation methodology, color figures that display the results for the various MIP detectors (PID, FID, and ECD), and the individual MIP logs with graphical presentation of the detector results. According to Columbia Technologies, the PID and ECD detectors are able to identify chlorobenzene while the FID detector cannot.

The MIP study results can be summarized as follows:

- Area A: With the exception of localized results at boring MIP-A02 (which was advanced within an area previously disturbed during excavation of RI test pits TP-A03 and TP-A04), the MIP results indicate that the VOC contamination is present within the saturated zone and limited to the southern portion of Area A. All detectors identified the area with highest detector responses to be located on the western portion of the Site that borders the railroad tracks. Historically, this area was the location of various former storage tanks associated with Area A operations. Several MIP borings were advanced in the vicinity of the sewer line for Outfall 006; no evidence was found during the MIP study to suggest that the sewer line backfill is a preferential pathway for migration of contaminated groundwater.

- Area C: The lack of any significant PID response, along with the localized ECD response at boring MIP-C01, suggests that the highest level of chlorobenzene in shallow groundwater is limited to the northwestern corner of Area C. This is consistent with the analytical data associated with the RI soil and groundwater sampling.

- Area E: The MIP results indicate the VOC contamination is present within the saturated zone in the vicinity of the large AST farm. MIP borings that exhibited the highest PID and FID responses within the saturated zone were MIP-E01, MIP-E04, and MIP-E09. Elevated ECD responses were observed at MIP-E01 and MIP-E04. MIP borings MIP-E05, MIP-E06 and MIP-E07 were advance immediately west of Area E along the 36”-inch diameter BSA sewer line that runs parallel to the property line. The intent of these borings was to determine if there was evidence that the sewer line backfill was acting as a preferential pathway for migration of chlorobenzene-contaminated groundwater. As shown in the Area E MIP report, there were no elevated detector responses associated with the MIP borings advanced along the sewer line.

As noted in Section 5.5.2, soil samples were collected from intervals of unsaturated soil samples at selected MIP boring locations where evidence of VOC contamination was identified by the MIP detectors. The soil samples were analyzed by STL for VOCs. The results of this testing are summarized in Table 12. The Commercial and Protection of Groundwater SCOs are provided on the table for comparison. As shown on the table, benzene and lesser concentrations of other VOCs were identified in several of the soil samples collected at Area A. No significant concentrations of VOCs were identified in the unsaturated soil samples collected from Area C. At Area E, several soil samples contained significant concentrations of benzene and chlorobenzene, with lesser concentrations of other VOCs. The significance of these results is discussed in Section 7.0.

6.6.3 TB-A15 Delineation Sampling

The analytical results for the soil samples collected from borings advanced in the vicinity of RI boring TB-A15 are summarized in Table 13. The relevant SCOs for the analyzed PAHs are also provided on the table for comparison. As shown on the table, concentrations of various PAHs were identified within the TB-A15 area borings at concentrations that exceed the SCOs. TICs, including nitrobenzene compounds, were also identified at this location as summarized in data tables The significance of these results is discussed in Section 7.0.

6.7 BACKGROUND STUDY

The analytical results for the fifteen (15) background soil samples are summarized in Table 14. Figure 7 identifies the background sample locations. As described in Section 5.6, MACTEC utilized EPA-approved software (ProUCL Version 4.0, 2007) to calculate the BTVs for arsenic and PAHs. The results of the statistical evaluation, including the output from the ProUCL software), are provided in Appendix H. The calculated BTVs are included on Tables 3 through 6 for comparison to the RI soil sample analytical data. The results of the Background study indicate that background values exceed the SCOs for arsenic and PAHs.

6.8 TENTATIVELY IDENTIFIED COMPOUNDS

As specified in the RI/FS Work Plan, identification of TICs for VOCs and SVOCs was included in the RI sample analytical program. TIC results are included on the tables and laboratory data validation reports provided in the RI Report. MACTEC has reviewed the TIC results and determined that they are consistent with the concentrations and types of contaminants identified in the Target Compound List analytes selected for the soil and groundwater samples (i.e., soil and groundwater samples with elevated levels of VOCs and SVOCs also contained corresponding levels of TICs) and/or samples with elevated organic TICs are included in the source areas identified on Areas A and E. This confirms that the remedial action specified in Section 9.0 will address the areas with organic soil and groundwater contamination.

