SWMU 1
Corrective Measures Study
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Prepared for

Hampshire Chemical Corp.

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CH2MHILL®

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Acronyms and Abbreviations

µg/L	micrograms per liter
amsl	above mean sea level
AOC	area of concern
bgs	below ground surface
CFR	Code of Federal Regulations
cm/sec	centimeter per second
CMS	corrective measures study
COC	constituent of concern
CSM	conceptual site model
DER	Division of Environmental Remediation
DOT	Department of Transportation
Dow	The Dow Chemical Company
facility	former Hampshire Chemical Corp. facility located at 228 East Main Street, Waterloo, New York
HASP	health and safety plan
HAZWOPER	hazardous waste operations
HCC	Hampshire Chemical Corp.
HSM	Health and Safety Manager
IC	institutional control
ID	identification
IDW	investigation-derived waste
LLDPE	linear low-density polyethylene
mg/kg	milligrams per kilogram
MMP	materials management plan
MW	monitoring well
NPV	net present value
NYCRR	New York Codes, Rules and Regulations

NYSCC	New York State Canal Corporation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operations and maintenance
OBG	O'Brien and Gere Engineers, Inc.
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PM_{10}	particulate matter less than 10 microns
PPE	personal protective equipment
QC	quality control
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
RTA	remedial target area
SAOC	Second Amended Order on Consent
SCG	standards, criteria, and guidance
SCO	soil cleanup objectives
SVOC	semivolatile organic compound
SWMU	solid waste management unit
T&D	transport and disposal
TAGM	Technical and Administrative Guidance Memorandum
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TMV	toxicity, mobility, or volume
TOGS	Technical and Operational Guidance Series
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WWTP	wastewater treatment plant

SECTION 1

Introduction

This corrective measures study (CMS) for Solid Waste Management Unit 1 (SWMU 1) at the former Hampshire Chemical Corp. (HCC) facility located at 228 East Main Street, Waterloo, New York, has been prepared pursuant to a Second Amended Order on Consent (SAOC) executed between HCC and the New York State Department of Environmental Conservation (NYSDEC), Index Number 8-20000218-3281, dated August 12, 2011 (NYSDEC 2011) to conduct Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) and implement appropriate corrective measures at the facility (Figure 1-1). HCC has retained environmental liabilities for the facility in accordance with the terms described in the purchase agreement between HCC and Bruno Bock, the current property owner. Discussions on several Areas of Concern (AOCs) and SWMUs, including SWMU 1 (Figure 1-2), have been included in the 2004 and 2006 RFI reports and the 2008 RFI Addendum (CH2M HILL 2004, 2006, 2008).

This CMS generally follows the procedures outlined in the NYSDEC Division of Environmental Remediation (DER)-10/Technical Guidance for Site Investigation and Remediation (NYSDEC 2010a). DER-10 is a NYSDEC program policy that provides guidance for DER and regulated entities on how to conduct investigation and remediation work at applicable sites.

1.1 Purpose and Objectives

This CMS provides the justification for developing and evaluating potential interim corrective action alternatives for the remedial target area (RTA) at SWMU 1, as identified by various phases of investigation, and proposes a remedy for addressing the defined area. While the alternatives evaluated within this document are being defined as a CMS, the goal of this study is to evaluate proposed corrective measures in accordance with DER-10, and thus provide a comprehensive evaluation of alternatives. This evaluation is a detailed alternatives study as outlined in DER-10 and the goal is that the CMS ultimately will provide the final corrective measures at the time of developing the facility-wide CMS.

The extent of the RTA proposed for a CMS and addressed in this document is shown on Figure 1-3. The CMS remedy for SWMU 1 will address the area of impacted soil and the debris and waste (bottle waste) within the property line of the former HCC (currently Evans Chemetics) property, the New York State Canal Corporation (NYSCC) right-of-way immediately south of SWMU 1, and the area of buried waste near a former resident house previously located southwest of SWMU 1 (Figure 1-3). The CMS remedy also will address limiting exposure and direct contact with the waste and a means to monitor the potential of future landfill bottle breakage and the consequential release of the bottles' liquid constituents into groundwater.

1.2 Site Description and Background

The facility is located at 228 East Main Street, Waterloo, New York. Waterloo, which is located in the north-central portion of Seneca County, New York, historically has been a rural agricultural area. The facility is bordered to the north by East Main Street, to the east by residential properties, to the west by East Water Street, and to the south by the Cayuga-Seneca Canal. The facility is surrounded by residential properties (north, east, and southwest), commercial businesses (to the west), and the Cayuga-Seneca Canal (to the south). South of the canal are some residences, warehouses, and farther downstream is the Village of Waterloo wastewater treatment plant (WWTP). Bruno Bock also owns property on the eastern side of Gorham Street where the employee parking lot for the site is located.

The facility consists of 8.3 acres of industrially developed land, containing several interconnected buildings that house offices; a quality control (QC) laboratory; manufacturing, maintenance, and shipping/receiving operations; and a WWTP. The site also includes outside drum storage areas and several aboveground storage tanks. An undeveloped open area containing a former dump is located near the southwestern boundary of the facility.

SWMU 1 is in the western area of the site. It is bounded to the east by the facility, to the south by the Cayuga-Seneca Canal, to the west by East Water Street, and to the north by the facility raceway. Figure 1-2 shows the location and configuration of SWMU 1 relative to the surrounding features and the facility, and NYSCC land.

1.2.1 Site History

The facility was first owned and operated by the Waterloo Woolen Manufacturing Company, which operated a woolen textile mill from before 1839[1] until approximately 1936, when the mill was closed. The facility was later reopened in 1943 by Evans Chemetics and produces divalent organic sulfur chemical intermediates to this day.

The facility was acquired by the W.R. Grace Company in 1979 and remained a part of Grace's Organic Chemical Division until 1992, when HCC completed a management buyout of the Organic Chemical Division. Evans Chemetics was part of the management buyout, and the facility became an operating unit of HCC. In 1995, while HCC remained the owner of the facility, HCC was purchased by and became a wholly owned subsidiary of Sentrachem, Ltd., a South African chemical company. In 1997, Sentrachem was acquired as a wholly owned subsidiary of The Dow Chemical Company (Dow). In 2005, Dow sold the facility (as well as other assets of Evans Chemetics) to Bruno Bock[2], a German manufacturing company. Evans Chemetics LP is now a wholly owned subsidiary of Bruno Bock and operates the site.

The facility has undergone significant changes over time. A number of onsite buildings were constructed in the mid- to late-1800s, but most of which were subsequently demolished. The Cayuga-Seneca Canal and Raceway system was much more extensive in the late 1800s and early 1900s than it is today. Since 1943, many of the old canals and raceways were gradually filled, old buildings demolished, and new buildings constructed. Figure 1-3 depicts the boundary of the waste and debris associated with the former Village of Waterloo Dump as identified during various phases of RFI investigations.

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[1] The oldest standing onsite building dates from 1839; however, there are indications buildings were onsite before that time.

[2] The Evans Chemetics facility is no longer associated with HCC. Dow sold assets of the Evans Chemetics facility to Bruno Bock (CH2M HILL 2006).

1.2.2 SWMU 1 History

Before the Village of Waterloo used the SWMU 1 area for a landfill, and based on Sanborn fire insurance maps from 1886 to 1911, the area was used for woolen mill operations (known as the West Mill). The locations of the former raceways in and around SWMU 1 are shown on Figure 1-3. The main raceway that supported the West Mill, which ran south of the building, had a lock system. Another smaller raceway appears to have been a waterway connection to the existing raceway, which was likely a waterfall based on the hydraulic head difference between the existing raceway and canal.

Based on an October 1918 Sanborn fire insurance map of the site, an area within the western portion of SWMU 1 is identified as the Village of Waterloo Dump. The Sanborn map also shows that the western portion of the large raceway south of the building was filled. Aerial photos from 1938 and 1954 also show the western portion of the former raceways as filled and the West Mill present. According to the *RCRA Facility Assessment Report* (A.T. Kearney 1993), the former Village of Waterloo Dump was probably in operation at the western edge of the site until 1951 (O'Brien & Gere Engineers, Inc. [OBG] 2003). The Village of Waterloo Dump appears to have been closed by 1954 based on the extent of grass and tree vegetation observed on the aerial photos.

Based on the Sanborn and aerial maps, it appears that the raceways west of the lock were filled in the 1910s to 1920s; the type of fill material used is unknown. The West Mill was removed between 1954 and 1959, and the remaining raceways were filled by 1963.

Correlation of SWMU 7 Investigation to SWMU 1

A soil investigation was conducted at SWMU 7 and SWMU 8, along with a limited soil removal near SWMU 7 in 1999. SWMU 7 was a hazardous container storage facility and SWMU 8 was a former nonhazardous waste storage facility. Both SWMU 7 and SWMU 8 were located near the construction footprint of a new WWTP. The investigation work was completed by Radian International and is documented in the *SWMU 7 and 8 Investigation Report, Evans Chemetics Facility, Waterloo, New York* (Radian International 1999). Soil samples were collected in June and July 1999 from the area immediately underlying SWMU 7 and the portion of SWMU 8 where the concrete was removed. The soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals. Soil samples collected in July 1999 also were analyzed for pesticides and total cyanide.

Chloroform was the only organic compound reported in the SWMU 7 soils above the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) cleanup level, and only exceeded the cleanup level in one sample. Other VOCs, metals, polynuclear hydrocarbons (PAHs), and PCBs were detected, but none above their respective TAGM cleanup level.

Based on these sample results from SWMU 7, soil at the location where chloroform exceeded TAGM was excavated vertically to a depth of 3 feet and laterally to approximately 20 feet by 20 feet area in August 1999. Upon completion of the soil excavation, six additional samples were collected from the floor and sidewalls of the excavation to confirm the remaining soils met the NYSDEC TAGM guidance criteria. These samples were analyzed for chloroform only. None of the confirmatory samples reported chloroform above the NYSDEC TAGM guidance criteria.

The soil removed from the excavation was placed into rolloff containers, sampled and analyzed for toxicity characteristic leaching procedure (TCLP) components, including VOCs, SVOCs, PCBs, chlorinated herbicides, ignitability, reactivity, pH, and TCLP metals. The material was characterized as nonhazardous based on these waste characterization analyses and was transported to the Modern Landfill Facility in Model City, New York, for disposal as nonhazardous waste.

Based on communication with Evans Chemetics, it was determined that some excavated soil materials generated during the construction of the new WWTP tank area (near SWMU 7 and SMWU 8) were placed on SWMU 1. However, a significant amount of investigational work has been conducted at SWMU 1 to determine the extent of waste and any associated environmental impacts. Based on the RFI and RFI Addendum investigations (CH2M HILL 2004, 2008), benzo(a)pyrene and dibenzo(a,h)anthracene were the only constituents detected above NYSDEC soil cleanup objective (SCO) industrial screening criteria in surface soil samples from the SWMU 1 cover, and only exceeded NYSDEC SCO industrial criteria in two (SS-04 and LFB-04) of the 15 surface soil sampling locations at SWMU 1 (Figure 1-3). Benzo(a)pyrene exceeded criteria at location LFB-04 by 0.1 mg/kg (1.2 mg/kg was the sample result as compared to the criteria is 1.1 mg/kg). The exceedances of benzo(a)pyrene and dibenzo(a,h)anthracene in soil at location SS-04 were only at 0-2 inches below ground surface (bgs); dibenzo(a,h)anthracene result exceeded criteria by only 0.29 mg/kg (1.39 mg/kg was the estimated result as compared to the criteria 1.1 mg/kg). Because both SS-04 and LFB-04 are near the asphalt roadway that crosses over SWMU 1, the presence of PAHs in surface soils at these two locations could be from runoff of the asphalt roadway. In addition, the detections of PAHs in the surface soils within the SWMU 1 cover do not correlate with the detection of VOCs, specifically chloroform, in soils at SWMU 7. Thus, the two minor detections of PAHs in the surficial soil at SWMU 1 are likely due to runoff, not historical impacts.

Later in December 2007, additional soil samples were collected as part of RFI, and human health and ecological risk assessments were performed using the available analytical results. The results collected from the SWMU 1 cover confirmed that no potential ecological and/or human health direct-contact risks existed (CH2M HILL 2008). Accordingly, the cover soil at SWMU 1 does not present a risk to human or ecological receptors and is not considered to be a waste material.

1.2.3 SWMU 1 Regulatory Background

The State of New York first established waste management regulations through the New York State Department of Health (NYSDOH) Part 19, Refuse Disposal in 1963 (NYSDOH 1963), and was later included under the NYSDEC, 6 New York Codes, Rules, and Regulations (NYCRR) Part 360, Refuse Disposal in 1973 (NYSDEC 1973) (Appendix A). Requirements established for final closure were similar between the NYSDOH Part 19 and 6 NYCRR Part 360 versions, which included a final cover over the refuse area of at least 2 feet of suitable compacted cover material.

Closure and post-closure requirements of landfills depend on the dates of operation of the landfill facility. Landfills that have ceased to accept waste before October 9, 1993 (with or without approved closure plans) must meet the NYCRR closure and post-closure requirements in effect when the facility ceased normal operation.

As formerly stated, Sanborn fire insurance maps of the site indicate the area along the western side of SWMU 1 was identified as the Village of Waterloo Dump as early as 1918 and that the dump was in operation at the western edge of the site until approximately 1951, suggesting an operation period of at least 33 years. The dump was closed by 1954 based on the extent of grass and tree vegetation observed on the aerial photos. As discussed above, the placement of soil in SWMU 1 in 1999, which did not include SWMU 7 soils, is not waste disposal, and therefore, is not waste disposal after 1973. It did not cause the previously closed landfill to be reopened. Thus, the relevant closure date for determining the applicability or inapplicability of closure requirements is the early 1950s.

The proposed approach for the closed Village of Waterloo Dump is to place an enhanced cover on it. This cover is anticipated to be comprised of 2 feet of low permeability soil. This approach is consistent with the applicable requirements.

1.3 Report Organization

This CMS work plan is organized into the following sections:

- **Section 1 -Introduction:** Briefly describes the regulatory framework, purpose and objectives, site description and background, regulatory framework and background, and report organization.
- **Section 2 - Description of Current Conditions:** Summarizes the physical characteristics, hydrogeology, and extent of constituent of concern (COC) impacts, and the potential pathways of site COCs to receptors.
- **Section 3 - Remedial Goals and Remedial Action Objectives** (RAOs): Defines the goals and objectives that are to be met for the RTA.
- **Section 4 - General Response Actions and Remedial Technology Screening:** Defines the basic actions and technologies that may be applicable to remediate a site.
- **Section 5 - Alternatives Development:** Presents the general description of each alternative, and its advantages and disadvantages.
- **Section 6 - Evaluation of Remedial Alternatives:** Presents the general description of each alternative, its advantages and disadvantages, and evaluates the effectiveness, implementability, and cost of the retained alternatives.
- **Section 7 - Proposed Alternative:** Recommends a final CMS alternative.
- **Section 8 - Performance and Operations Monitoring:** Summarizes the purpose and types of monitoring programs and monitoring documents that will be developed.
- **Section 9 - Permits:** Lists and describes the purposes of permits that will be needed to implement the CMS and the associated regulatory agencies that will receive and process the permit applications.

- **Section 10 - Waste Management and Disposal:** Describes the waste streams that will be generated, and how each waste stream will be managed until disposal at an approved offsite disposal facilities.
- **Section 11 - Project Schedule:** Provides a schedule that shows milestones for the deliverables, submittal dates, and regulatory review timeframe.
- **Section 12 - References:** Provides the references cited in the report.

SECTION 2

Description of Current Conditions

2.1 Physical Characteristics

The boundary of the SWMU 1 area shown on Figure 1-3 is defined as the area known to have accepted waste as the Village of Waterloo Dump as shown on historical Sanborn maps of the site and based on extent of lateral waste found up to 2008. As RFIs progressed since 2008, the lateral and horizontal extent of the waste- and debris-impacted area at SWMU 1 continued to be delineated. The current boundary identifying the extent of waste and debris is represented on Figure 1-3, which shows the waste and debris extending from the facility property south onto NYSCC property. NYSCC owns the right-of-way extending south of SWMU 1 and parallel to the canal. The area of waste and debris has an approximate extent of 2.1 acres.

The existing waste and debris at SWMU 1 comprise residential and industrial waste generated by the Village of Waterloo and the facility. The waste and debris below the non-native soil cover (fill material) layer include glass and plastic fragments, scrap metal, black ash and coal, ceramics, shoes, brake pads, copper wire, tires, cobbles, bricks, wood, and metal scrap, porcelain, and/or wood fragments. Numerous intact glass bottles containing white and clear liquids were also found in some areas.

A paved access road runs from East Water Street through SWMU 1 and east into the facility and is used by large haul trucks for Evans Chemetics product transportation.

The area north of the access road and south of the raceway is gravel-covered. In this area, and as seen on the conceptual site model (CSM; Figure 2-1), there is a covered shelter for drum staging and an adjacent area to the east that is also used for drum staging. West of the drum staging shelter, the gravel-covered area is used for large haul trucks to pull to the side of the access road and idle before entering the facility, as needed. Large plastic totes that hold liquid are staged on the gravel-covered area south of the access road.

The area south of the access roadway is vegetated and some of it is wooded. As seen on the CSM (Figure 2-1), a portion of the southern extent of SWMU 1 where waste and debris have been identified (as determined by soil borings and historical aerials) is on a former residential property now owned by HCC. The former residence has been purchased by HCC and has been demolished.

2.1.1 Topography

Topography plays a key role in discerning the potential direction of overland flow for rain or snowmelt (precipitation). Cross-sections in Appendix B illustrate the elevation variability across the site. The elevation across the site varies from approximately 453 feet above mean sea level (amsl) at the elevated soil mound area in the center of the site to approximately 436 feet amsl in the southern and southeastern areas of SWMU 1. The elevated soil area is south of the access road as illustrated within the oblong 450-foot amsl contour line and extends west-east-southeast (Appendix B). From this mounded area, the ground surface gently slopes down and north toward the raceway and south toward the canal. The dashed line shown on Figure 2-1 represents the elevated center point of the mounded area within SWMU 1 from which overland flow is diverted north or south.

2.1.2 Geology and Hydrogeology

The facility lies on the contact between the Lower Devonian age Manlius Limestone and Rondout Dolostone to the southeast and the Lower to Middle Devonian age Onondaga limestone to the northeast. These units overlie Silurian-age shales, dolomites, and sandstone. Below the Silurian sequence are the Ordovician-age shales, sandstones, shales, and limestones, which cap the Upper Cambrian dolomites and sandstones, and the Precambrian basement of gneiss, marble, and quartzite at depths of 5,000 feet below ground surface (bgs) (Van Tyne 1974, as summarized in Saroff 1987).

From the ground surface, the unconsolidated material overlying bedrock at SWMU 1 generally consists of non-native soil (fill material) that generally overlies waste and debris mixed with non-native soil. The above fill materials are usually underlain by native clay and/or glacial till, which in turn are underlain by limestone bedrock. At some locations, as within the former raceways, non-native material mixed with waste extends to the bedrock surface.