6.9 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control (QA/QC) procedures were utilized throughout the project as described in the QAPP set forth in the RI/FS Work Plan. The project QA/QC protocol was consistent with the most recent version of DER-10. Quality control samples in the form of aqueous trip blanks, aqueous field blanks, duplicate groundwater samples, and matrix spike/matrix spike duplicate (MS/MSD) samples were collected and analyzed as specified in the QAPP. The analytical results for the QC samples are included in the analytical reports provided on the CD in Appendix F.

Category B deliverables as defined in the NYSDEC ASP were reported for all samples collected during remedial investigation activities. Analytical data was validated by a MACTEC project chemist in accordance with NYSDEC Data Usability Summary Report (DUSR) guidelines (NYSDEC, 2002) and Honeywell Remediation program data validation procedures. Complete copies of the data validation reports are provided in Appendix I.

It should be noted that, as a result of the data validation process, data qualifiers have been modified for certain constituents and samples; the modified data qualifiers are included on the various data summary tables provided in this report. No significant data quality issues were identified through the validation process. Therefore, the analytical results generated during the RI are considered to be reliable for the purposes of this report and the separately-issued AAR.

7.0 CONTAMINANT EVALUATION

The data obtained during the RI, as well as data obtained from previous investigations and studies, have been used to identify the areas with Site-related contamination above the SCOs (soil) and the Class GA standards (groundwater). The extent and locations of impacted areas, along with the conceptual site model, are discussed below.

7.1 LOCATION, TYPE AND EXTENT OF CONTAMINATION

The following sections describe the location, type and extent of contamination by area and media.

7.1.1 Site Soil

Figures 12 and 13 summarize the RI soil sample analytical results that exceeded the Commercial SCOs and Figures 14 and 15 summarize the results that exceeded the Protection of Groundwater SCOs. The Commercial and Protection of Groundwater SCOs were chosen for direct comparison because they are the most relevant from a risk evaluation standpoint and are representative of the most likely future use scenario.

<u>SURFACE SOIL</u>

As shown on Tables 3 through 6 and Figures 9 and 11, the majority of RI surface soil samples (i.e., samples collected from the upper two inches of soil, in many cases immediately below surface pavement) were found to contain concentrations of arsenic and PAHs that exceeded the Commercial and Protection of Groundwater SCOs. However, the majority of these samples do not exceed the calculated background values for arsenic and PAHs as shown on Tables 3 through 6. Other metals, such as mercury and lead, were found in certain soil samples at concentrations that exceeded the SCOs. No VOCs were identified in any RI soil sample at levels that exceeded the Commercial SCOs. A limited number of surface samples (one on Area A, none on Area B, two on Area C, and six on Area E) were found to contain certain VOCs above the Protection of Groundwater SCOs.

<u>SUBSURFACE SOIL</u>

As shown on Tables 3 through 6 and Figures 13 and 15, many of the RI subsurface soil samples (i.e., samples collected below a depth of two inches and above the first saturated interval) were found to contain concentrations of arsenic and PAHs that exceeded the Commercial and Protection of Groundwater SCOs. These results are consistent with the prior soil sampling results, including the RFI soil data and the results of soil samples collected at Area A during the ICM construction process described in Section 2.1. Similar to the surface soil samples, many of these samples do not exceed the calculated background values for arsenic and PAHs as shown on Tables 3 through 6. Other metals, such as mercury and lead, were found in certain soil samples at concentrations that exceeded the SCOs. Potential sources of soil to groundwater impact were identified at the following locations as depicted on Figure 18:

- Area A in the vicinity of boring TB-A15 (SVOCs, including aniline and nitrobenzenes); the approximate surface area of impact is 14,500 ft^2, and the average depth to saturated soil is 4 feet, which results in an approximate volume of 56,000 ft^3 (or 2,100 cubic yards) of impacted soil.

- Area E in the vicinity of the large AST farm located on the southwestern side of the parcel (benzene, chlorobenzene and other VOCs); the approximate surface area of impact is 55,000 ft^2, and the average depth to saturated soil is 4 feet, which results in an approximate volume of 220,000 ft^3 (or 8,150 cubic yards) of impacted soil.

The described source areas were identified based on the presence of elevated concentrations of organic substances that are also present in localized Site groundwater. Soil volumes were conservatively calculated based on distances to nearest samples that did not exhibit elevated organic concentrations and depth to the first zone of saturation.

Samples TB-A33-0709 and TB-C11-0708 were identified as containing significant concentrations of chlorobenzene and other VOCs; however, these samples were collected at or below the water table and are likely influenced by the presence of these VOCs in the groundwater.

Acetone was found in certain subsurface soil samples above the Protection of Groundwater SCO. This substance is not believed to be related to Site activities since it is not present in Site groundwater at significant concentrations and is a common laboratory contaminant.

7.1.2 Site Groundwater

Figures 16 and 17 summarize the RI groundwater sample analytical results that exceeded the Class GA groundwater standards. The following paragraphs discuss the RI results by aquifer and area on the site.

7.1.2.1 Shallow Aquifer

AREA A

As depicted on Figure 16, the shallow groundwater on the southern half of Area A contains reported concentrations of chlorobenzene and aniline at parts per million levels. Lesser concentrations of other VOCs and SVOCs are also present in the shallow groundwater on the site. Under static conditions, the shallow groundwater at Area A discharges to the Buffalo River. Pumping at ICM extraction well EW-1 has occurred on a continuous basis since April 2007. As described in Section 3.0, full-scale operation of the Area A groundwater extraction system was initiated in December 2007 and is ongoing. Discharge from extraction wells EW-1 and EW-2 is pretreated to reduce chlorobenzene levels via the on-Site treatment system prior to discharge to the Area A low-lift station. The effluent from wells EW-3, EW-4 an EW-5 is currently discharged to the low-lift station without pretreatment. The low-lift station discharges to the BSA sewer system in accordance with a BSA permit.

Based on the RI data, the floating separate-phase liquids (LNAPL) encountered on Area A in ICM extraction well EW-5 and piezometers PZ-103 and PZ-110 appear to be isolated to those locations. Comparing the analytical results for the sample of the groundwater collected at EW-5 during the RI to the levels of VOCs and SVOCs present in the LNAPL itself indicates that the material is not highly soluble, as would be expected for a heavier phase hydrocarbon such as fuel oil, which information indicates was previously stored and used in historic power generation operations in the vicinity of EW-5. MACTEC has removed several gallons of LNAPL from EW-5 via hand-bailing. Measurements made at EW-5 since April 2008 have not identified measurable LNAPL. Due to well construction and system controls (i.e. the LNAPL/water level is maintained well above the pump intake and screen via use of level controls and pump set point), there is little to no potential for LNAPL to be pumped at EW-5 via the current ICM. The plan for future monitoring and recovery of LNAPL is presented in Section 9.0 of the AAR. Separate-phase liquids were not identified in other nearby Area A wells and piezometers during the RI groundwater sampling event. Furthermore, no evidence of significant distribution of free-phase hydrocarbons was identified during completion of the RI test borings.

Various metals and inorganics were also identified in the Shallow Aquifer on Area A at levels that exceeded the Class GA standards. Many of these substances are associated with glacial formations (such as iron, manganese, and sodium), have been identified across the entire Site, and are likely consistent with background levels within the Shallow Aquifer.

AREA B

Groundwater samples collected from the wells screened in the shallow aquifer at or near Area B contained concentrations of various metals and inorganic compounds at levels consistent with those found in the shallow aquifer across the site (Figure 16). Trace concentrations of aniline and naphthalene were also found in several of the wells at low part per billion (ug/L) concentrations. Concentrations of VOCs, including chlorobenzene, tetrachloroethene (PCE), and trichloroethene (TCE), were identified in the groundwater sample collected from well RFI-27 at levels that exceeded the Class GA standards. This well is located on the southwestern corner of Area B. A trace concentration of benzene was identified in the sample collected from well RFI-28, which is located near the southeastern corner of Area B. There are no known corresponding soil source areas on Area B in connection with the contaminants identified in well RFI-27 and RFI-28. Groundwater flow direction from these two locations is toward Area A.

AREA C

On Area C, the RI groundwater sample collected from well RFI-20 contained chlorobenzene (7.7 mg/L) and other VOCs at levels that exceeded the Class GA standards (Figure 16). The groundwater sample collected from well RFI-31, which is downgradient from RFI-20, contained lower concentrations of similar VOCs. The RI soil sampling and MIP survey did not identify any existing on-Site soil source at Area C.