The non-native soil (fill material) consists of mostly silt and clay with some sand and gravel. The non-native material largely overlays the waste materials, although in some cases (on the south portion of SWMU 1), waste and debris have been observed at the ground surface. Laboratory tests of the geotechnical soil samples collected from the soil cover showed that the fill material from 0 to 5 feet bgs has a high percentage of silt and clay-sized material indicating that this material can be expected to behave more as clay than a sandy soil. Based on the Atterberg limits, the plasticity index varies from 6.8 to 24.2 percent and the liquid limit varies from 28.2 to 42.4 percent, which indicates the presence of inorganic clays of low to medium plasticity with a low shrink-swell potential. Permeability test results indicate that soil present up to a maximum depth of 5 feet bgs at the SWMU 1 area is of low permeability at 5.52×10^{-07} cm/sec (1.56×10^{-03} feet per day) to 9.71E-07 cm/sec (2.75×10^{-03} feet per day), which helps to reduce infiltration where present (CH2M HILL 2012a).

Native material, including clay and/or glacial till, overlies the bedrock. The bedrock material appears to be hard, fresh, fine-grained gray to very dark gray limestone. At the northwestern area of SWMU 1 (BS-09 and BS-14, as shown on Figure 4 in Appendix B), and at the southwestern area of SWMU 1 (BS-11 and BS-12), the top of bedrock appeared to dip slightly toward the former raceway. The top of bedrock at the eastern side of SWMU 1 appeared to dip in a southeasterly direction toward the canal (CH2M HILL 2012a). The elevation of the top of bedrock encountered by the borings varied from 429.4 feet amsl at BS-11 to 416.4 feet amsl at BS-06.

The water table intersects the non-native soil/waste and debris layer at approximately 9 to 23 feet bgs (CH2M HILL 2012b). The highest groundwater elevation of the 14 soil borings was measured at BS-09 (435.0 feet amsl), north of the former raceways. The lowest groundwater elevations were measured at BS-12 (427.2 feet amsl), southwest of the former raceway, and at BS-01 (427.8 feet amsl), southeast of the former raceways. The groundwater flow direction at SWMU 1 flows south toward the Cayuga–Seneca Canal.

A slope stability evaluation was performed along the slopes of the SWMU 1 area as part of the RFI Addendum (CH2M HILL 2008). As stated in accordance with the summary of the evaluation, there is minimal potential for structural instability within the existing western, eastern, northern, and most of the southern slopes of SWMU 1. The potential exists for future structural instability along the southern slope and near the eastern end of the southern slope. In addition, the potential exists for future surface erosion during large storm events in areas where vegetation is non-existent, sparse or not maintained, and at the canal bank near the eastern end of the landfill where waste and debris are present.

2.2 Summary of RCRA Facility Investigations

Several phases of RFIs have been performed at the site, and the detailed results of these investigations have been discussed in various reports submitted to NYSDEC. This section summarizes the results of the RFI activities performed at SWMU 1.

Before the investigation at SWMU 1, the raceway boundaries were constructed using historical maps, and a surveyor then located and marked out the former raceways and other structures in the field. The RFI sampling visit work plan (OBG 2001) proposed to evaluate the boundaries of the former Village of Waterloo Dump site with test pit excavations and an investigation as to whether there have been releases from the landfill. The sampling visit work was performed between December 2001 and March 2002 (OBG 2003).

As noted in the OBG sampling visit report (OBG 2003), nine test pits were completed in the SWMU 1 area to locate the former raceways, and describe the fill material encountered. Of these test pits, only one did not encounter the raceway walls or bottom. Intact glass bottles were found in one test pit. Six shallow and one intermediate groundwater monitoring wells were installed during the field activities. Groundwater sampling also was conducted at the monitoring wells and reported in the sampling visit report (OBG 2003).

In April and May 2004, CH2M HILL performed the RFI activities, which included excavating three test pits at SWMU 1. Approximately 7 cubic yards of fill material containing glass bottles and associated soil were removed from the excavations. Additional RFI work was performed by CH2M HILL in December 2005 that included the installation of five temporary piezometers. Groundwater sampling also was conducted at the site monitoring wells and temporary piezometers and documented in the RFI report (CH2M HILL 2006).

A slope stability and erosion evaluation was performed as part of the RFI Addendum to observe the current conditions of SWMU 1 and to address NYSDEC’s request that a CMS be conducted to evaluate options for reducing the risk of the exposed waste creating a hazard (CH2M HILL 2008).

In December 2009, 14 test pits were excavated and visually assessed on property owned by the NYSCC, which is located along the southern side of the former HCC facility. Native material within the investigation area was overlain by a silty sand fill material, intermixed with ash, rocks, bottleware, and glassware, including small bottles, as well as construction debris (including concrete and brick). The area where bottles were observed that may be associated with facility operations also contained municipal waste and construction debris, which is not believed to be site related. Within the test pits completed during this field event, no stained soils, elevated photoionization detector (PID) readings, or indications of discharges were observed.

Additional investigations for waste delineation near the former residence house (Appendix C) and subsurface methane survey (Appendix D) were completed at SWMU 1 and reported in 2013. Waste located on the residential property was removed during the house demolition and canal dewatering pad construction and disposed of offsite at an approved landfill.

All of the above investigations were conducted to present a comprehensive site history and provide site-specific COC information. Groundwater data collected in 2012 were used to supplement historical groundwater data in this CMS and have been submitted to NYSDEC in the first quarter of 2013 in the *Groundwater Monitoring Results Report April and October 2012 Monitoring Events* report (CH2M HILL 2013a).

The investigation data were used to develop a CSM that depicts how constituents may mobilize and migrate from impacted soil and identifies the potential receptors for SWMU 1 (Figure 2-1).

2.3 Identification and Extent of Waste

In 2001, test pits were excavated within SWMU 1 to identify fill material and locate the former raceways (OBG 2003). Cover and fill material was placed over the native deposits across most of the site. The fill material on the eastern, northern, and southern areas of the SWMU generally consists of silt, sand, and gravel with varying amounts of brick fragments, filter fabric material, cinder, ash, ceramic, scrap metal, glass and plastic bottles, wood, shoes, copper wires, and tires. This fill presumably was placed during development of the property to raise low-lying areas and fill in raceway structures to facilitate construction. Test pits completed on the western side of SWMU 1 (TP-6 and TP-7) indicate the fill thickness ranges from approximately 10 to 20 feet. Fill material on the western side of the SWMU consists of cobbles, bricks, concrete, wood, and scrap metal, with smaller pockets of ashes, coal, and glass fragments. The thickest fill deposits are on the western portion of the site.

Intact bottles were identified in TP-9, located on the eastern side of SWMU 1. Some of the bottleware identified in TP-9 contained a thick, white-colored liquid. The liquid material from three bottles was sampled and sent to a laboratory for analyses. Acetone was the only organic compound reported in the liquid samples at a concentration of 90,000 micrograms per liter (µg/L), in addition to the metals zinc, sodium, and lead.

Information from soil and well boring logs indicate the fill material extends to the east along the southern side of the manufacturing area and the edge of the canal. It appears a limited amount (less than 3 feet) of fill was placed on the northeastern side of the facility, which is consistent with the location of some of the original buildings.

Additional test pits were completed in 2009 south of SWMU 1 and within the NYSCC right-of-way. Native material was overlain by a silty sand fill material approximately 2 to 7.5 feet thick, intermixed with ash, rocks, bottleware, and glassware including the small bottles that are consistent with those observed during the April 2008 field event, as well as construction debris (including concrete and brick). The area where bottles were observed that may be associated with facility operations also is impacted with municipal waste and construction debris, which is not believed to be site related. In the test pits completed during this field event, no stained soils, elevated PID readings, or indications of discharges were observed.

Based on visual observations, all 14 test pits exhibited a heterogeneous mixture of municipal waste and construction debris over an average depth of 5.5 feet bgs (debris depths ranged from 2 to 7.5 feet bgs), which represents an approximate volume of 2,175 cubic yards of soil impacted with debris of this nature within the investigation area.

Bottles consistent with those observed during the April 2008 field event were identified in 11 of the test pits (TP-01, TP-02, TP-04, TP-05, TP-06, TP-07, TP-08, TP-09, TP-10, TP-11, and TP-13), and although at varying percentages, the bottles were intermixed with municipal waste and construction debris. An approximate volume of 1,500 cubic yards (1,177 cubic yards associated with Bottle Area 11 and 333 cubic yards associated with Bottle Area 12) of debris is impacted with the small bottles previously observed during the April 2008 field event.

Construction debris and cut stone blocks along the southeastern slope and toe of the landfill provide additional stability to the slope and reduce erosion. Waste including debris, bottles, and other trash has been identified along the canal bank near the southeastern end of the landfill where the landfill toe is estimated to be approximately 20 feet from the canal bank. In addition, bottleware and metal waste were identified on the ground surface within the NYSCC right-of-way.

2.4 Identification and Extent of COCs Impact

The RTA, the area where waste and debris are present, covers approximately 2.1 acres. Based upon the waste materials observed in the test pits, monitoring well boring logs, and soil boring logs at SWMU 1, it is estimated that the depth of waste and debris comprises the upper 5- to 15-foot bgs interval. In addition, based on these observations, the volume of SWMU 1 being addressed by corrective measures is approximately 50,000 cubic yards.

2.4.1 Soil

Soil data collected from surface and subsurface sample locations at SWMU 1 show limited soil impact at one surface and one subsurface sample locations of a maximum of two SVOCs. The two SVOCS are PAHs, benzo(a)pyrene and dibenzo(a,h)anthracene, and are the only constituents found in surface soil in SWMU 1 that have been detected above the NYSDEC SCO industrial screening criteria. The two locations, LFB-04 and SWMU1-SS-04, with PAH concentrations exceeding the NYSDEC SCO industrial criteria are shown on Figure 1-3.

Soil sample location LFB-04 had a detection (1.2 milligrams per kilogram [mg/kg]) of benzo(a)pyrene above its NYSDEC SCO industrial criterion (1.1 mg/kg).

Soil sample SWMU1-SS-04 had detections of two PAHs. The SWMU1-SS-04A (0 to 2 inches bgs) sample had detections of both benzo(a)pyrene (7.75 mg/kg) and dibenzo(a,h)anthracene (1.39 J mg/kg) above the NYSDEC SCO industrial criteria (1.1 mg/kg). The SWMU1-SS-04B (2 to 12 inches bgs) sample had a benzo(a)pyrene detection (3.73 mg/kg) above the NYSDEC SCO industrial criterion (1.1 mg/kg).

Human health and ecological risk assessments were performed as part of the RFI addendum in 2007 and concluded there are no potential ecological and/or human health direct contact risks based on the SWMU 1 soil sample results (CH2M HILL 2008). These SVOCs are not known to have been used in the production process or analytical laboratory, but may be related to historical storage of coal and use of coal-fired boilers at the facility and/or paving of roadways, and are not likely attributable to individual SWMUs or AOCs. In 2012, seven additional soil borings (BS-15 through BS-21) were completed to delineate the southern extent of landfill materials. Information on these borings is summarized in the *SWMU 1 Additional Fill Survey Technical Memorandum* in Appendix C.

2.4.2 Groundwater

In April and May 2004, three test pits were excavated at SWMU 1. Approximately 7 cubic yards of fill material containing glass bottles and associated soil were removed from the excavations. Acetone also was found at a concentration of 90,000 μg/L in liquid from an intact glass bottle retrieved from an open excavation (CH2M HILL 2004). A water sample collected from the TP-9-1 excavation was found to have an acetone concentration of 194 μg/L, which is above the Technical and Operational Guidance Series (TOGS) standard (50 μg/L) (NYSDEC 1998; CH2M HILL 2004). Nine additional test pits were excavated in 2006 in the western portion of the site, which confirmed the boundaries of the former raceways and provided information about the extent and characteristics of the fill material (CH2M HILL 2006). A number of intact glass bottles containing a thick, white-colored liquid were encountered. Analytical results of the liquid content from the bottles reported acetone and select metals.

Groundwater samples were collected from the existing monitoring well network in the SWMU 1 area (MW-14, MW-15, MW-16S/I, MW-17, MW-18, MW-26, MW-27, MW-28, TW-01, and TW-02) (Figure 1-2). The only VOC exceedance occurred in 2002 from a groundwater sample collected at MW-17, which reported acetone at 75 J μg/L and exceeding the TOGS criterion of 50 μg/L. Acetone has not been detected since 2002.

PAHs historically have been detected in SWMU 1 groundwater samples (2002 to 2011). Groundwater samples collected from five of the site wells (MW-15, MW-16, MW-28, TW-01, and TW-02) have reported concentrations of select PAHs above their associated TOGS standards (CH2M HILL 2012b). For the recent 2012 sitewide sampling event, groundwater samples collected from only two monitoring wells (MW-28 and TW-01) reported PAHs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene above their respective TOGS criteria. Based on historical groundwater data from 2002 to present, PAHs in groundwater appear to be decreasing in concentrations over time. PAHs are not believed to be associated with landfilling activities.

Total metals (iron, manganese, magnesium, and sodium) historically have been detected above their associated TOGS in the 11 SWMU 1 monitoring wells. The elevated concentrations of iron, manganese, magnesium, and sodium (exceeding respective TOGS) in groundwater at SWMU 1 are consistent with historically elevated concentrations of sodium and sporadically elevated concentrations of manganese, magnesium, and iron in groundwater from background wells MW-05S and MW-06. In 2012, groundwater samples from the 11 SWMU 1 monitoring wells had concentrations of iron, magnesium, manganese, and sodium above the associated TOGS criteria. Other compounds such as chloride and sulfate exceeded the TOGS criteria in groundwater from a maximum of only four monitoring wells.

As indicated by the analytical results of the annual sitewide sampling events, the concentrations of constituents in site groundwater appear to be stable or generally trending lower over time (CH2M HILL 2008, 2012b, 2013a). In general, concentrations of metals in groundwater at SWMU 1 appear to be consistent with background concentrations.

2.4.3 Soil Vapor and Methane Gas

In December 2007, soil vapor points SGP-09 and SGP-10 were installed and soil vapor was sampled. The soil vapor probes were installed to depths of 6 feet bgs and 7.5 feet bgs at SGP-09 and SGP-10, respectively. In addition to the soil vapor samples, an ambient air sample was collected in the vicinity of SWMU 1 concurrent with the soil vapor samples to document background conditions.

Based on data collected from this soil gas investigation, it was concluded that the VOCs detected in the SWMU 1 soil vapor samples are likely to present a vapor intrusion concern (CH2M HILL 2008). Data collected to evaluate the potential soil vapor intrusion pathways to the residential property downgradient of SWMU 1 identified methyl ethyl ketone (2-butanone) and methyl isobutyl ketone (4-methyl-2-pentanone) at lower concentrations in the residential property crawl space air sample than in the SWMU 1 soil vapor samples, which suggested these compounds in the residential property indoor air did not appear to be related to vapor intrusion (CH2M HILL 2011a). However, the former residential property was recently demolished in November 2013, and thereby removing any potential vapor intrusion issues within the former house.

In October and November 2012, a methane gas survey was conducted at SWMU 1 to evaluate conditions within the subsurface and support the corrective measures included in the CMS work plan (Appendix D). The survey used six existing shallow groundwater monitoring wells at SWMU 1 retrofitted with a cap/labcock valve. It was concluded that the current methane, oxygen, and carbon dioxide levels measured at each of the SWMU 1 sampling locations appear to indicate more aerobic conditions that would not favor the production of methane gas. In addition, since the methane levels in all six monitoring locations were not higher than 0.1 percent (by volume) and significantly lower than the lower explosive limit (5 percent by volume), and the duration of time that the waste has been buried at SWMU 1 (more than 60 years) is significantly beyond the peak of landfill gas production (generally 5 to 7 years after burial), the presence of methane gas in the subsurface due to waste decomposition would not be expected. Low to nondetected levels of methane at SWMU 1 would not present a concern for offsite vapor intrusion.

2.5 Potential COC Migration Pathways and Proximal Receptors

2.5.1 Potential Direct Contact to Site Workers, Trespasser, and Ecological Habitat

Direct exposure to waste materials, including broken glass and sharp metal and wood debris, could occur through dermal contact. Bottleware on the ground surface or slightly below the ground surface could break and create sharp broken pieces. Site workers, trespassers, and/or ecological receptors could have dermal contact and injury with the sharp pieces of debris. Therefore, direct contact with the waste debris is considered a potential receptor pathway.

Two PAHs (benzo(a)pyrene and dibenzo(a,h)anthracene) were detected in surface soils at two locations above the NYSDEC SCO industrial soil screening criteria at SWMU 1. Direct exposure to surface soil could occur via inhalation and/or ingestion. During movement of soil such as grading, dust could be created and site workers, trespassers, and/or ecological receptors could inhale the dust particles. If a human or animal has dermal contact with soil, ingestion of soil could occur intentionally or unintentionally via hand-to-mouth transfer. Accordingly, direct contact with surface soil and inhalation are considered potential receptor pathways.

2.5.2 Potential Migration via Overland Flow or Wind

Most of SWMU 1 is vegetated by grass, brush, or trees, and a small section of the northern area is covered with gravel and asphalt. The southern portion of SWMU 1 has less soil cover, and in some areas, bottles and/or waste are present at the surface. An evaluation of the stability of the slope of SWMU 1 was completed in 2008 and showed that because of the vegetation cover, no immediate threat to erosion of waste and/or bottles is present in this area. However, within the southeastern area of the landfill, the migration of waste and/or bottles that are on or near the ground surface could be considered a minor potential pathway.

2.5.3 Potential Impact to Groundwater

Waste and debris have been identified in the subsurface as well as along the surface at SWMU 1. Presently, the waste material, including the bottleware and their associated contents, do not seem to be affecting groundwater even though that potential may exist in the future.

The current soil cover at SWMU 1 is generally a clayey sand with well-graded gravel. Infiltration is minimized because of the mounded nature of the ground surface, asphalt from the access roadway, and presence of clayey sands in the current soil cover. Only two PAHs (benzo(a)pyrene and dibenzo(a,h)anthracene) were detected in surface soil above the NYSDEC SCO industrial criteria. Because of the aromatic ring structures exhibited by PAHs, the compounds tend to bind to soil particles, and therefore have low relative mobility. Therefore, impact to groundwater by the waste materials currently is considered a minor potential pathway at SWMU 1.

2.5.4 Potential Groundwater Migration Offsite

As previously discussed, concentrations of select PAHs in surficial aquifer groundwater samples historically have been detected above their associated TOGS criteria. There is the potential for release of liquid materials from the landfilled bottleware if breakage were to occur. If the liquid material from broken bottleware were to reach the water table, the constituents could migrate offsite and toward the canal. Therefore, groundwater migration offsite is considered a minor potential pathway at SWMU 1.

2.5.5 Potential Vapor Migration Offsite

Waste materials in the subsurface, including the liquid contents of the bottleware, could potentially create a vapor intrusion concern. Analytical results of the liquid content of some of the bottleware from test pit TP-9 reported the presence of VOCs. Therefore, the potential for vapor migration offsite could exist if the bottleware were broken and released the liquid contents into the surrounding environment.

Since 2002, only once has a VOC (acetone) concentration exceeded its applicable TOGS criterion in groundwater for the SWMU 1 monitoring well network. Based on the data collected from the 2007 soil vapor investigation, it was concluded that none of the COCs detected in the SWMU 1 soil vapor samples is likely to present a vapor intrusion concern (CH2M HILL 2008). In addition, based on the subsurface methane survey conducted at SWMU 1 in 2012, the absence of methane indicates explosive conditions in the subsurface are not favorable (CH2M HILL 2013c). In addition, the closest off-site business is located approximately 400 feet northwest of the center of the SWMU 1. Therefore, indirect exposure through vapor migration or intrusion is considered an incomplete pathway from site soil, and groundwater was not considered as part of this CMS.