AREA E

On Area E, the RI groundwater sampling and the MIP study have identified an area of the shallow aquifer impacted by elevated levels of chlorobenzene and other VOCs (Figure 16). The groundwater sample collected from well RFI-32, which is located immediately downgradient of the large AST farm on the southwestern corner of Area E, contained a chlorobenzene concentration of 33 mg/L. The MIP study, which included borings advanced along the BSA sewer line located in the offsite area immediately downgradient of the AST farm, and the analytical results for groundwater samples collected on the PVS Chemicals property immediately downgradient of this location, indicate that the impacted groundwater has not left the site or migrated along the adjacent BSA sewer main to any significant degree.

Groundwater samples collected from shallow wells near the locations of the former wastewater lagoons on the southeastern corner of Area E did not contain VOCs above NY Class GA standards or otherwise show evidence of groundwater impact attributable to the former lagoons (Figure 16).

A steep gradient exists in the Shallow Aquifer where groundwater moves toward the Buffalo River on the south side of Area E and on PVS Chemicals property. Figures 10 and 16 illustrate this gradient, which coincides with the boundary between the upland till unit and the alluvial deposits that are adjacent to the river. The RFI cross sections (Golder) included in Appendix A depict this geologic boundary.

During groundwater monitoring completed for the First, Second and Third Quarters of 2008, an accumulation of LNAPL was identified in well R-14. In the 1990s, well R-14 contained measurable LNAPL. The well is located on the southeastern corner of Area E in the vicinity of the capped/closed wastewater lagoons (Figure 4). This is also in the vicinity of an area where a former oil company is identified by Sanborn maps as having occupied in the late 1800s/early 1900s. There is no historic information to suggest that the lagoons managed appreciable quantities of oily or petroleum-impacted wastewaters.

During the Third Quarter 2008 groundwater monitoring event, LNAPL was also identified in piezometer ICM-PZ-04S, which is located offsite and to the south of the BSA sewer line (Figure 16). This piezometer was installed during the 2006 ICM construction and had not previously been found with LNAPL. The LNAPL at both locations was reported by MACTEC field personnel to exhibit characteristics of oil/petroleum hydrocarbons. Samples of the LNAPL and groundwater at these two locations were collected by MACTEC for laboratory testing during the Third Quarter 2008 groundwater monitoring event. As described in the Section 9.3.6 of the AAR, additional investigation of this area will be completed as part of the remedial design process to evaluate the extent of LNAPL and determine monitoring and remedial requirements.

Similar to Areas A, C, and E, trace concentrations of other VOCs and PAHs and concentrations of metals and inorganics were found throughout the site at levels that exceeded the Class GA standards.

7.1.2.2 Confined Aquifer

No VOCs were detected at concentrations above the Class GA standards in any confined aquifer groundwater samples (Figure 17). This includes the samples collected from wells RFI-21D and RFI-16, which are located at or downgradient of locations where significant levels of chlorobenzene and other VOCs were identified in the shallow aquifer. Only very low (part per billion) levels of aniline, nitrobenzene and naphthalene were reported in several of the confined aquifer samples above the Class GA standards. This supports the findings of the prior RFI study and indicates that the glaciolacustrine clay unit found throughout the site is an effective aquitard. The effectiveness of the aquitard is reinforced by the fact that this facility had been in operation for well over 100 years.

The transport mechanism that allowed low levels of these site related contaminants to reach the confined aquifer is not clear but may have occurred due to historic localized conditions (such as old building foundations) that allowed only limited vertical migration to occur. However, the remedial action selected for the Site will help address concerns regarding potential future vertical contaminant migration from existing areas of contamination. Concentrations of iron, sodium, and magnesium were also reported in one or more confined aquifer groundwater samples at levels that exceeded the Class GA standards; however, the available evidence suggests that the presence of these constituents is due to the condition of the regional aquifer, not Site activities.

7.1.3 Indoor Air – 100 Lee Street Office Building

As shown on Table 8 and discussed in Section 6.3, no substances for which the NYSDOH has established indoor air guidelines were identified in the subslab soil vapor samples collected from the 100 Lee Street office building. Various other substances that currently do not have applicable NYSDOH indoor air criteria were identified in the subslab vapor samples. The 100 Lee Street building is on the portion of Area B that was purchased by a third party during the Buffalo Color bankruptcy proceedings. As described in Section 9.3.6 of the AAR, Honeywell has agreed to collect additional subslab vapor samples at the 100 Lee Street building, as well as indoor and outdoor air samples, during the remedial design process to be consistent with NYSDOH guidance. This assumes that property access will be granted by the current owner of the building.