SECTION 3

Remedial Goals and Remedial Action Objectives

Remedial goals and RAOs form the basis for identifying remedial technologies appropriate to site conditions, screening technologies, and assembling accepted technologies into remedial alternatives for evaluation.

3.1 Remedial Goals

The remediation goals that will help achieve the site's RAOs are outlined in the SAOC (NYSDEC 2011). The SAOC specifies that impacted soil on the facility or soil that has migrated from the facility must not exceed state and federal regulatory limits that are promulgated at the time of the approval of the corrective measures, guidance values, or other criteria developed as part of the RCRA corrective action program. The remedial criteria associated with this remedial goal are:

- Eliminate hazards posed by exposed waste and debris
- Manage contaminated soil and bottleware waste appropriately to prevent human and ecological exposure, and prevent migration from the facility
- Ensure that contaminated soil or groundwater on or migrating from the facility does not pose a threat to human health or the environment

3.2 Remedial Action Objectives

RAOs are medium or operable-unit-specific objectives for protecting public health and the environment and are developed based on contaminant-specific standards, criteria, and guidance (SCG) to address the contamination identified at a site (NYSDEC 2010a). NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation document (NYSDEC 2010a) serves as a guide in assigning primary consideration to remedial alternatives that attain or exceed RAOs.

The RAO for SWMU 1 is as follows:

- Minimize potential future exposure to humans and the environment posed by waste and debris within the SWMU 1 boundary, the canal right-of-way, and the area around the former resident.

DER-10 states that where applicable, generic RAOs identified on NYSDEC's website can be used for various media. NYSDEC's website provides a list of generic RAOs that can be used to develop RAOs and has the capability to develop site-specific RAOs based on site conditions. The generic RAOs are broken out as groundwater, soil, surface water, sediment, and soil vapor, with each having a component of protection of public health and the environment. Based on the target area defined and the potentially complete pathways for

COC migration presented in this CMS, the only potentially applicable RAOs are for soil (as summarized in Section 2).

SECTION 4

General Response Actions and Remedial Technology Screening

4.1 General Response Actions

Identifying general response actions, which define basic actions required to remediate a site, forms the first step in the corrective measures analysis process. For the SWMU 1 area, it is a goal that the effectiveness of the proposed CMS will be proven such that the CMS will ultimately be documented as the final corrective measure as part of the sitewide CMS. Each general response action may involve several remedial technologies. Moreover, each technology may break down into multiple process options. Once developed, technologies and process options then are screened based on several criteria. Technologies and process options retained after screening then are assembled into alternatives, which are discussed in Section 6. The following is a presentation of general response actions that may prove applicable to the SWMU 1 area.

4.1.1 General Response Actions for Soil, Waste, and Groundwater at SWMU 1

The response area is approximately 2.1 acres where waste and debris are present. Waste and debris are assumed to be from 0 to 15 feet bgs depending on the area of the SWMU, which results in approximately 50,000 cubic yards of impacted soil and waste that requires implementation of corrective measures. Applicable general response actions focused on waste and debris include the following:

- No Action - Under the no further action response, no action would be taken.
- Institutional Controls (ICs) - ICs limiting intrusive activities, such as restrictive covenants on the property, may be necessary in concert with other actions.
- Monitoring - Monitoring involves the continued evaluation and inspection of types of engineering controls (soil and asphalt covers/caps) to maintain their effectiveness; in the case of the SWMU 1 area, this would involve the continued monitoring and maintenance of alternatives involving engineering controls. In addition, monitoring also includes continued monitoring of groundwater conditions as a part of the sitewide monitoring plan.
- Containment - Containment is used to minimize the risk of constituent migration and/or prevent direct contact exposures through covers and caps consisting of soils or asphalt.
- Grading – Grading is used to reshape topography to control infiltration, runoff, and erosion. Grading also is used to stabilize sloped surfaces of the landfill by placement of a geotextile matting and reseeding.
- Excavation and Disposal - Excavation and disposal are used to remove impacted soil for disposal at a controlled landfill. Excavation and disposal includes excavating the soils

containing waste/debris and transferring it to a permitted and approved offsite disposal facility. Clean backfill would be placed and compacted to reestablish the desired grade.

4.2 Technology Screening Methodology

This section presents the screening of technologies and process options. Screening starts with development of an inventory of technology types and process options based on professional experience, published sources, computer databases, and other available documentation coordinated to the general response actions identified in Section 4.1.

Each technology type and process option represents either a proven process or a potential process that has undergone laboratory trials or bench-scale testing. The screening of technology types and process options hinges on two factors, implementability and effectiveness. These factors encompass the following characteristics: the state of technology development, site conditions, waste characteristics, nature and extent of contamination, and the presence of constituents that could limit the effectiveness of the technology.

Implementability refers to the relative degree of difficulty anticipated in executing a particular process option under regulatory, technical, and schedule constraints posed at the site. Effectiveness describes the ability of the process option to perform as part of a comprehensive remedial plan to meet RAOs under the conditions and limitations present at the site. The effectiveness of a technology is the degree to which a technology or combination of technologies achieves reduction in toxicity, mobility, or volume (TMV), and complies with the RAOs for the site.

Following qualitative screening, remedial technologies and process options considered viable for remediating site media are carried forward for incorporation into potential alternatives.

SWMU 1 contains waste and debris. Therefore, technologies and process options for remediating soil were screened, while carrying through redundant technologies such as institutional controls, monitoring, etc. for the site's one medium (soil). Because groundwater impacts related to the waste material were not observed, and exceedances of metals are similar to concentrations reported in groundwater from background wells and not directly related to SWMU 1, technologies and process options for remediating groundwater were not evaluated. However, because of the potential for release of liquid materials into the subsurface from the landfilled bottleware if breakage were to occur, continued groundwater monitoring was included as a component of all of the alternatives developed.

4.2.1 Screening Technologies and Process Options

Appendix E presents the remedial technology screening and process options. The remedial technologies and process options retained after screening become available for inclusion in the remedial alternatives. Process options not considered implementable or effective were rejected for further consideration. This approach highlights differences within a remedial technology group to allow the best process within each group to be identified and selected.

The following technologies were evaluated for further consideration.

No Action

A no action response entails no remedial action. A no action general response action is retained through the CMS process as a baseline technology and alternative forming a basis for comparison with technologies and alternatives involving active remediation.

Institutional Controls

ICs for soil include restrictive measures limiting the potential access of the public to impacted area or the use of impacted soil. The nature and extent of the soil contamination would be specified and use would be restricted as deemed appropriate. ICs involve using signage, deed restrictions, environmental easements or notices, or similar measures to limit exposure. In accordance with DER-10, types of ICs include:

- Environmental easement is an IC used to impose land use limitations or requirements to protect current or future users from environmental contamination. Activities or uses that may be limited or required include prohibition of use of groundwater for potable purposes, restrictions on property uses, prohibition of certain uses of sites such as construction of basements or trenches, and/or operation or maintenance of engineering controls and reporting.
- Deed restriction is an IC used to identify the restrictions and requirements for the use of the site as set forth in the site management plan to assure the continued protectiveness of the site remedy, as necessary.
- Environmental notices are informational documents that may be filed with the county clerk or the registrar in New York City. Environmental notices may be used at the discretion of NYSDEC, when an environmental easement or deed restriction cannot be obtained from the owner of a site.

ICs were retained to develop the corrective measures.

Monitoring

Monitoring is performed to record site conditions (includes groundwater monitoring and inspection), confirm CMS effectiveness, and document continued establishment of remedial measures. Monitoring associated with the SWMU 1 area was retained and is expected to be used to verify engineering controls are maintained throughout the life cycle of the remedy. In addition, sentinel groundwater monitoring will be implemented over a duration agreeable to both parties to evaluate groundwater quality post-closure. If sustained impact is confirmed, appropriate action will be taken to protect existing canal water quality.

Engineering Controls

Engineering controls involve technologies that encapsulate the waste so it may remain in place and eliminate potential exposure. Specific types of engineering controls include coverings such as grading/consolidation of wastes, soil covers, soil caps, multilayer caps and/or asphalt caps. For the areas of a site where impacted soil exceeds the applicable SCOs for protection of human health and/or ecological resources, the soil cover/cap shall be at least 2 feet thick (commercial/industrial use) and may include a demarcation layer between the soil cover/cap and the impacted soil or waste that remain in place. A demarcation layer would not be included in areas where existing asphalt would act as a cap. The demarcation layer would be placed under the soil cover/caps and asphalt caps that would be constructed as a part of this CMS.

Containment via soil cover, soil capping, and asphalt capping were retained for development of remedial alternatives. Grading would be required as a part of soil cover, soil cap, or multilayer cap construction to enhance drainage and slope stability.

Excavation and Removal

This technology includes removing constituents from soil by physical methods (excavation and disposal). Excavated soil management consists of offsite disposal with imported soil backfill.

There is a significant concern over breakage of bottle waste during removal, which would affect soil and groundwater, and the process would be disruptive to surrounding area. It is possible that odor issues could arise through excavation activities and require active management. Therefore, this technology was not retained because of risk of bottle breakages and further impact to site soil and surficial groundwater.

SECTION 5

Alternatives Development

The remedial technologies and process options that remained after screening were assembled into a range of remedial alternatives. The specific details of the remedial components discussed for each alternative are intended to serve as representative examples to allow order-of-magnitude cost estimates in the alternatives evaluation. Other viable options within the same remedial technology that achieve the same objectives may be evaluated during remedial design activities for the site. The following subsections provide a detailed description of each alternative. The developed remedial alternatives are summarized in Table 5-1.

TABLE 5-1
Assembly of Remedial Alternatives
Former Hampshire Chemical Corp. Facility, Waterloo, New York

General Response Action	Remedial Technology/ Process Option	Alternative 1 – No Action	Alternative 2 – Soil Cover, Asphalt Cap and Institutional Controls with Monitoring	Alternative 3 – Soil Cap, Asphalt Cap and Institutional Controls with Monitoring	Alternative 4 – Partial Soil Cover, Asphalt Cap and Institutional Controls and Monitoring	Alternative 5 – Multilayer Cap, Asphalt Cap and Institutional Control and Monitoring
No Action		X				
Institutional Controls	Deed restrictions		X	X	X	X
	Access control		X	X	X	X
Engineering Controls	Soil cover with demarcation layer		X		X	
	Asphalt cap		X	X	X	X
	Soil cap with demarcation layer			X		X
	Multilayer cap					X
	Grading		X	X	X	X
Monitoring	Monitoring		X	X	X	X

5.1 Summary of Remedial Alternatives

The technologies and process options were assembled into the following alternatives for further evaluation:

- Alternative 1—No Action
- Alternative 2—Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring
- Alternative 3—Soil Cap, Asphalt Cap, and Institutional Controls with Monitoring
- Alternative 4—Partial Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring
- Alternative 5—Multilayer Cap, Asphalt Cap, and Institutional Controls with Monitoring

Except for Alternative 1, No Action, the remedial action alternatives are discussed in further detail in Section 6. The intent of the alternative assembly process was to create a set of alternatives that represents a range of performance and cost options so the alternatives could be comparatively evaluated against each other to select a preferred alternative. The following subsections provide further details of each alternative.

5.1.1 Alternative 1—No Action

Alternative 1 would not involve implementation of any remedial technology or activities at the site.

5.1.2 Alternative 2—Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring

The objective of Alternative 2 is to limit contact with waste in the remedial target areas. The following are the main components of Alternative 2:

- ICs
- Engineering controls (grading, soil cover, and asphalt cap)
- Inspection/Monitoring

Institutional Controls

ICs include establishing a deed restriction and access controls on the parcels of impacted property, which documents the impacted soil and waste and limits. IC implementation will affect the future potential use of the area. The ICs, along with the site-specific materials management plan (MMP) would be used to ensure that soil and waste movement activities will be managed appropriately.

ICs also would be implemented around the property south of the landfill and along the canal right-of-way adjacent to SWMU 1 after completion of sitewide activities and immediately after controls are established for the canal right-of-way. The NYSCC would be engaged to seek permission for the implementation of ICs on the canal right-of-way.

Engineering Controls

A combination of engineering controls would be used to eliminate direct exposure to impacted soil and waste materials. The components of the engineering controls are:

- Asphalt cap
- Soil cover
- Demarcation layer

The existing asphalt cap (access road) with an extension further to the north (Figure 4-1) to the raceway would be used as the engineering control in that area to protect against rutting or other damage from site truck traffic.

For the other areas between the existing asphalt access road (asphalt cap) and the canal, a 2-foot-thick soil cover would be installed. Before cover activities begin, clearing and grubbing of vegetation to the limit of waste extents would be required, along with general site grading and grading imported fill to create a slope of no less than 3 percent to prevent future ponding and promote runoff away from adjacent properties and toward the canal or raceway.

Before placement of the soil cover, a demarcation layer would be installed to alert future workers to the presence of the underlying impacted soil in the event of future excavation. The area is considered commercial/industrial use and would require a minimum of 2 feet of imported compacted soil cover over an appropriate demarcation layer with a top 6-inch topsoil layer. Disturbed areas would be seeded during construction to reestablish vegetation for stabilization and erosion control. Because of site grading and tree removal activities, the canal bank would be repaired using appropriate bank stabilization methods such as riprap/gabions and erosion control blankets.

Soil to be used for cover will meet the requirements of DER-10, Section 4.1(f), will be suitable to support vegetative growth of native grasses, and will be verified to not have any impacts above the applicable SCOs. Soil that exists at, or is imported to, a site that is used to construct a soil cover, site cap system, or as excavation backfill must meet the requirements of 6 NYCRR 375-6.7(d). The clean fill material would be sampled at the frequency provided in Table 5.4(e)10 of DER-10.

Inspection/Monitoring

Following implementation of the corrective measures, inspections and monitoring would be performed to verify the use has not changed, or the area and cover have not been disturbed. In addition, a sentinel groundwater monitoring program that includes one upgradient (MW-06) and five downgradient monitoring wells (MW-16I, MW-17, MW-18, MW-26, and TW-01) would be implemented (Figure 4-1). The groundwater monitoring is specified in the sidewide groundwater monitoring plan. For cost estimating purposed, it was assumed the sampling would be established upon completing the CMS and would consist of annual sampling events focused on the COCs for SWMU 1, which include VOCs, PAHs, and target analyte list (TAL) metals. Monitoring would be conducted for a period 30 years, with 5-year reviews during the monitoring period to allow for the cessation of monitoring before the 30-year period has ended.

5.1.3 Alternative 3—Soil Cap, Asphalt Cap, and Institutional Controls with Monitoring

The objectives of Alternative 3 are to eliminate direct contact to impacted media and windborne transport. The following are the main components of Alternative 3:

- ICs
- Engineering controls (grading, soil cap, and asphalt cap)
- Inspection/Monitoring

Institutional Controls

ICs include establishing a deed restriction and access controls on the parcels of impacted property, as documented in Alternative 2.

Engineering Controls

A combination of engineering controls would be used to eliminate direct exposure to impacted soil. The components of the engineering controls are:

- Soil cap
- Asphalt cap
- Demarcation layer

The existing asphalt cap (access road) with an extension further to the north (Figure 4-1) toward the raceway would be used as the engineering control in that area to protect against rutting or other damage from site truck traffic.

For the other areas between the existing asphalt access road (asphalt cap) and the canal, a 2-foot-thick soil cap would be installed. Before cover activities, clearing and grubbing of vegetation to the limit of waste extents would be required, along with general site grading and grading imported fill to create a slope of no less than 3 percent to prevent future ponding and promote runoff away from adjacent properties and toward the canal or raceway.

Before placement of the soil cap, a demarcation layer would be installed to alert future workers to the presence of the underlying impacted soil in the event of future excavation. The soil cap would consist of 2 feet of imported compacted soil with a hydraulic conductivity of less than 1.0×10^{-7} cm/sec overlain by a 6-inch topsoil layer. Disturbed areas would be seeded during construction to reestablish vegetation for stabilization and erosion control.

Soil to be used for the cap will meet the requirements of DER-10, Section 4.1(f), will be suitable to support vegetative growth of native grasses, and will be verified to not have any impacts above the applicable SCOs. Soil that exists at, or is imported to, a site that is used to construct a soil cover, site cap system, or as excavation backfill must meet the requirements of 6 NYCRR 375-6.7(d). The clean fill material would need to be sampled at the frequency provided in Table 5.4(e)10 of DER-10.

Inspection/Monitoring

Inspection and monitoring for Alternative 3 would be the same as for Alternative 2.

5.1.4 Alternative 4—Partial Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring

The objective of Alternative 4 is to limit contact with waste in the remedial target areas while removing as few tress/vegetation as possible. The following are the main components of Alternative 4:

- ICs
- Engineering controls (grading, partial soil cover, and asphalt cap)
- Inspection/Monitoring

Institutional Controls

ICs include the establishment of a deed restriction and access controls on the parcels of impacted property, as documented in Alternative 2.

Engineering Controls

A combination of engineering controls would be used to eliminate direct exposure to impacted soil and waste materials. The components of the engineering controls are:

- Asphalt cap
- Partial soil cover
- Demarcation layer

The existing asphalt cap (access road) with an extension further to the north (Figure 4-1) to the raceway would be used as the engineering control in that area to protect against rutting or other damage from site truck traffic.

For the other areas between the existing asphalt access road (asphalt cap) and the tree line (see the tree line on Figure 4-2 south of the SWMU 1 high point), a 2-foot-thick imported soil cover would be installed. Before cover activities begin, general site grading and grading imported fill will be performed to create a slope of no less than 3 percent to prevent future ponding and promote runoff away from adjacent properties and toward the canal or raceway. The cover limits would extend to the tree line on the western and southern portions of the soil cover area (Figure 4-2). Surficial waste debris and litter that are visible in the wooded areas would be collected during cover activities.

Before placement of the soil cover, a demarcation layer would be installed to alert future workers to the presence of the underlying impacted soil in the event of future excavation. The area is considered commercial/industrial use and would require a minimum of 2 feet of compacted soil cover over an appropriate demarcation layer with a 6-inch topsoil layer. Disturbed areas would be seeded during construction to reestablish vegetation for stabilization and erosion control. Because no tree removal activities would occur, disturbance to the canal bank is not anticipated.

Soil to be used for cover will meet the requirements of DER-10, Section 4.1(f), will be suitable to support vegetative growth of native grasses, and will be verified to not have any impacts above the applicable SCOs. Soil that exists at, or is imported to, a site that is used to construct a soil cover, site cap system, or as excavation backfill must meet the requirements of 6 NYCRR 375-6.7(d). The clean fill material would need to be sampled at the frequency provided in Table 5.4(e)10 of DER-10.

Inspection/Monitoring

Inspection and monitoring for Alternative 4 would be the same as for Alternative 2.

5.1.5 Alternative 5—Multilayer Cap, Asphalt Cap, and Institutional Controls with Monitoring

The objectives of Alternative 5 are to eliminate direct contact to impacted media, windborne transport, and nearly eliminate precipitation infiltration. The following are the main components of Alternative 5:

- ICs
- Engineering controls (grading, multilayer cap, and asphalt cap)
- Inspection/Monitoring

Institutional Controls

ICs include establishing a deed restriction and access controls on the parcels of impacted property, as documented in Alternative 2.

Engineering Controls

A combination of engineering controls would be used to eliminate direct exposure to impacted soil. The components of the engineering controls are:

- Multilayer cap
- Asphalt cap
- Demarcation layer

The existing asphalt cap (access road) with an extension farther to the north to the raceway would be used as the engineering control in that area to protect against rutting or other damage from site truck traffic.

For the other areas between the existing asphalt access road (asphalt cap) and the canal, a multilayer cap would be installed. Before cover activities begin, clearing and grubbing of vegetation to the limit of waste extents is required, along with general site grading and grading imported fill to create a slope of no less than 4 percent to prevent mounding within the drainage layer, prevent future ponding, and promote runoff away from adjacent properties and toward the canal or raceway.

The multilayer cap would be placed on top of the prepared subgrade and include the flowing components:

- 40-mil linear low-density polyethylene (LLDPE) geomembrane
- Lateral drainage layer – double-sided geocomposite material
- 24-inch protective soil layer
- 6-inch topsoil layer

The presence of the geocomposite material would serve as the demarcation layer.

Soil to be used for the multilayer cap will meet the requirements of DER-10, Section 4.1(f), will be suitable to support vegetative growth of native grasses, and will be verified to not have any impacts above the applicable SCOs. Soil that exists at, or is imported to, a site that is used to construct a soil cover, site cap system, or as excavation backfill must meet the requirements of 6 NYCRR 375-6.7(d). The clean fill material would need to be sampled at the frequency provided in Table 5.4(e)10 of DER-10.

Inspection/Monitoring

Inspection and monitoring for Alternative 5 would be the same as for Alternative 2.

SECTION 6

Evaluation of Remedial Alternatives

The detailed analysis of alternatives presents the information needed to compare the remedial alternatives assembled for the SWMU 1 area. It follows the development and screening of alternatives, and precedes selection of the proposed corrective measure for the SWMU 1 area. This analysis is based on available data and types of remedial technologies evaluated. The remedial alternatives analysis consists of evaluating each alternative against the DER-10 evaluation criteria followed by a comparative evaluation.

This section presents the evaluation of the remedial alternatives identified in Section 5. Provisions of DER-10 require that each alternative be evaluated against ten criteria. These criteria were published to provide a basis for comparison of the relative performance of the alternatives and identify their advantages and disadvantages. This approach is intended to provide sufficient information to adequately compare the alternatives and select the most appropriate alternative for implementation at the SWMU 1 area in the Statement of Basis. The evaluation criteria are as follows:

1. Overall protection of human health and the environment
2. Compliance with SCGs
3. Long-term effectiveness and permanence
4. Reduction of TMV through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. Land use
9. Community acceptance
10. Sustainability

The criteria are divided into three groups: threshold, balancing, and modifying criteria.

Threshold criteria must be met by a particular alternative for it to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria; they must be met by a particular alternative or the alternative is not considered acceptable. The two threshold criteria are overall protection of human health and the environment and compliance with SCGs.

Unlike the threshold criteria, the six balancing criteria weigh the tradeoffs between alternatives. A low rating on one balancing criterion can be compensated by a high rating on another. The six balancing criteria include long-term effectiveness and permanence, reduction of TMV through treatment, short-term effectiveness, implementability, cost, and land use.

The modifying criteria are community acceptance and sustainability. This is evaluated following public comment and used to modify selection of the recommended alternative.

6.1 Threshold Criteria

DER-10 indicates that to be eligible for selection, an alternative must meet the two threshold criteria described below.

Overall Protection of Human Health and the Environment (Criterion 1)

Protectiveness is the primary requirement that remedial actions must meet under DER-10 guidance. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risk posed by the site through each exposure pathway. The assessment against this criterion describes how the alternative achieves and maintains protection of human health and the environment.

Standards, Criteria, and Guidance (Criterion 2)

Compliance with SCGs is a DER-10 requirement of remedy selection. SCGs are cleanup standards, standards of control, and other substantive environmental statutes or regulations that are either "applicable" or "relevant and appropriate" to the cleanup action. The assessment against this criterion describes how the alternative complies with SCGs. The following are SCGs that are considered applicable for remedial action at the site.

Chemical-Specific SCGs

The chemical-specific SCGs are defined through the RAOs in Section 3.

Location-Specific SCGs

Location-specific SCGs were defined in Section 3. The applicable agencies will be contacted to obtain a full understanding of the regulations for the adjacent areas such as the presence of habitats for threatened and endangered species, wetlands and floodplains mapping, and discharge to surface water requirements.

Action-Specific SCGs

RCRA is the action-specific SCG for impacted material at the site during soil and groundwater handling and disposal (defined in Section 3) and for worker protection during remediation activities.

Impacted material generated during remediation activities will be characterized, managed, and disposed of in accordance with the MMP (CH2M HILL 2010b) and any applicable RCRA regulations. It is anticipated that no hazardous waste will be generated during the removal action; however, any waste generated will be managed as if it is hazardous until it is characterized according to 40 Code of Federal Regulations (CFR) 261 (U.S. Environmental Protection Agency [USEPA] 1980a). The concentration of the components in the waste will be compared to the TCLP list in 40 CFR 261.24 (USEPA 1980a). Once characterized and proven nonhazardous, the waste will be managed and disposed of in accordance with the MMP (CH2M HILL 2010b). If hazardous waste is encountered, the MMP will be updated to address hazardous waste handling and disposal. Hazardous waste, if generated, will be managed and disposed of in accordance with 40 CFR 262 (USEPA 1980b).

A health and safety risk analysis will be performed for each task. The project health and safety manager (HSM) will consider various methods for mitigating the hazards (elimination, substitution, engineering controls, warnings, administrative controls and use of personal protective equipment [PPE]). Employees will be trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects, daily safety topics, and routine audits.

A detailed project-specific health and safety plan (HASP) will be developed to detail comprehensive hazard controls and safe work practices such as general hazards, project-specific hazards, physical hazards, biological hazards, and COCs. Standard operating procedures will be included, as appropriate. In addition, the HASP may adopt procedures from the project work plan and will incorporate governing regulations including applicable Occupational Safety and Health Administration (OSHA) regulations. If there is a contradiction between the HASP and any governing regulation, the more stringent and protective requirement will apply.

All site workers engaging in hazardous waste operations (HAZWOPER) or emergency response shall receive appropriate training as required by 29 CFR 1910.120 (USEPA 1974a) and 29 CFR 1926.65 (USEPA 1979). Personnel who have not met these training requirements will not be allowed to engage in HAZWOPER or emergency response activities. Additionally, all site workers will be required to possess training as applicable to their roles and responsibilities in the areas of PPE (29 CFR 1910 Subpart I) (USEPA 1974b), toxic and hazardous substances (29 CFR 1910 Subpart Z), and other regulations as appropriate (USEPA 1974c).

In compliance with 29 CFR 1910.132(d)(2), the project HSM will complete a hazard assessment for the project to determine if hazards are present, or are likely to be present, which necessitate the use of PPE (USEPA 1974a). Specifically, and in addition to other physical hazards associated with remediation tasks, PPE specifications for hand, feet, face, body protection, and respiratory protection will address dermal and airborne contact with soil potentially impacted with arsenic.

Action levels will be established based, at a minimum, on applicable OSHA permissible exposure limits. When available, action levels likely will be based on more conservative National Institute for Occupational Safety and Health-recommended exposure levels and/or American Conference of Governmental Industrial Hygienists threshold limit values.

Atmospheric monitoring will be performed at the source, in the employees breathing zone, and at the perimeter. Whenever possible, monitoring will be conducted before entering a potentially impacted area. All atmospheric monitoring and associated equipment calibration activities will be documented using standard forms, in project logbooks, and/or equipment data logging features. Air monitoring and calibration records will be archived consistent with CH2M HILL procedures and retained as required by applicable regulations.

6.2 Balancing Criteria

The six balancing criteria listed below are those upon which the detailed evaluation and comparative analysis of sediment treatment alternatives are based.

Long-Term Effectiveness and Permanence (Criterion 3)

Long-term effectiveness and permanence are measured by the overall effectiveness of the remedy after completion. Alternatives providing the highest degree of long-term effectiveness and permanence are those that maximize removal or treatment, make long-term maintenance and monitoring unnecessary, and minimize or eliminate the need for ICs.

Reduction of TMV through Treatment (Criterion 4)

The statutory preference is a remedial action that employs treatment to reduce the TMV of COCs. Criterion 4 addresses the anticipated performance of technologies to reduce TMV of COCs. Alternatives that do not include treatment technologies are not considered to reduce TMV. This criterion considers the following:

- Treatment process(es)
- Amount of COCs that would be treated or destroyed
- Degree of expected reduction in TMV through treatment, including how the treatment addresses the principal risk(s)
- Degree to which the treatment will be irreversible
- Type and quantity of residuals that will remain following treatment

Short-Term Effectiveness (Criterion 5)

This criterion considers the short-term effects of an alternative on human health and the environment. Short-term effectiveness is measured by the following factors:

- Short-term impacts that might be posed to the community during implementation of an alternative
- Potential adverse impacts on workers during implementation, and the effectiveness and reliability of protective measures
- Potential for adverse environmental impacts during implementation, and effectiveness and reliability of mitigation measures
- Estimated duration of implementation needed to achieve the remedial objectives

Implementability (Criterion 6)

Implementability deals with the difficulties of constructing and operating an alternative and the availability of materials and services required. The following facets are considered:

- Ability to construct and operate
- Ease of acting further, if needed
- Ability to monitor effectiveness
- Ability to obtain approvals and coordinate with other agencies
- Availability of services and capabilities
- Availability of necessary equipment, specialists, and materials
- Availability of technologies

Cost (Criterion 7)

This criterion is an evaluation of the overall cost effectiveness of an alternative remedy. According to DER-10, the overall cost effectiveness of a remedy will be evaluated by comparing factors set forth by Criteria 4, 5, and 6 to the cost of the alternative and effectiveness of the remedy. These cost estimates will be used to compare the alternatives, but not to bid the work. These estimates are based on available information (i.e., they have an expected accuracy of -30 percent to +50 percent) and reasonable assumptions for the scope of action described for each alternative. The estimates of the capital costs will be based on information provided by vendors, regulators, and personnel with experience on similar projects.

Land Use (Criterion 8)

Land use scenarios evaluated for assessing risks and developing RAOs and goals include land uses that may be appropriate (e.g., industrial, residential, and construction scenarios). The evaluation will consider future, current, and historical (cultural and heritage) use and/or recent development patterns; consistency with local, state, and federal laws; and burden on the community.

6.3 Modifying Criteria

Community Acceptance (Criterion 9)

The community will be notified of the interim corrective measure to be implemented at SWMU 1. This criterion is weighed on an appropriate remedial alternative only after a public review of the remedy selection process.

Each remedial alternative is described and evaluated against the nine provisions of the DER-10 as stated in Section 5. The proposed remedy for the site will be recommended based on the results of this evaluation process.

Considering the key site characteristics described in Sections 1 and 2, as well as the site-specific RAO and remedial technologies appropriate for the SWMU 1 area, various technologies were grouped to form the remedial alternatives that are presented in Section 6.1.

Sustainability (Criterion 10)

Sustainability is to be evaluated against the actions of each alternative in accordance with DER-31, Green Remediation (NYSDEC 2010b). The technologies for implementation shall be evaluated for limiting environmental impacts such as reducing greenhouse gas emissions, minimizing vegetation disturbance, limiting waste generation, identifying renewable energy resources, reducing long-term operations and maintenance (O&M), and others.

6.4 Remedial Alternatives

The following remedial alternatives were evaluated and compared to the criteria described above:

- Alternative 1—No Action
- Alternative 2—Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring
- Alternative 3—Soil Cap, Asphalt Cap, and Institutional Controls with Monitoring
- Alternative 4—Partial Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring

- Alternative 5—Multilayer Cap, Asphalt Cap, and Institutional Controls with Monitoring

Alternative 1 is a general corrective measure used to provide a baseline for comparison against other technologies.

The Appendix F Remedial Alternatives Evaluation table presents a brief description of each of the alternatives in terms of the proposed technology.

All of the alternatives discussed have been conceptually evaluated as part of this CMS. Certain assumptions were made for all alternatives based on the current knowledge of site conditions and the engineering involved for each. These assumptions are subject to change as additional design information is completed.

6.5 Description and Evaluation of Remedial Alternatives

The following sections provide descriptions and evaluations of the alternatives. The alternative descriptions are provided at a conceptual level of detail. They are based on assumptions developed from the available data set and are considered sufficient to perform a comparative analysis on the alternatives and develop remedial cost estimates. For each alternative evaluated, portions of the work would include actions on the NYSCC right-of-way. HCC is working with NYSCC to obtain its final endorsement of the preferred alternative evaluated and proposed in this CMS. Within this CMS, the goal was to develop alternatives that would either maintain the current use of the area or consider removal of the impacted soil and waste; however, if NYSCC were to request changes to the proposed remedy on its property, they will be evaluated as part of the design of the remedy.

Each technology is screened against, threshold criteria, balancing criteria, modifying criteria, long-term risks, uncertainties, and sustainability.

6.5.1 Alternative 1—No Action

This alternative was included for comparative purposes only. This alternative is a general corrective measure that does not involve any remedial actions or monitoring activities for the site. It is used to provide a baseline for comparison against other remedial alternatives. This alternative is the least expensive and is the most readily implementable; however, a no action alternative is expected to be neither protective of the human health and the environment nor acceptable to the community and regulators. Table 6-1 contains a detailed evaluation of Alternative 1.

TABLE 6-1
Individual Analysis of Alternative 1 – No Action
SWMU 1 CMS

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Not protective.
Environmental Protection	Not protective.
COMPLIANCE WITH SCGs	
Chemical-Specific	Not in compliance.
Location-Specific	None.

TABLE 6-1
Individual Analysis of Alternative 1 – No Action
SWMU 1 CMS

Action-Specific	None.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Same as currently present.
Adequacy and Reliability of Controls	Not applicable.
Individual Technical Components	None.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	None.
Amount of Impacted Material Destroyed or Treated	None.
Expected Reduction in TMV	None.
Irreversibility of Treatment	Not applicable.
Type and Quantity of Treatment Residual	Not applicable.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Not applicable.
Protection of Workers During Remedial Action	Not applicable.
Time Until Remedial Goals Achieved	Unknown and not monitored or evaluated.
Environmental Impacts	Same as currently present.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Not applicable.
Reliability of Technology	Not applicable.
Availability of Services and Material	Not applicable.
Administrative Feasibility	Not expected to be feasible based on regulatory and public opposition.
COSTS	
Cost	None.
LAND USE	
Land Use	Not protective of future, current, and historical land use.

TABLE 6-1
Individual Analysis of Alternative 1 – No Action
SWMU 1 CMS

COMMUNITY ACCEPTANCE	
Community Acceptance	Probably not acceptable.
SUSTAINABILITY	
Sustainability	Acceptable – no action protects existing trees and does not allow for greenhouse gas emissions.

6.5.2 Alternative 2—Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring

This alternative would implement ICs for the SWMU 1 area to limit exposure pathways from impacted soil and waste to human and ecological receptors. Even though the former residential property adjacent to SWMU 1 is zoned as residential, the site ICs would prohibit future sensitive uses of the site such as an extensive residential development. The ICs would allow other future uses with conditions. Coordination with NYSCC also would be required because of the location of its easement along the southern portion of the SWMU 1 area. In addition, this alternative includes placement of an asphalt cap north of the existing entry road (existing asphalt cap) to protect the cover from truck traffic, grading, placement of a soil cover with a demarcation layer over the other areas of the ICs restricting use of the area, and inspection documenting the extent and type of engineering controls used in addition to groundwater monitoring. Disturbed areas will be seeded during construction to reestablish vegetation for stabilization and erosion control. Because of site grading and tree removal activities up to the limits of waste extents, the canal bank will be repaired using appropriate bank stabilization methods such as riprap/gabions and erosion control blankets.

Under this alternative, the maintenance of the asphalt cap (patching, crack sealing) and maintenance of the soil cover areas (such as mowing, reseeding or planting, as needed) will be undertaken. Details of the monitoring and maintenance activities will be included in the ICs.

Based on initial estimates, the capital cost (rough order of magnitude estimate) of implementing Alternative 2 is $1,621,000, and includes developing the ICs, annual inspection/monitoring of the controls with groundwater sampling, and project management costs. The net present value (NPV) for this alternative has been determined to be $1,773,000. Refer to the Proposed Remedial Alternative Assumptions Table in Appendix G for assumptions used to develop the cost estimates quoted herein. Table 6-2 contains a detailed evaluation of Alternative 2.

TABLE 6-2
Individual Analysis of Alternative 2 – Soil Cover, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 2 will achieve RAOs, which will be protective of human health by limiting use of the area and contact to the impacted media.
Environmental Protection	Soil cover and asphalt cap will limit migration of COCs to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Complies.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Same as currently present.
Adequacy and Reliability of Controls	Silt fences and other erosion control type features will be built to protect from erosion during construction. Riprap, erosion control matting and vegetation will be used to protect the area from erosion over the long term.
Individual Technical Components	Land use restrictions, asphalt cap and soil cover and grading, and inspections.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	A 24-inch compacted soil cover (overlain by a 6-inch topsoil layer) with demarcation layer will be placed in those areas of the site that are not covered by the existing asphalt or extension thereof.
Amount of Impacted Material Destroyed or Treated	None.
Expected Reduction in TMV	Implementation of this remedy will not reduce toxicity or volume, but will decrease mobility via potential erosion.
Irreversibility of Treatment	Placement of cover is reversible.
Type and Quantity of Treatment Residual	Same as currently present.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Protective - members of the community will not be allowed to have free access to the work zone. Dust control measures will be implemented and dust monitoring will be performed.
Protection of Workers During Remedial Action	Potential for exposure during remediation – will be addressed by appropriate PPE.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may introduce minimal foreign matter to environment.

TABLE 6-2
Individual Analysis of Alternative 2 – Soil Cover, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Technically feasible- will require traffic management.
Reliability of Technology	Reliable.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based on attainability of permits and agreements. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	Medium.
LAND USE	
Land Use	Protective of future land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain, but unlikely
SUSTAINABILITY	
Sustainability	Acceptable – reduces greenhouse gas emissions by covering waste in place versus offsite trucking and not specifying a hydraulic conductivity, which results in the need for a more costly and distant clayey borrow source.

Implementation of this alternative is expected to be acceptable to the community and regulators based on its potential effectiveness and its ability to not disrupt the surrounding community during construction.

6.5.3 Alternative 3—Soil Cap, Asphalt Cap, and Institutional Controls with Monitoring

This alternative includes ICs, placement of asphalt cap north of the existing entry road (existing asphalt cap) to protect the cover from truck traffic), grading, placement of a soil cap (that has low permeability to limit infiltration) with a demarcation layer over the other areas to the extent of the waste limits of the ICs restricting the use of the area, and inspection documenting the extent and type of engineering controls used in addition to groundwater monitoring.