7.1.4 Site Sewers and Outfalls

Various substances were identified in the solids samples collected from the Site process sewers (which discharge to the BSA system) and storm sewers (which discharge to the Buffalo River via Outfalls 006 and 011). Detected substances included various metals, VOCs and SVOCs. As expected, concentrations were lower in the solids samples collected from storm sewers (SED-A01 and SED-B01) than concentrations of substances reported in samples collected from the process sewer lines (SED-A02, SED-C01, SED-C03, SED-E01, and SED-E02). Table 9 compares (for informational purposes) the sewer sediment results to the Protection of Ecological Resources SCOs. As shown on Table 9, the results for various constituents in the storm sewer sediment samples, primarily metals, exceeded the Ecological SCOs. As described in Section 9.1.3.1 of the AAR, remediation of the storm sewer system will include measures to address the potential discharge of existing impacted sewer sediment to the Buffalo River.

Various substances were identified in the effluent samples collected from Outfalls 006 and 011. These substances included chlorobenzene and dichlorobenzenes, aniline, and other VOCs/SVOCs. In general, higher concentrations of VOCs and SVOCs were identified in the Outfall 006 sample as compared to the Outfall 011 sample. The presence of these substances in the effluent samples indicates that groundwater is likely infiltrating the storm sewer lines where the lines are below the water table..

7.2 CONCEPTUAL SITE MODEL

Using the data obtained during the RI, MACTEC has developed a Conceptual Site Model (CSM), presented as Figure 19. As shown by the CSM, the following complete or potentially complete exposure pathways exist for the site contaminants:

- SOIL: direct-contact exposure (via dermal contact or ingestion) to contaminated soils; potential receptors include constructions workers, site workers, trespassers, and terrestrial biota.

- AIR: Inhalation of particulate or vapors due to volatilization or dispersion of contaminants; potential receptors include construction workers, site workers, trespassers, and terrestrial biota.

- GROUNDWATER: Direct-contact exposure to contaminated groundwater via inhalation of vapors or dermal contact; potential receptors include construction workers (inhalation and dermal contact) and site workers, trespassers and terrestrial biota (inhalation only).

- SURFACE WATER: Impact to surface water is a potentially complete exposure pathway at Area A, where chlorobenzene-impacted groundwater may discharge to the Buffalo River under static (non-pumping) conditions.

The above exposure pathways must be addressed during evaluation and selection of the final remedy, as provided in the AAR.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The data obtained during completion of the RI, combined with data from the previous RFI and other investigations, has been used to develop the following conclusions and recommendations regarding the former Buffalo Color Areas ABCE Site:

- FUTURE LAND USE SCENARIOS AND REMEDY SELECTION: As described in Section 1.0, the proposed redevelopment will involve some combination of industrial, commercial and green space uses which will utilize a combination of engineering controls, environmental easements and/or deed restrictions to address exposure pathways.

- SOIL (POTENTIAL SOURCES OF GROUNDWATER CONTAMINATION): Based on proximity to shallow groundwater that contains similar contaminants, two likely sources of soil to shallow aquifer impact have been identified above the first zone of saturation: 1) approximately 2,100 cubic yards of SVOC-impacted soils located in the central part of Area A in the vicinity of RI boring TB-A15; and 2) approximately 8,150 cubic yards of VOC-impacted soil in the vicinity of the large AST farm on the southwestern side of Area E. The remedial measures identified in the AAR, consistent with the planned future land use of the Site, are protective of human health and the environment with respect to contaminated soil that may exist below the water table.