General site grading will be required for the soil cap placement areas to promote positive drainage and to prevent ponding over the cover. The soil cap will be comprised of a 24-inch-thick soil cap with a permeability of less than 1.0×10^{-7} cm/sec (overlain by a 6-inch topsoil layer), which will be underlain by a demarcation layer to alert future workers to the presence of impacted soil below the cover. The soil cap will extend south from the existing entry road to near the canal. Additionally, armoring will be placed in the area along the canal bank to prevent erosion. Disturbed areas will be seeded during construction to reestablish vegetation for stabilization and erosion control. Because of site grading and tree removal activities, the canal bank will be repaired using appropriate bank stabilization methods such as riprap/gabions and erosion control blankets.

Under this alternative, the maintenance of the asphalt cap (patching, crack sealing) and maintenance of the soil cap areas (such as mowing, reseeding or planting, as needed) will be undertaken. Details of the monitoring and maintenance activities will be included in the ICs.

Based on initial estimates, the capital cost (rough order of magnitude estimate) of implementing Alternative 3 is $1,720,000. The NPV for this alternative has been determined to be $1,872,000. Table 6-3 contains a detailed evaluation of Alternative 3.

TABLE 6-3
Individual Analysis of Alternative 3 – Soil Cap, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 3 will achieve RAO which will be protective of human health.
Environmental Protection	Will protect the environment by constructing a soil cap and asphalt cap to prevent constituent migration to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Complies.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Impacted soil will be covered with either the asphalt cap or a soil cap.
Adequacy and Reliability of Controls	Silt fences and other erosion control type features will be built to protect offsite areas from erosion during construction. Riprap, erosion control matting and vegetation will be used to protect the area from erosion over the long term.
Individual Technical Components	Land use restrictions, asphalt and soil cap, and inspections.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	A 24-inch-thick low-permeability (less than 1.0×10^{-7} cm/sec) soil cap (overlain by a 6-inch topsoil layer) with demarcation layer will be placed in those areas of the site that will not be covered by the asphalt cap.
Amount of Impacted Material Destroyed or Treated	None.
Expected Reduction in TMV	Implementation of this remedy will not reduce toxicity or volume, but will decrease mobility via overland flow as well as through infiltration reduction.
Irreversibility of Treatment	Placement of cap is reversible.
Type and Quantity of Treatment Residual	None.

TABLE 6-3
Individual Analysis of Alternative 3 – Soil Cap, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Protective - members of the community will not be allowed to have free access to work zone. Dust control measures will be implemented and dust monitoring will be performed.
Protection of Workers During Remedial Action	Potential for exposure during remediation – will be addressed by appropriate PPE
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may introduce minimal foreign matter to the environment.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Technically feasible- will require traffic management.
Reliability of Technology	Reliable.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based on attainability of permits and agreements. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	Medium - high. More expensive than Alternative 3 because of low permeability soil cap.
LAND USE	
Land Use	Protective of current land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain, but likely.
SUSTAINABILITY	
Sustainability	Acceptable – reduces greenhouse gas emissions by covering waste in place versus offsite trucking. Greenhouse gas emissions increased over Alternative 2 with inclusion of a low-permeability soil barrier layer.

Implementation of this alternative is expected to be acceptable to the community and regulators based on its potential effectiveness and its ability to not disrupt the surrounding community during construction.

6.5.4 Alternative 4—Partial Soil Cover, Asphalt Cap, and Institutional Controls with Monitoring

This alternative would implement ICs for the SWMU 1 area to limit exposure pathways from impacted soil and waste to human and ecological receptors. The site ICs would prohibit future sensitive uses of the site such as an extensive of residential development.

The ICs would allow other future uses with conditions. Coordination with NYSCC also would be required because of the location of its easement along the southern portion of the SWMU 1 area. In addition, this alternative will include placement of an asphalt cap north of the existing entry road (existing asphalt cap) to protect the cover from truck traffic, grading, placement of a soil cover with a demarcation layer over the other areas of the ICs restricting the use of the area, and inspection documenting the extent and type of engineering controls used in addition to groundwater monitoring. Disturbed areas will be seeded during construction to reestablish vegetation for stabilization and erosion control. The soil cover would only extend up to the existing tree line to protect the existing mature vegetation. A surface debris clean up would occur within the treed area.

Under this alternative, the maintenance of the asphalt cap (patching, crack sealing) and maintenance of the soil cover areas (such as mowing, reseeding or planting, as needed) will be undertaken. Details of the monitoring and maintenance activities will be included in the ICs.

Based on initial estimates, the capital cost (rough order of magnitude estimate) of implementing Alternative 4 is $1,334,000, and includes developing the ICs, annual inspection/monitoring of the controls with groundwater sampling, and project management costs. The NPV for this alternative has been determined to be $1,486,000. Table 6-4 contains a detailed evaluation of Alternative 4.

TABLE 6-4
Individual Analysis of Alternative 4 – Partial Soil Cover, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Not protective. Implementation of Alternative 4 will achieve RAOs, which will be protective of human health by limiting use of the area and most of the contact to the impacted media; however, direct contact would still exist within the maintained tree area.
Environmental Protection	Soil cover and asphalt cap will limit migration of COCs to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Complies.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Same as currently present.
Adequacy and Reliability of Controls	Silt fences and other erosion control type features will be built to protect from erosion during construction. Riprap, erosion control matting and vegetation will be used to protect the area from erosion over the long term.
Individual Technical Components	Land use restrictions, asphalt cap and soil cover and grading, waste consolidation and inspections.

TABLE 6-4
Individual Analysis of Alternative 4 – Partial Soil Cover, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	A 24-inch-thick compacted soil cover (overlain by a 6-inch topsoil layer) with demarcation layer will be placed in those areas of the site that are not covered by the existing asphalt or areas that currently possess large mature trees.
Amount of Impacted Material Destroyed or Treated	None.
Expected Reduction in TMV	Implementation of this remedy will not reduce toxicity or volume, but will decrease mobility via potential erosion.
Irreversibility of Treatment	Placement of cover is reversible.
Type and Quantity of Treatment Residual	Same as currently present.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Protective - members of the community will not be allowed to have access to the work zone. Dust control measures will be implemented and dust monitoring will be performed.
Protection of Workers During Remedial Action	Potential for exposure during remediation – will be addressed by appropriate PPE.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may introduce minimal foreign matter to environment.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Technically feasible- will require traffic management.
Reliability of Technology	Reliable.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based on attainability of permits and agreements. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	Medium.
LAND USE	
Land Use	Protective of future land use within cover and cap areas only; tree area not protective.

TABLE 6-4
Individual Analysis of Alternative 4 – Partial Soil Cover, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain, not likely.
SUSTAINABILITY	
Sustainability	Acceptable – reduces greenhouse gas emissions by covering waste in place versus offsite trucking and not specifying a hydraulic conductivity, which results in the need for a more costly and distant clayey borrow source. More sustainable than other alternatives by protective existing large mature trees.

Implementation of this alternative is not expected to be acceptable to the community and regulators based on the soil cover not covering all debris and waste within the tree-covered area.

6.5.5 Alternative 5—Multilayer Cap, Asphalt Cap, and Institutional Controls with Monitoring

This alternative would implement ICs for the SWMU 1 area to limit exposure pathways from impacted soil and waste to human and ecological receptors. The site ICs would prohibit future sensitive uses of the site such as an extensive of residential development. The ICs would allow other future uses with conditions. Coordination with NYSCC also would be required because of the location of its easement along the southern portion of the SWMU 1 area. In addition, this alternative will include placement of an asphalt cap north of the existing entry road (existing asphalt cap) to protect the cap from truck traffic, grading, placement of multilayer cap over the other areas of the ICs restricting the use of the area, and inspection documenting the extent and type of engineering controls used in addition to groundwater monitoring. Disturbed areas will be seeded during construction to reestablish vegetation for stabilization and erosion control. The multilayer cap would encompass the areas identified with waste outside of the asphalt cap.

Under this alternative, the maintenance of the asphalt cap (patching, crack sealing) and maintenance of the multilayer cap areas (such as mowing, reseeding or planting, as needed) will be undertaken. Details of the monitoring and maintenance activities will be included in the ICs.

Based on initial estimates, the capital cost (rough order of magnitude estimate) of implementing Alternative 5 is $2,019,000 and includes developing the ICs, annual inspection/monitoring of the controls with groundwater sampling, and project management costs. The NPV for this alternative has been determined to be $2,171,000. Table 6-5 contains a detailed evaluation of Alternative 5.

TABLE 6-5
Individual Analysis of Alternative 5 – Multilayer Cap, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 5 will achieve RAOs, which will be protective of human health by limiting use of the area and contact to the impacted media.
Environmental Protection	Multilayer cap and asphalt cap will limit migration of COCs to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Complies.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Same as currently present.
Adequacy and Reliability of Controls	Silt fences and other erosion control type features will be built to protect from erosion during construction. Riprap, erosion control matting, and vegetation will be used to protect the area from erosion over the long term.
Individual Technical Components	Land use restrictions, asphalt cap, and multilayer cap and grading, waste consolidation, and inspections.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	A 40-mil LLDPE geomembrane, double sided geocomposite drainage layer with a 24-inch-thick protective soil overlain by a 6-inch topsoil layer with will be placed in those areas of the site that are not covered by the existing asphalt.
Amount of Impacted Material Destroyed or Treated	None.
Expected Reduction in TMV	Implementation of this remedy will not reduce toxicity or volume, but will decrease mobility via erosion or infiltration.
Irreversibility of Treatment	Placement of caps are reversible.
Type and Quantity of Treatment Residual	Same as currently present.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Protective - members of the community will not be allowed to have free access to the work zone. Dust control measures will be implemented and dust monitoring will be performed.
Protection of Workers During Remedial Action	Potential for exposure during remediation – will be addressed by appropriate PPE.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may introduce minimal foreign matter to environment.

TABLE 6-5
Individual Analysis of Alternative 5 – Multilayer Cap, Asphalt Cap and Institutional Controls with Monitoring
SWMU 1 CMS

IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Technically feasible - will require traffic management.
Reliability of Technology	Reliable.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based on attainability of permits and agreements. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	High.
LAND USE	
Land Use	Protective of future land use within cover and cap areas only.
COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain, but likely.
SUSTAINABILITY	
Sustainability	Acceptable – reduces greenhouse gas emissions by covering waste in place versus offsite trucking. Increased use of natural resources over other alternatives with manufacturing of geosynthetic components.

Implementation of this alternative is expected to be acceptable to the community and regulators based on its potential effectiveness and its ability to not disrupt the surrounding community during construction.

SECTION 7

Recommended Alternative

Considering the key site characteristics described in Sections 1 and 2, as well as the site-specific RAOs and remedial alternatives appropriate for the SWMU 1 conditions, Alternative 1 is not acceptable, as its implementation does not eliminate potential exposure to impacted surface soil. Alternative 4, while being sustainable by protecting existing vegetation and large mature trees and which may provide a greater natural tree buffer along the canal that is more aesthetically pleasing to the community, does not completely remove direct contact between waste debris and impacted soil to receptors. By not providing proper grading, drainage, and cover along the southern slope of the landfill as part of Alternative 4, the potential for slope erosion could expose additional waste debris within the landfill and create another source for direct contact with the debris. In addition, having to maintain the integrity of the current southern slope of the landfill in the tree area and protect it from further erosion would require additional long-term O&M costs.

Alternatives 2, 3, and 5 each comply with SCGs and are effective at reducing exposure to the waste materials and impacted soil. However, based on the alternatives evaluation, Alternative 2 is the preferred alternative when considering the balance of effectiveness, implementability, and lower implementation cost when compared to Alternatives 3 and 5. Containment using the existing asphalt access road as a cap, placing an asphalt cap over the northern portion of SWMU 1, and constructing a soil cover over the remaining area to the limits of the waste extents (removing trees as needed) removes the potential for direct contact to waste materials and impacted soil, reduces potential runoff and erosion of impacted surface soil and waste materials to adjacent properties and the canal, and provides both short- and long-term protection. The use of a low-permeability cap or a multilayer cap, as proposed in Alternatives 3 and 5, respectively, provide few additional benefits because the incremental reduction in infiltration is not necessary given the limited groundwater impact related to the waste material observed under current conditions.

SECTION 8

Performance and Operations Monitoring

This section summarizes the performance monitoring requirements for the CMS action. Additional details regarding field monitoring and data management are described in the quality assurance project plan (CH2M HILL 2009a) and will be included in the design implementation plan.

8.1 Air Monitoring

USEPA guidance document *Air/Superfund National Technical Guidance Study Series: Volume IV – Guidance for Ambient Air Monitoring at Superfund Sites* (USEPA 1993) is used herein to develop the general design for an air monitoring network. Because of the possibility of dust being generated during the construction phase, air monitoring will be conducted to quantify the offsite migration of air particulate. Data collected during the CMS implementation will include particulate matter less than 10 microns (PM_{10}) emissions, which are considered respirable and directly applicable to human health exposure, and meteorological data to support the ambient air sampling program. Data will be collected from four sampling points around the perimeter of the construction area. One air sample location will be upwind and the remaining three locations will be downwind of the construction area.

Air monitoring equipment will be capable of measuring PM_{10} and integrating air sample data over a period of 15 minutes (or less) for comparison to the airborne particulate action level, as indicated in the technical memorandum *Community Air Monitoring Plan* for former HCC facility (CH2M HILL 2009b). The equipment will have an audible alarm to indicate an exceedance of the action level. Data will be collected for a maximum of 10 hours per shift during excavation operations. In addition, fugitive dust migration will be visually assessed during work activities.

The prevailing wind direction at the site will be monitored daily during site activities. In addition, a website that records daily wind direction for Waterloo, New York, will be consulted, and the wind direction information will be recorded in the field log. The primary wind direction for the site has been documented to be generally southwest and northwest (CH2M HILL 2013a).

8.2 Noise Monitoring

Noise levels will be monitored for the duration of construction phase activities. Because soil moving, grading, and soil cover placement operations will be performed for a maximum of 10 hours per shift during daylight hours (subject to change), the period used to establish the background noise level will be daytime. Monitoring will take place at locations where there is the potential for levels to exceed 85 decibels such as during soil grading and soil cover operations. This monitoring will help to define the areas where hearing protection is required as well as determining whether the hearing protection being used is adequate.

8.3 Canal Water Monitoring

Canal water monitoring is not anticipated at this time. The RFI investigative findings included bottle debris found at approximately 10 feet from the canal bank. However, if waste and/or debris is found nearer to the bank during construction, that material also will be addressed. In this case, a change of conditions will have occurred and the need for canal monitoring will be reassessed.

8.4 Reporting

Reporting will include collecting, photo documenting, and presenting field data pertinent to the CMS activities. These will be maintained in field logbooks, photo logs, and QC check forms. As project work begins and progresses through multiple phases, process changes and lessons learned may indicate the need for modifications to the reporting tools. Modifications to the work plan will be managed through the change of conditions management process.

Data collected will be field-verified daily for quantitative and qualitative accuracy as the data are generated. Data entry will be performed to digitize hard copy information. A QC check will be performed on these data to ensure accuracy. A monthly progress report will be submitted to NYSDEC.

Mobilization and operational measures including site security and fencing, runoff/run-on control (diversion or collection devices) for soil, noise, and dust suppressants will be evaluated and described in the design implementation plan. The inspection frequency of these project elements will be provided in the design implementation plan.

SECTION 9

Permits

This section discusses the federal, state, and local permits that would typically be required for implementing the selected remedy. The process of obtaining the necessary permits and approvals for soil remediation requires an understanding of the regulatory jurisdictions, the application requirements, necessary agency approvals, and processing times of the permits.

Several agencies have been identified and contacted to discuss the permit requirements for soil disturbance, stormwater management, impacts to wildlife and associated habitat, construction activities within floodplain areas, construction activities on state-owned lands, and restoration of disturbed areas. HCC is working with NYSDEC on applicable permits required to implement the remedy. A final list of permits required for performing the fieldwork will be included in the design implementation plan and submitted to the regulatory agencies for review. Copies of the permit applications and approvals for each agency will be included in a technical memorandum that will be submitted to NYSDEC before the planned start of fieldwork in summer 2014.

SECTION 10

Waste Management and Disposal

This section identifies the waste management and disposal procedures that will be followed during the CMS at SWMU 1. Waste will be managed in accordance with the revised MMP (CH2M HILL 2010b) and project-specific HASP. The anticipated waste streams include decontamination water and PPE. Soil and construction debris may also be potential waste streams. Excavation is not planned at this time; however, if excavation is needed during the construction phase, the MMP guidance will be followed for any excavation-related waste streams.

Decontamination water will be stored in 55-gallon Department of Transportation (DOT)-approved drums. Other liquid waste may be generated from surface runoff, rainfall, snowmelt, or groundwater infiltration into the area proposed for grading and soil covering during the construction phase. This liquid will be pumped out of the construction area and stored in 55-gallon DOT-approved drums, a frac tank, or other approved storage container, before disposal at an approved licensed facility.

Waste containers will be staged in a secured (i.e., fenced, locked) area in accordance with the site MMP (CH2M HILL 2010b). The construction supervisor will be responsible for inspecting investigation-derived waste (IDW) containers daily. Post-construction inspection will be conducted at a predetermined frequency until IDW containers are properly disposed.

Containers will be labeled with their contents. Labels will contain the following information:

- Container identification (ID)
- Generator ID
- Date that waste was first placed in the container
- Site name (e.g., AOC # etc.)
- Description/source of waste (e.g., soil borings, purge water)

If hazardous wastes are encountered, the container with hazardous waste contents will be labeled with the words “Hazardous Waste”.

Appropriate disposal options for wastes generated will be selected based on the analytical results of waste characterization sampling and generator knowledge. Following the site MMP (CH2M HILL 2010b), grab and composite samples will be collected as appropriate for each waste stream at a frequency that is based on the volume of waste generated.

TABLE 10-1
Initial Waste Characterization Sampling Guidelines

Waste Staged In:	Sample Type	Frequency
Stockpile	Grab	1 per 100 cubic yards
Frac tank	Grab	1 per tank
Rolloff	Grab	1 per rolloff
Drums	Composite	1 per 10 drums

Notes: If bulk wastes are sampled in stockpiles and subsequently transferred to rolloff boxes, resampling is not required.

IDW samples will be analyzed by collecting composite samples of the waste and performing analysis for VOCs, PAHs, and metals via TAL methodologies. In general, sampling will occur after the generation of soil occurs. However, in situ classification of soil may be completed to assist with load-out logistics. If in situ classification of soil is completed, HCC will be provided a copy of the analytical results from the laboratory.

Nonhazardous waste will be removed from the site as soon as practicable. It is anticipated that no hazardous waste will be generated; however, if generated hazardous waste will be removed from the facility within 90 days from the date of generation and will be treated and/or disposed offsite at a facility licensed to accept hazardous waste. The waste manifests will be signed by a competent individual representing the generator. When possible, waste profiles will be submitted to a Dow-approved waste treatment or disposal facility for approval before commencing construction activities. This procedure will reduce the need for managing large quantities of waste at the site, and expedite the transport and disposal (T&D) process.

Nonhazardous wastes will be disposed of at a Subtitle D facility, municipal landfill, or properly permitted wastewater treatment facility. Nonhazardous waste manifests are the preferred shipping documents for nonhazardous wastes. Hazardous wastes, if encountered, will be sent to a facility licensed and approved to manage hazardous waste (RCRA Subtitle C facility or properly permitted wastewater treatment facility). A universal hazardous waste manifest will be used to transport hazardous wastes. Additionally, a Land Disposal Restriction Notification/Certification is required to accompany shipments of hazardous waste. The licenses and permits for T&D of waste streams generated during this project will comply with applicable federal, state, and local laws, codes, and regulations. Disposal and treatment facilities will be required under the contract to provide the generator with weight tickets for bulk wastes and a certificate of disposal indicating the final disposition of the waste, and will be signed by the authorized agent of the facility.

SECTION 11

Project Schedule

The field implementation schedule is subject to NYSDEC approval of the preferred CMS alternative.

11.1 Schedule of Preferred Alternative

Implementation of the preferred alternative is estimated to be completed within the summer of 2014. Additional schedule details will be provided with the design submittals.

11.2 Notifications

Notification of fieldwork will be made to stakeholders at least 2 weeks before fieldwork begins, unless otherwise noted.

SECTION 12

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Figures

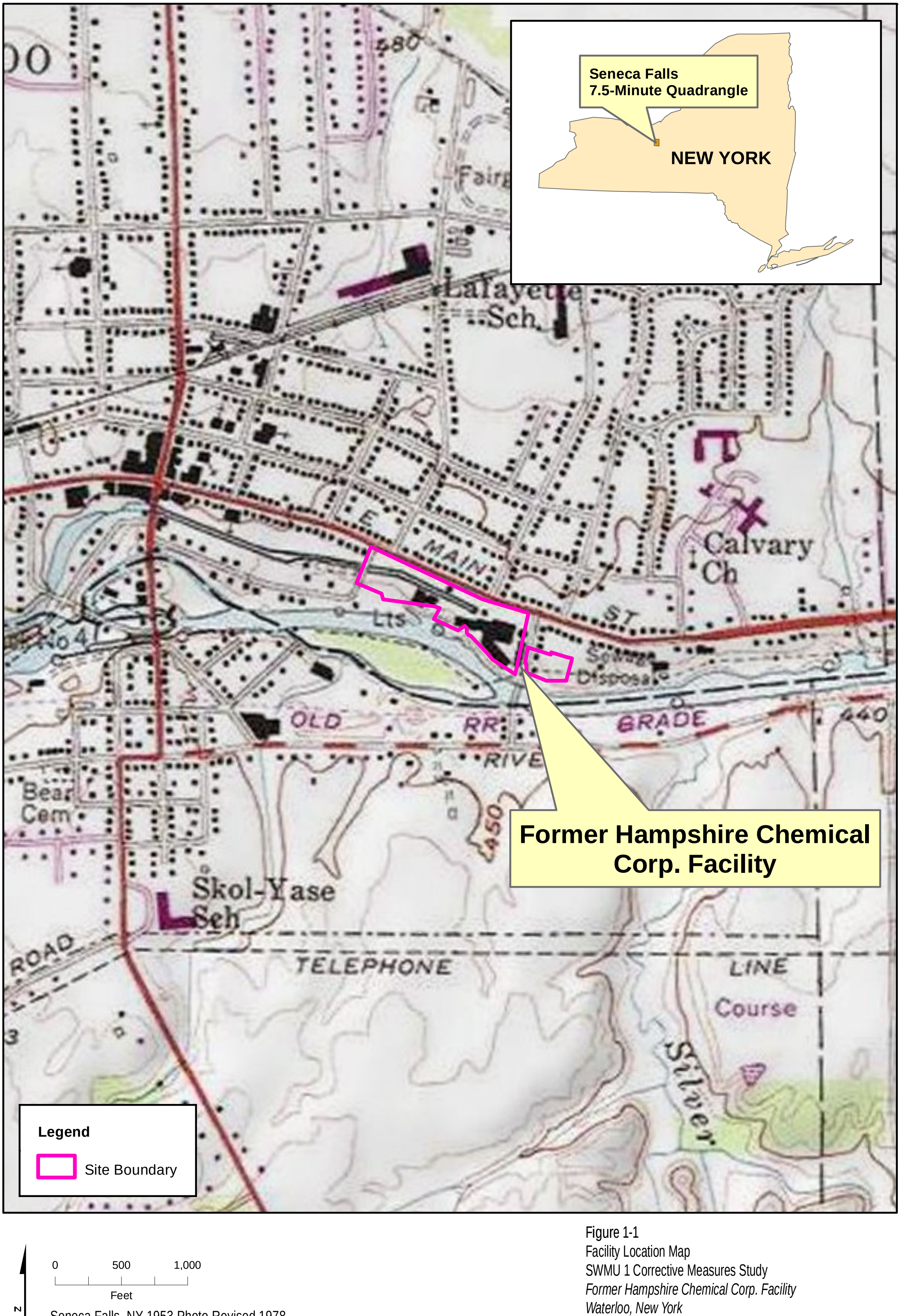


Figure 1-1
Facility Location Map
SWMU 1 Corrective Measures Study
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2013\SWMU01_CMS\MAPFILES\FIGURE 01-01 - FACILITY LOCATION MAP.MXD JHANSEN1 8/16/2013 1:18:59 PM
Originator: L. La Fortune Checked By: B. Carling Approved by SM: D. Brodmerkel

Notes:
NFA - No further action
NFA issued by NYSDEC on Dec. 2, 2003.
SWMU 28 (NFA) - Wash Water Sewer System (Buildings 2, 3, 4, 9, 13, 14 and 16)
SWMU 29 (NFA) - SPDES Sewer System (Buildings 1, 2, 2A, 2B, 3, 4, 5, 14 and Reactor)

Figure 1-2
SWMU/AOC Site Locations
SWMU 1 Corrective Measures Study
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2013\SWMU01_CMS\MAPFILES\FIGURE 01-02 - SWMU-AOC- SITE LOCATIONS - SWMU1.MXD JHANSEN1 8/16/2013 11:25:20 AM

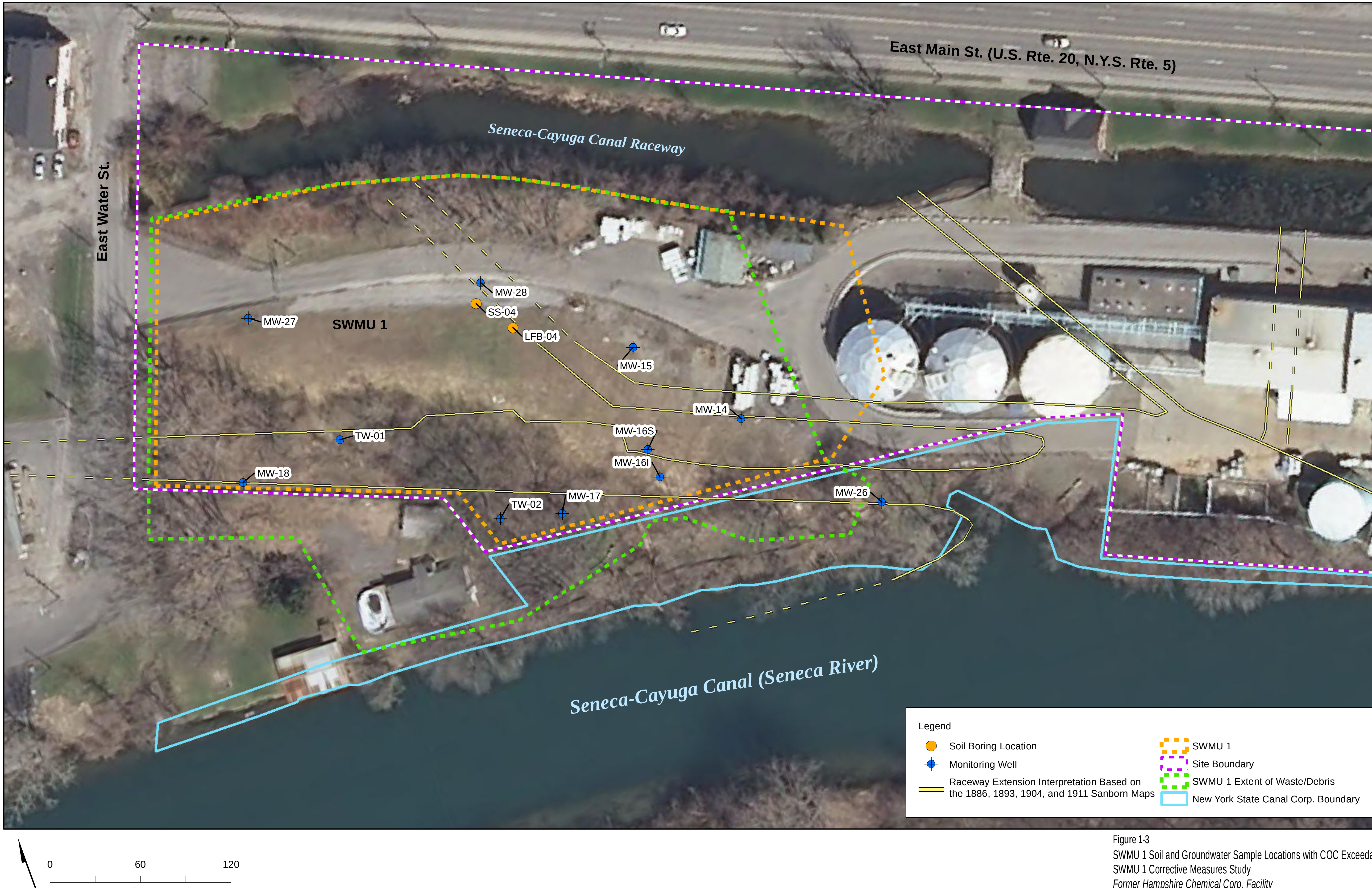
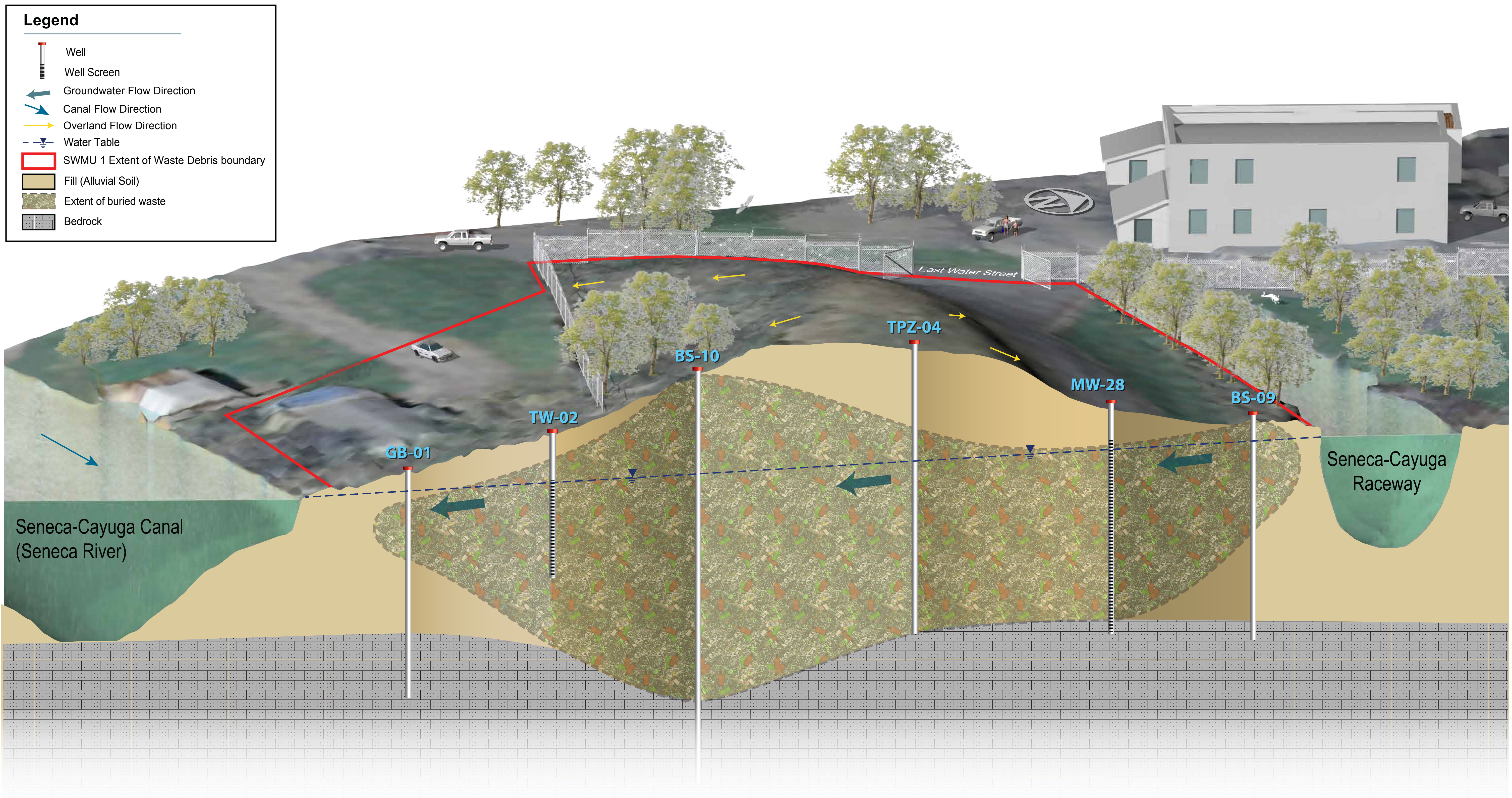


Figure 1-3
SWMU 1 Soil and Groundwater Sample Locations with COC Exceedances
SWMU 1 Corrective Measures Study
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL



Note:
TW-02 well screen: 5.5 ft to 10.5 ft bgs
MW-28 well screen: 6 ft to 16 ft bgs

Not to Scale

Figure 2-1
SWMU 1 Conceptual Site Model
SWMU 1 Corrective Measures Study
Former Hampshire Chemical Corp. Facility
Waterloo, New York

ES012712152229GNV Dow_SWMU-1_ICM_Work-Plan_rev7.ai 10/10/2013 LED

CH2MHILL.

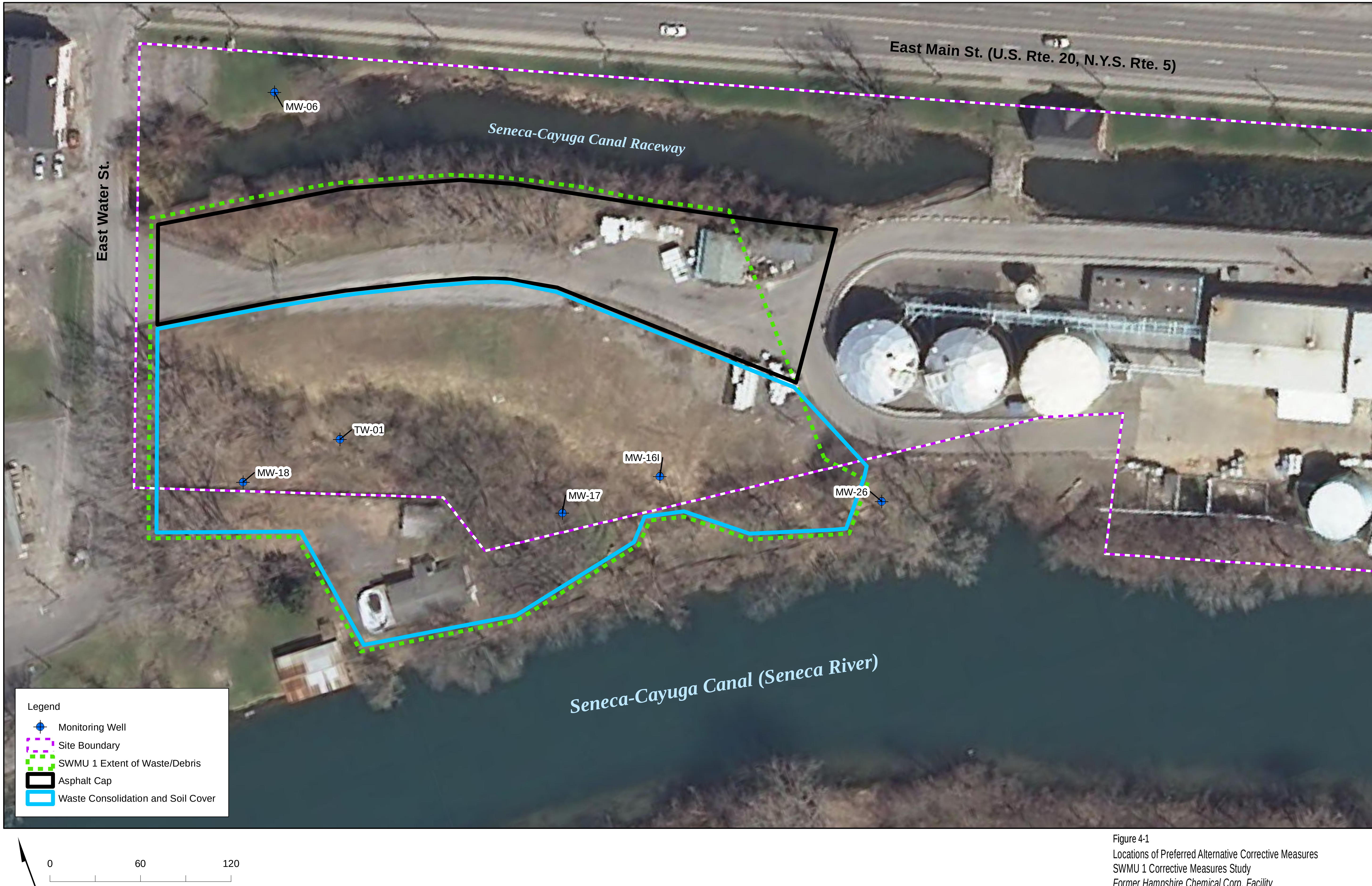


Figure 4-1
Locations of Preferred Alternative Corrective Measures
SWMU 1 Corrective Measures Study
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2013\SWMU01_CMS\MAPFILES\FIGURE 04-01 - LOCATIONS OF PREFERRED ALTERNATIVE CORRECTIVE MEASURES.MXD JHANSEN1 8/16/2013 12:08:02 PM

Figure 4-2
Location of Proposed Partial Soil Cover
SWMU 1 Corrective Measures Study
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2013\SWMU01_CMS\MAPFILES\FIGURE 04-02 - LOCATION OF PROPOSED PARTIAL SOIL COVER.MXD JHANSEN1 10/23/2013 9:22:15 AM

Appendix A

Regulatory Background References

PART 19

REFUSE DISPOSAL

(Statutory authority: Public Health Law, § 225)

Historical Note

Part added, filed Oct. 10, 1962 to be eff. January 1, 1963.

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Section 19.1 Definitions. (a) *Refuse* shall mean all putrescible and non-putrescible solid wastes including garbage, rubbish, ashes, incinerator residue, street cleanings, dead animals, offal and solid commercial and industrial wastes.

(b) *Refuse disposal area* shall mean land used for the depositing of refuse except that it shall not include the land used for the depositing of refuse from a single family, a member of which is the owner, occupant or lessee of said land, or any part of a farm on which only animal wastes resulting from the operation of such farm are deposited.

(c) *Person* shall mean an individual, group of individuals, partnership, firm, corporation, association, county, city, town or village or improvement district.

(d) *Full-time health officer* shall mean the health commissioner or health officer of a city of 50,000 population or over, or of a county or part-county health district, or the State district health officer in those areas of the State not located within a county, part-county or city health district.