- SOIL (DIRECT CONTACT PATHWAY): Metals (primarily arsenic and to a lesser extent mercury) and PAHs were found across the site in both surface and subsurface soil at levels that exceed the Commercial SCOs. For the direct contact pathway, surface soil samples are considered the most relevant data points. The data also suggests that the locations with levels of arsenic and PAHs within background levels are not sources of groundwater contamination. SBD will utilize the Commercial SCOs to address the direct contact pathway. The majority of the site (roughly 60%) is currently covered by pavement or buildings (which have concrete floor slabs), as shown on Figures 2 and 20. Remedial options evaluated in the AAR to address the soil direct contact pathway (which includes dermal contact and inhalation of particulates) include utilizing the presence of new and/or existing pavement and buildings and identifying uncovered areas that, in the context of planned future land use at the Site, require remedial action. In addition, the erosion control mat installed on the Area A riverbank as part of the ICM is an effective barrier against direct contact. Options to address unpaved or exposed areas where surface soil concentrations exceed the Commercial SCOs include use of NYSDEC presumptive remedies such as removal, capping with one foot of clean soil, or placement of new facilities or paving. Using the Commercial SCOs as cleanup objectives as shown on Figure 20, approximately 5 acres of presently exposed soil exceed the Commercial SCOs and require further consideration under a Commercial use scenario. Management of soils at depth, which may be encountered during future construction or property redevelopment activities, will be accomplished via use of soil management procedures and environmental easements and/or deed restrictions, as specified in a NYSDEC-approved Site Management Plan.

- SHALLOW AQUIFER: Groundwater is not used or planned for use at the Site or in the vicinity of the Site for drinking purposes. Thus, there is no current human exposure pathway associated with the presence of metals and inorganic compounds in the shallow aquifer at levels that exceed the Class GA standards (which are based on a potable use scenario). Potential impact to the Buffalo River via discharge of contaminated shallow groundwater exists at Area A, which is the only portion of the Site that abuts the river. Shallow groundwater on Areas B, C and E also flows toward the river. However, the RI data indicate the chlorobenzene plumes on Areas C and E have not migrated beyond the property boundaries. During the remedial design process, additional monitoring wells will be installed on Areas C and E to further delineate the extent of the groundwater plumes, as described in Section 9.3.6 of the AAR. The AAR focuses on identification of remedies for the shallow groundwater impacted by chlorobenzene and other organic contaminants at the following locations:

    - On Area A, where the shallow groundwater contains chorobenzene, aniline and other organic Site-related constituents at part per million levels and,

    - On the northwestern corner of Area C (at well RFI-20 and extending downgradient toward well RFI-31), where levels of chlorobenzene at part per million levels were identified; and

- o On the southwestern portion of Area E in a limited area around the large AST farm and well RFI-32, where levels of chlorobenzene and other organic compounds have been identified in groundwater at part per million levels and impacted soil has also been identified as described above.

- DEEP GROUNDWATER (CONFINED AQUIFER): As described in the RI report, only metals/inorganic compounds and part per billion levels of SVOCs were identified sporadically in the groundwater samples collected from the wells screened within the confined aquifer. Chlorobenzene, which in its pure state is heavier than water, was not identified in any of the confined aquifer groundwater samples at levels that exceeded the Class GA standards, indicating that the glacial clay unit is an effective aquitard. As with the shallow aquifer, groundwater within the confined aquifer is not used for potable purposes, and no such use is known or planned for the Site or properties in the vicinity. It is expected that the discharge point for the confined aquifer is likely downgradient along the Buffalo River valley to Lake Erie based on surface water elevations and the southwesterly flow direction of the confined aquifer, which mimics the flow direction of the Buffalo River drainage basin. Based on the types and levels of contaminants identified within the confined aquifer groundwater samples collected from the Site, there is no potential for adverse impact to the Buffalo River or Lake Erie. Thus, it is concluded that (i) institutional controls/environmental easements may be required to preclude on-site use of the confined aquifer; and (ii) there is no need for further study or active remediation of the confined aquifer.

- SITE SEWERS AND STORMWATER OUTFALLS: The existing Site process sewers are connected to the nearby BSA sewer lines. The RI sampling identified the presence of residual contaminants in solids within the facility process sewers (including sediments or sludges). The RI sampling data, along with the fact that sewer invert elevations along Outfalls 006 and 011 are below the water table, suggest that shallow groundwater may infiltrate portions of facility storm sewers and discharge to the Buffalo River via the outfalls, especially at Outfall 006. However, the mass of contaminants discharged to the river via groundwater infiltration is negligible given the concentrations identified in the effluent and estimated typical groundwater flow rate of 20,000 to 40,000 gallons per day per outfall (based on BCC SPDES monthly reports issued when the plant was no longer operating and thus when no non-contact cooling water was discharging to the outfalls). Even though the discharge may be negligible, this AAR identifies remedial activities associated with plugging or rehabilitating the Site underground sewer system.