Historical Note

Sec. added, filed Oct. 10, 1962 to be eff. Jan. 1, 1963.

53 H 10-18-62

10/18/62

19.2 Refuse disposal areas. (a) *Operation and maintenance.* Any person who maintains or operates a refuse disposal area or permits the use of land as a refuse disposal area shall maintain and operate such area in conformance with the requirements of this Part.

(1) Burning of refuse at a refuse disposal area is prohibited unless an exemption in writing is granted by the full-time health officer within whose jurisdiction said refuse disposal area is located, and provided that such exemption does not contravene the standards established by the Air Pollution Control Board.

(2) No refuse shall be deposited in such manner that refuse or leachings from it shall cause or contribute to a condition in contravention of the standards adopted pursuant to section 1205 of the Public Health Law.

(3) Dumping of refuse shall be confined to an area which can be effectively maintained and operated in accordance with these regulations. This shall be controlled by supervision, fencing, signs, or equally effective means unless an exemption in writing is granted by the full-time health officer within whose jurisdiction said refuse disposal area is located.

(4) Refuse at a refuse disposal area shall be compacted and covered daily with a compacted layer of at least six inches of a suitable cover material, and a final compacted cover of at least two feet of a suitable cover material shall be placed within one week after the final deposit of refuse at any portion of such refuse disposal area unless an exemption in writing is granted by the full-time health officer within whose jurisdiction said refuse disposal area is located.

(5) Effective means shall be taken to control flies, rodents, and other insects or vermin at a refuse disposal area to the extent that they shall not constitute a nuisance affecting public health.

(6) Fencing or other suitable means shall be used to confine papers and other refuse to the refuse disposal area.

(7) The salvaging of refuse at a refuse disposal area, if permitted by the operator of the refuse disposal area, shall be conducted in such a manner as not to create a nuisance affecting public health.

(8) The approach road to a refuse disposal area open to the general public shall be kept passable to vehicular traffic during all seasons of the year.

(9) The full-time health officer within whose jurisdiction a refuse disposal area is located is authorized and empowered to issue and grant annually the exemptions hereinbefore referred to, if in his judgment no nuisance or hazard to public health shall be created thereby. Any exemption hereby authorized shall expire and become void if by reason of said exemption the operation of a refuse disposal area shall be or become a nuisance or a hazard to public health or contravene any provision of this Part from the operation of which an exemption has not been granted.

(b) *New sites.* A new refuse disposal area shall not be established until the site and method of proposed operation have been approved in writing by the full-time health officer in whose respective jurisdiction such proposed refuse disposal area will be located. Such health officer is authorized to approve a new refuse disposal area if, in his judgment, it can be operated and maintained in such manner as not to constitute a nuisance or hazard to public health. The health officer may require such plans, reports, specifications, and other data as is necessary for him to determine whether the site is suitable and the proposed method of operation feasible.

Historical Note

Sec. added, filed Oct. 10, 1962 to be eff. Jan. 1, 1963.

19.3 Municipal incinerators. Municipal incinerators shall be operated and maintained so as not to create a nuisance or hazard to public health.

Historical Note

Sec. added, filed Oct. 10, 1962 to be eff. Jan. 1, 1963.

19.4 Adequacy of operation and maintenance. Operation and maintenance of a refuse disposal area pursuant to subdivision (a) of section 19.2 of this Part and operation and maintenance of a municipal incinerator pursuant to section 19.3 of this Part shall be under the surveillance of the full-time health officer in whose jurisdiction said refuse disposal area or municipal incinerator is located. The full-time health officer shall be charged with the duty of enforcing the sections of this Part and shall cause such inspections to be made as he may deem necessary to determine whether the operation and control of such refuse disposal area or municipal incinerator are in compliance with the provisions of this Part.

Historical Note

Sec. added, filed Oct. 10, 1962 to be eff. Jan. 1, 1963.

19.5 Interjurisdictional nuisances and hazards to public health. (a) Where the operation of a refuse disposal area is conducted in such a manner as to constitute a nuisance or a hazard to public health outside a health district in which said refuse disposal area is located, the officer designated in subdivision (b) hereof shall have the authority, and it shall be his duty, on receipt of a written complaint by any person, to inquire into the facts concerning such operation. If he shall find that said operation is in contravention of any of the sections contained in this Part, he shall make and cause to be served personally or by mail upon the person operating said refuse disposal area a notice in writing stating the manner in which said operation contravenes such section or sections and specifying the particular section or sections contravened and ordering the person operating such refuse disposal area to correct or to cease such operation. If the person served as aforesaid does not comply with the requirements of such order within the time specified therein, said officer shall forthwith cause a report in writing containing a summary of the facts as disclosed by his inquiry, a recital of all action taken, and his recommendations, if any, to be transmitted to the State Commissioner of Health for such action as he may deem advisable.

(b) The officer having jurisdiction to take the action authorized and directed in subdivision (a) hereof shall be:

(1) The county or part-county health commissioner where the refuse disposal area and the residence or real property occupied by the complainant are located in the same county or part-county health district.

(2) The State district health officer where the refuse disposal area and the residence or real property occupied by the complainant are located in the same State district health area, but not in the same county or part-county health district.

(3) In all other cases, the regional health director having jurisdiction in the area in which the refuse disposal area is located.

Historical Note

Sec. added, filed Oct. 10, 1962 to be eff. Jan. 1, 1963.

State of New York
DEPARTMENT OF STATE } ss.:

It is Hereby Certified, *That* the attached is a true copy of 6 NYCRR Part 360 as filed with the New York State Department of State on August 30, 1973 to be effective September 1, 1973.

Witness *my hand and the official seal of the Department of State at the City of Albany, this* tenth *day of* May *one thousand nine hundred and* ninety-one.

Secretary of State

382101-019 (3/85)

SUBCHAPTER B

Solid Wastes

PART 360

REFUSE DISPOSAL

(Statutory authority: Environmental Conservation Law, § 27-0503; L. 1973, ch. 399)

Historical Note

Part (§ 360.1) added, filed Oct. 15, 1970; renum. Part 454, Title 9, filed Sept. 1971; new (§§ 360.1—360.5) added, filed Apr. 28, 1972; repealed, new Part (§§ 360.1—360.3) added, filed Aug. 30, 1973 eff. Sept. 1, 1973.

Section 360.1 Definitions. (a) *Commissioner* shall mean the Commissioner of Environmental Conservation.

(b) *Refuse* shall mean all putrescible and nonputrescible solid wastes including garbage, rubbish, ashes, incinerator residue, street cleanings, dead animals, offal and solid commercial and industrial wastes.

(c) *Refuse disposal area* shall mean land used for the depositing of refuse except that it shall not include the land used for the deposting of refuse from a single family, a member of which is the owner, occupant, or lessee of said land, or any part of a farm on which only animal wastes resulting from the operation of such farm are deposited.

(d) *Person* shall mean an individual, group of individuals, partnership, firm, corporation, association, county, city, town or village or improvement district.

Historical Note

Sec. added, filed Oct. 15, 1970; renum. 454.1, Title 9, filed Sept., 1971; new added, filed Apr. 28, 1972; repealed, new filed Aug. 30, 1973 eff. Sept. 1, 1973.

360.2 Refuse disposal areas. (a) *Operation and maintenance.* Any person who maintains or operates a refuse disposal area or permits the use of land as a refuse disposal area shall maintain and operate such area in conformance with the requirements of this Part.

(1) Burning of refuse at a refuse disposal area is prohibited except in accordance with a permit issued by the commissioner on application therefor. An application for such permit shall include the reasons why such burning should be permitted and such other information as may be required by the commissioner to assure that such burning will not result in contravention of air quality standards or to cause air pollution. If the commissioner approves such application he will issue a permit which shall be for a specified period and shall contain such conditions as are deemed necessary to prevent air pollution and contravention of air quality standards. The permit may be revoked by the commissioner if there is: a failure to comply with its conditions; a violaiton of law in connection

with the burning; or the occurrence, or likely occurence, of either air pollution or contravention of air quality standards as a result of the burning. Before revocation of a permit, the permittee shall have the right to be heard; but where prompt action is necessary because of danger to the public health or safety, or to prevent serious air pollution, the permit may be suspended pending a hearing.

(2) No refuse shall be deposited in such manner that refuse or leachings from it shall cause or contribute to a condition in contravention of the classification and standards of quality and purity of the waters of the State established, adopted and so assigned pursuant to section 17-0301 of the Environmental Conservation Law and derivative statutes relative thereto.

(3) Dumping of refuse shall be confined to an area which can be effectively maintained and operated in accordance with this Part. Such area shall be controlled by supervision, fencing, signs or equally effective means unless an exemption in writing is ganted by the commissioner.

(4) Refuse at a refuse disposal area shall be compacted and covered daily with a compacted layer of at least six inches of a suitable cover material, and a final compacted cover of at least two feet of a suitable cover material shall be placed within one week after the final deposit of refuse at any portion of such refuse disposal area unless an exemption in writing is granted by the commissioner.

(5) Effective means shall be taken to control flies, rodents, and other insects or vermin at a refuse disposal area to the extent that they shall not constitute a nuisance affecting public health.

(6) Fencing or other suitable means shall be used to confine papers and other refuse to the refuse disposal area.

(7) The salvaging of refuse at a refuse disposal area, if permitted by the operator of the refuse disposal area, shall be conducted in such a manner as not to create a nuisance affecting public health.

(8) The approach road to a refuse disposal area open to the general public shall be kept passable to vehicular traffic during all seasons of the year.

(9) The commissioner may issue and grant annually the exemptions hereinabove referred to, if in his judgment no nuisance or hazard to public health or the environment shall be created thereby. Any exemption hereby authorized shall expire and become void if by reason of said exemption the operation of a refuse disposal area shall be or become a nuisance or hazard to public health or the environment, or contravene any provision of this Part from the operation of which an exemption has not been granted.

(b) *New sites.* A new refuse disposal area shall not be established until the site and method of proposed operation have been approved in writing by the commissioner. The commissioner may approve a new refuse disposal area if, in his judgment, it can be operated and maintained in such manner as not to constitute a nuisance or hazard to public health or the environment. The commissioner may require such plans, reports, specifications, and other data as is necessary for him to determine whether the site is suitable and the proposed method of operation feasible.

Historical Note

Sec. added, filed Apr. 28, 1972; repealed,
new filed Aug. 30, 1973 eff. Sept. 1, 1973.

360.3 Municipal incinerators. Municipal incinerators shall be operated and maintained so as not to create a nuisance or hazard to public health or the environment.

Historical Note

Sec. added, filed Apr. 28, 1972; repealed,
new filed Aug. 30, 1973 eff. Sept. 1, 1973.

360.4 — 360.5

Historical Note

Secs. added, filed Apr. 28, 1972; repealed, filed Aug. 30, 1973 eff. Sept. 1, 1973.

PART 361

GENERAL PROVISIONS REGARDING THE PAYMENT OF STATE AID FOR THE FISCAL YEAR BEGINNING APRIL 1, 1972

(Statutory authority: Public Health Law, art. 6 ~~and~~ ch. 33 (L. 1972))

Historical Note

Part (§§ 361.1—361.8) added, filed Oct. 15, 1970; renum. Part 455, Title 9, filed Sept., 1971; new (§§ 361.1—361.3) filed April 28, 1972 eff. May 1, 1972.

Section 361.1 General. The provisions of Subchapter B of this Chapter are modified by the following provisions regarding State aid for the State fiscal year April 1, 1972 through March 31, 1973.

Historical Note

Sec. added, filed Oct. 15, 1970; renum. 455.1; Title 9, filed Sept., 1971; new filed April 28, 1972; amd. filed Aug. 14, 1972 eff. immediately. Changed dates.

361.2 **Special provisions regarding payments from appropriations for the State fiscal year beginning April 1, 1972.** Payments from appropriations pursuant to chapter 33 of the Laws of 1972 for State aid programs will be paid at rates and in amounts calculated to exhaust, but not to exceed, the amounts approved by the Director of the Budget.

Historical Note

Sec. added, filed Oct. 15, 1970; renum. 455.2, Title 9, filed Sept., 1971; new filed Apr. 28, 1972; amd. filed Aug. 14, 1972, eff. immediately. Changed "chapter 53" to "chapter 33" and changed dates.

361.3 **Methods of payment.** The following methods of payment shall apply to the several State aid programs:

(a) *State aid for general public health work.* State aid will be paid at a rate determined by the Commissioner of Environmental Conservation after review and approval of State aid applications, with such adjustment of that rate as may be necessary to distribute the entire allocation.

(1) Claims must be submitted quarterly by all jurisdictions not later than two months after the calendar quarter in which the expenditures claimed were made. Upon receipt of the fourth claim from all jurisdictions, or after June 15, 1973, the Commissioner of Environmental Conservation shall calculate the amounts claimed by each claimant during the entire year and shall distribute any balance remaining in the total allocated for the payment of State aid for general public health work in proportion to the relationship which each claimant's total expenditures bears to the total expenditures of all claimants, except that no claimant shall receive more than 50 percent of its total reimbursable expense, subject to paragraph (4) below.

Appendix B
SWMU 1 Cross-Sections and Top-of-Bedrock Figure

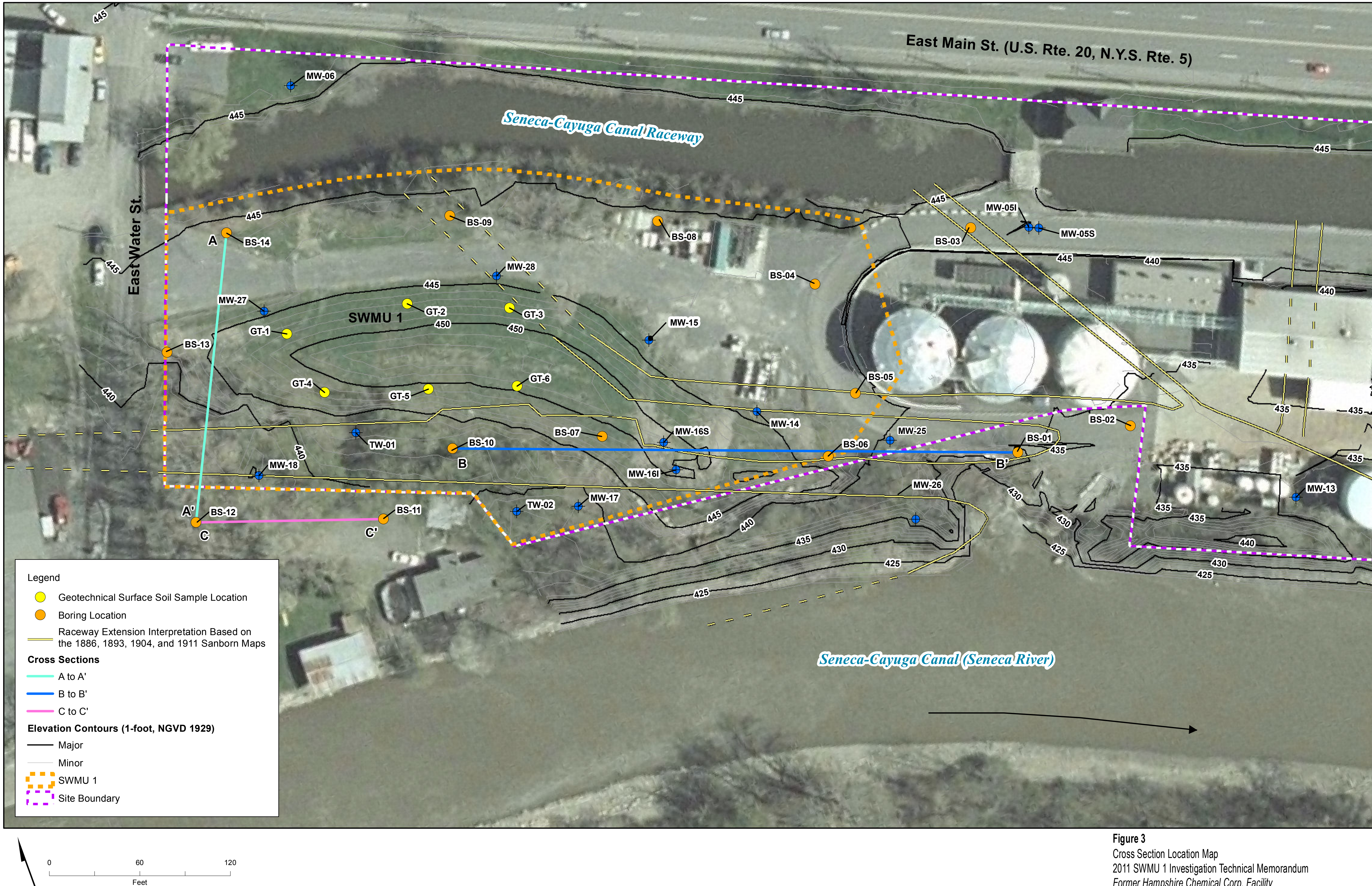

Figure 3
Cross Section Location Map
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

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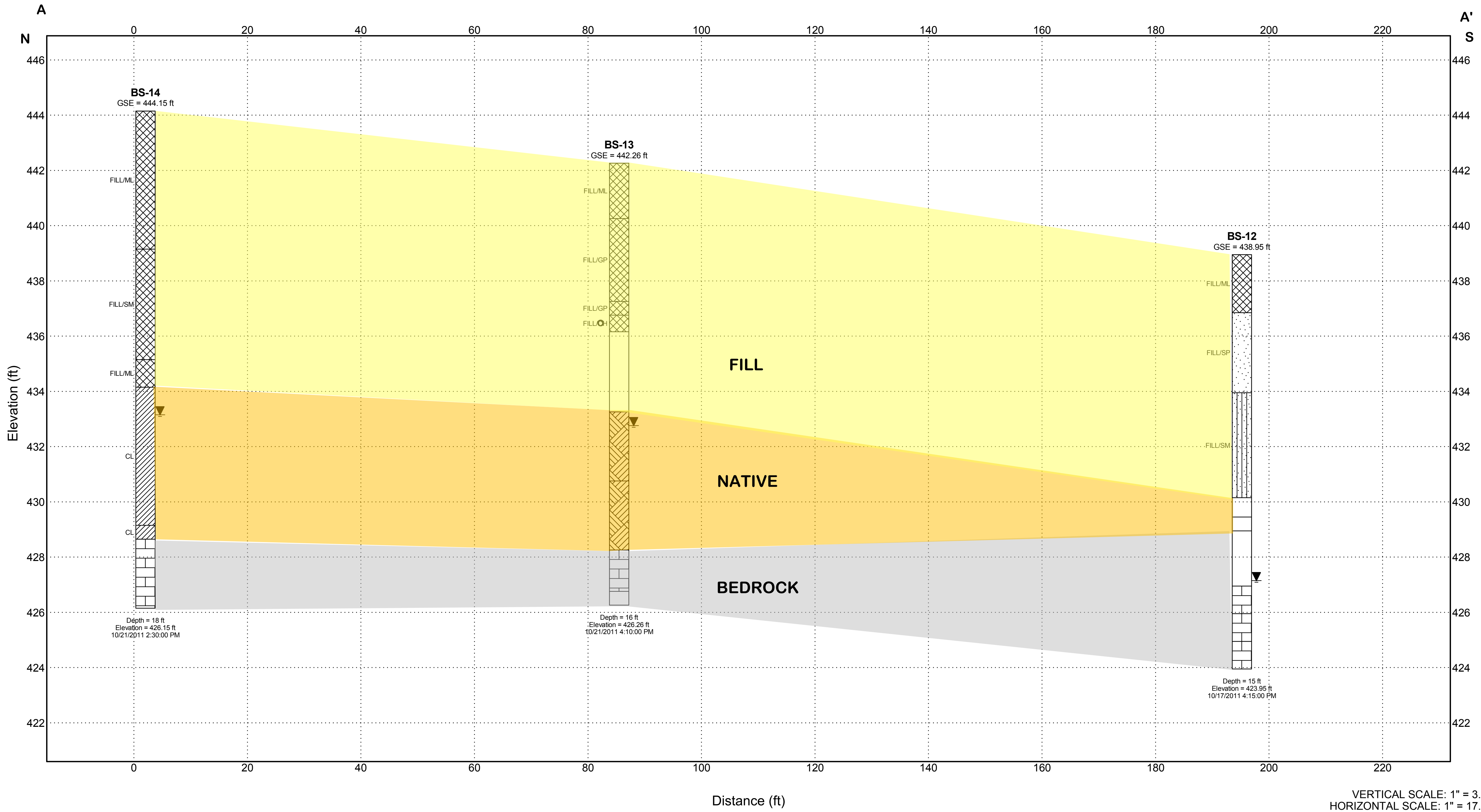