- INDOOR AIR: As noted in Section 9.3.6 of the AAR, sampling will be completed at the 100 Lee Street office building located on Area B. This additional sampling will be consistent with NYSDOH guidance and will be completed during the remedial design process. On Area E, Honeywell will attempt to obtain additional information on the status of vapor intrusion investigation and mitigation efforts being undertaken by others for the warehouse building located at 343 Elk Street. Honeywell will further evaluate whether additional vapor intrusion investigation or mitigation is required at this location. In addition, the indoor air pathway will be addressed or eliminated during construction of any future occupied structures on the Site. This requirement may be addressed via implementation of environmental easements and/or deed restrictions.

- FORMER AREA E WASTEWATER LAGOONS: As discussed in Section 2.1, the former Area E wastewater lagoons were drained, dredged and capped between 1984 and 1988 in accordance with closure plans approved by the NYSDEC. As noted in Section 7.1.2.1, groundwater samples collected from shallow wells located near the locations of the three former lagoons did not contain VOCs above NY Class GA standards or otherwise show evidence of impact related to the former lagoons. Thus, it is concluded that additional remedial measures are not necessary for the former lagoons at this time. Future groundwater monitoring events, as conducted under an approved OM&M program, will include monitoring and sampling of wells in the vicinity of the former lagoons. Requirements for cap maintenance, monitoring and future use limitations for the lagoon areas will be addressed via environmental easements and/or deed restrictions, as specified in the Site Management Plan..

9.0 REFERENCES

The following is a list of significant references used in preparation of this report. Other documents, including project correspondence documents and records maintained in Buffalo Color Corporation files, were used to supplement the information obtained from the references listed below.

1. Buffalo Color Corp., June 30, 1977, closing documents, “Acquisition of Dye Plant from Allied Chemical Corp.”

2. Buffalo Color Corp., not dated, tabular listing of dye plant storage tanks and historical releases and spills.

3. Buffalo Color Corp. not dated, computer spreadsheet printout showing dye plant historical chemical usage by chemical name and date.

4. Buffalo Color Corp. vs Allied Signal, Inc. Case Number 97-CV-478C, Item 15, Affidavit of David Sauer, including exhibits.

5. Conestoga-Rovers & Associates, November 26, 2002, “New York State Inactive Site Registry Listing Evaluation, Buffalo Color Corp. Plan Site”.

6. Golder Associates, April 1995, “Report on RCRA Facility Investigation Task 1, Description of Current Conditions, Buffalo Color Corporation, Buffalo, New York”.

7. Golder Associates, November 1997, “Final Report on RCRA Facility Investigation, Buffalo Color Corporation, Buffalo, New York”.

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9. Golder Associates, January 2000, “Report on Corrective Measures Study, Buffalo Color Corporation, Buffalo, New York”.

10. MACTEC Engineering and Consulting, Inc., March 2006, “Final Operations, Maintenance & Monitoring Plan, Interim Corrective Measure, Buffalo Color Area ABCE, Buffalo, New York”.

11. New York State Department of Environmental Conservation, February 9, 1988, letter to Joseph Sciascia (NYSDEC) from T. J. Wlodarczak (Buffalo Color), with attachments.

12. New York State Department of Environmental Conservation, May 15, 1991, letter to G. Bolles (Buffalo Color Corp.) from Paul Counterman (NYSDEC Bureau of Hazardous Waste and Facility Management, regarding Preliminary Draft Part 373 Permit.

13. New York State Department of Environmental Conservation, 1988, questionnaires completed by former employees of the Allied Chemical Buffalo Dye Plant.

14. New York State Department of Environmental Conservation, December 25, 2002, “Draft DER-10 Technical Guidance for Site Investigation and Remediation”.

15. New York State Department of Environmental Conservation, Division of Solid & Hazardous Materials, November 7, 2001, “Draft Statement of Basis for Buffalo Color Corporation”.

16. New York State Department of Health, Center for Environmental Health, Bureau of Environmental Exposure Investigation, February 2005, “Guidance for Evaluating Soil Vapor Intrusion in the State of New York, Public Comment Draft”.

17. O’Brien & Gere, 2000, “Certification Report, Buffalo Color Area D”, Section 2.17.1.

18. Order on Consent, New York Department of Environmental Conservation, File No. 02-04, Index No. B9-0512-0105, effective date March 25, 2005.