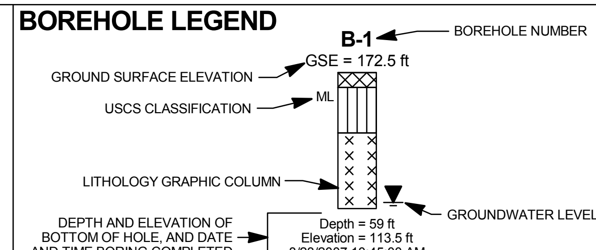
VERTICAL SCALE: 1" = 3.5'
HORIZONTAL SCALE: 1" = 17.1'

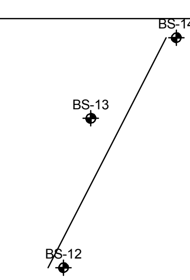
CH2MHILL

LITHOLOGY GRAPHICS

- Fill
- Poorly Graded Sand
- Silty Sand
- Limestone
- Bedrock
- Lean Clay

BOREHOLE LEGEND



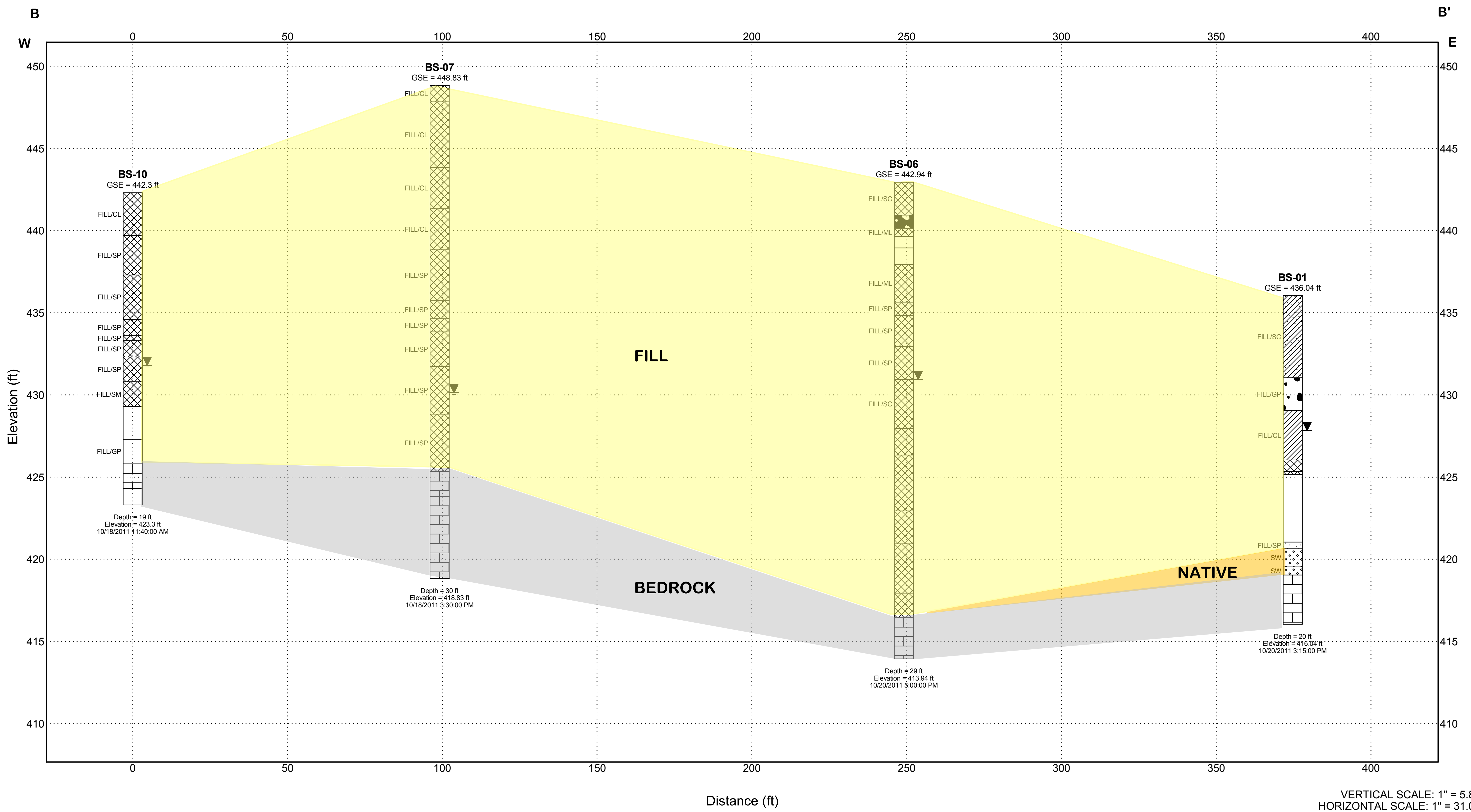


Section A-A'

2011 SWMU 1 Investigation Technical Memorandum
RCRA Facility Investigation
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Project Number: 416903.03.05

11X17 STICK LOG WITH LEGEND RFI 2011 SWMU 1 INVESTIGATION.GPJ CH2M GEOTECH-REVISED.GDT 11/2/11



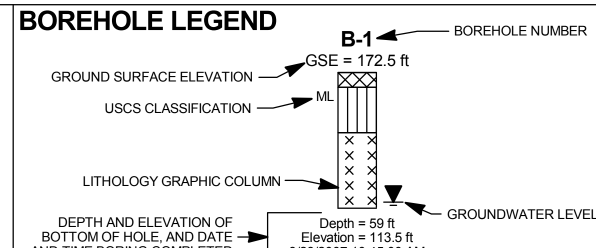
VERTICAL SCALE: 1" = 5.8'
HORIZONTAL SCALE: 1" = 31.0'

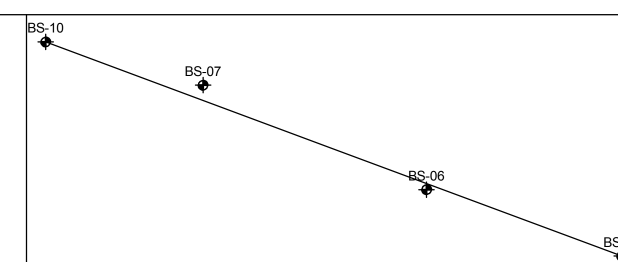
CH2MHILL

LITHOLOGY GRAPHICS

- Clayey Sand
- Poorly Graded Gravel
- Lean Clay
- Fill
- Poorly Graded Sand
- Well-Graded Sand
- Limestone
- Boulders and cobbles

BOREHOLE LEGEND





Section B-B'

2011 SWMU 1 Investigation Technical Memorandum
RCRA Facility Investigation
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Project Number: 416903.03.05

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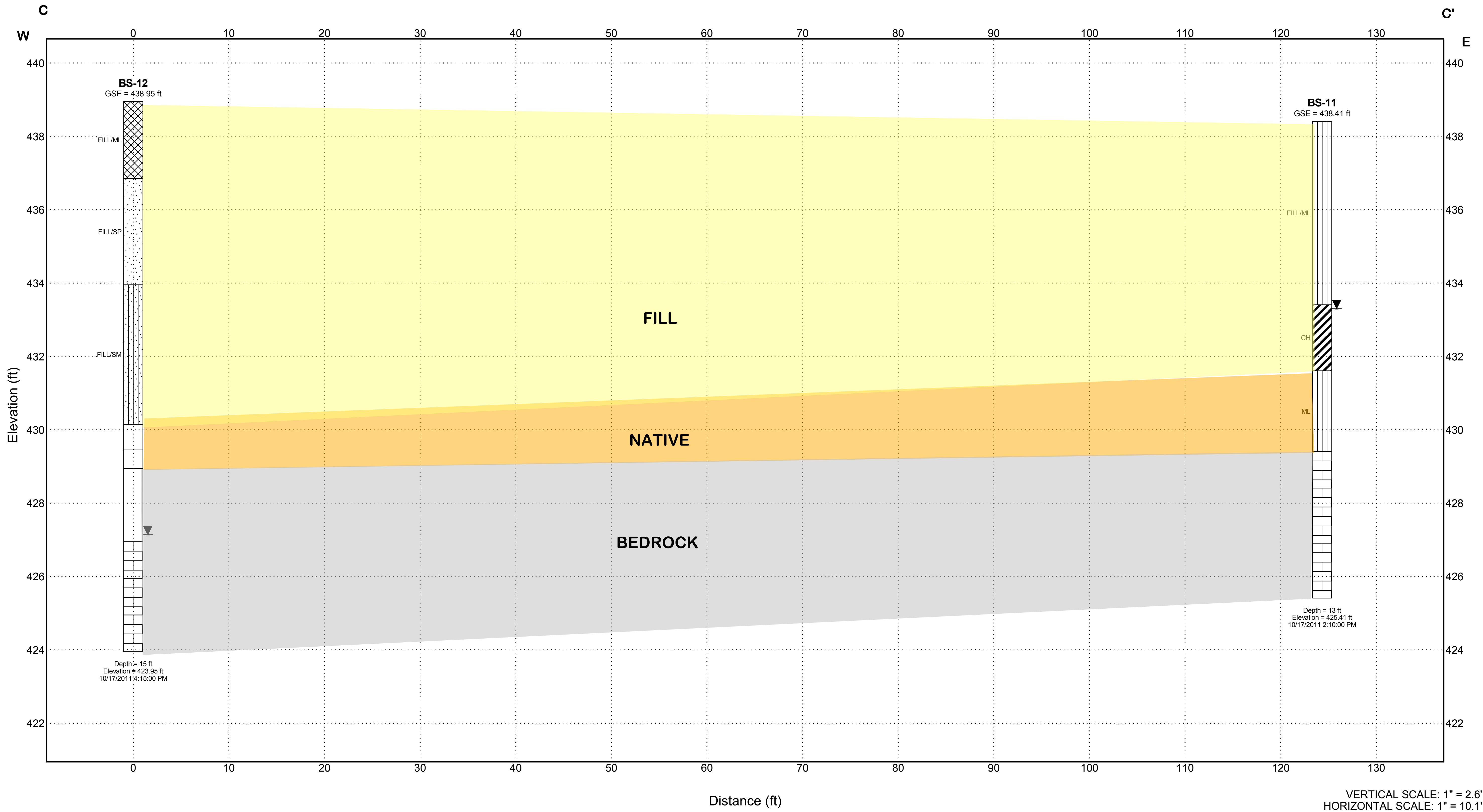
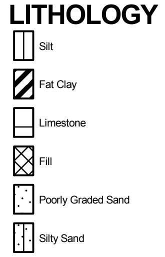


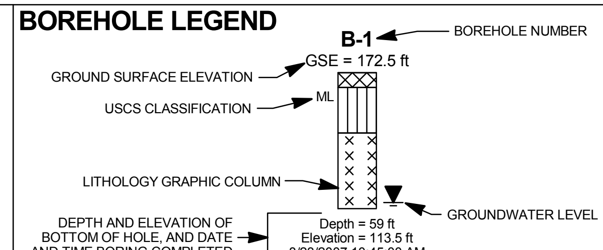
VERTICAL SCALE: 1" = 2.6'
HORIZONTAL SCALE: 1" = 10.1'

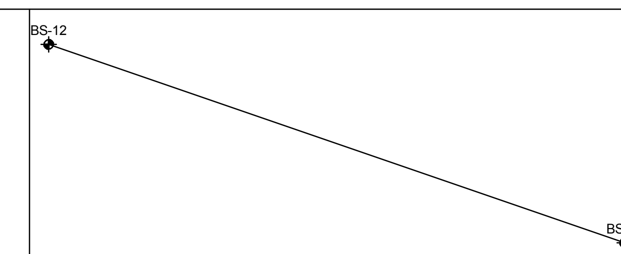
CH2MHILL

LITHOLOGY GRAPHICS



BOREHOLE LEGEND



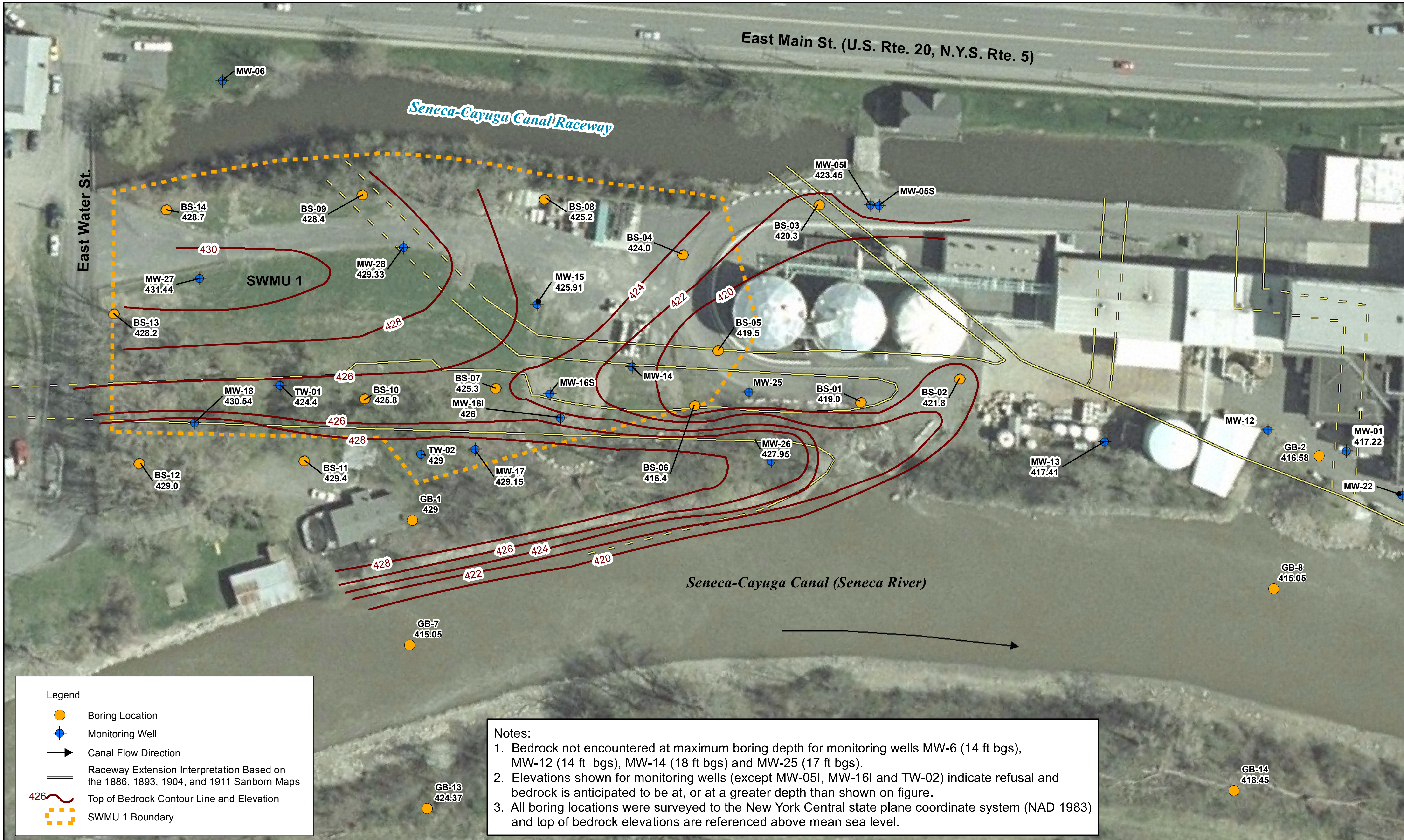


Section C-C'

2011 SWMU 1 Investigation Technical Memorandum
RCRA Facility Investigation
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Project Number: 416903.03.05

11X17 STICK LOG WITH LEGEND RFI 2011 SWMU 1 INVESTIGATION.GPJ CH2M GEOTECH-REVISED.GDT 11/2/11



Notes:

1. Bedrock not encountered at maximum boring depth for monitoring wells MW-6 (14 ft bgs), MW-12 (14 ft bgs), MW-14 (18 ft bgs) and MW-25 (17 ft bgs).
2. Elevations shown for monitoring wells (except MW-05I, MW-16I and TW-02) indicate refusal and bedrock is anticipated to be at, or at a greater depth than shown on figure.
3. All boring locations were surveyed to the New York Central state plane coordinate system (NAD 1983) and top of bedrock elevations are referenced above mean sea level.

Figure 4
SWMU 1 Top of Bedrock Contour Map
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

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Appendix C

SWMU 1 Extent of Waste Delineation Technical Memorandum

SWMU 1 Extent of Waste Delineation, Former Hampshire Chemical Corp. Facility, Waterloo, New York

PREPARED FOR: The Dow Chemical Company

PREPARED BY: CH2M HILL

DATE: July 1, 2013

Introduction

This technical memorandum reports the results of the July-August 2012 soil boring investigation conducted to delineate the extent of fill/waste to the west-southwest of the former Hampshire Chemical Corp. (HCC) Facility Solid Waste Management Unit 1 (SWMU 1) in Waterloo, New York. The delineation activities were conducted during July-August 2012 using seven direct-push borings at the former HCC facility, now known as the Evans Chemetics Facility (the site). The site is regulated under Title 6 of the New York Code of Rules and Regulations Part 373 and the Resource Conservation and Recovery Act (RCRA), with the New York State Department of Environmental Conservation as the lead agency. RCRA facility investigations (RFIs) have been performed at the facility since 1993 to evaluate the nature and extent of releases to the environment.

The field activities detailed in this technical memorandum were performed in support of selecting a remedial alternative for the corrective measures study at SWMU 1, and in accordance with the site-specific quality assurance project plan (CH2M HILL 2009) and CH2M HILL's site-specific health, safety, and environmental plan (CH2M HILL, 2012a).

Background

Site Location and Setting

The site is located at 228 East Main Street in the village of Waterloo, Seneca County, New York (Figure 1). The site is bordered to the north by East Main Street, to the east by Gorham Street, to the west by East Water Street, and to the south by the Seneca-Cayuga Canal. Several interconnected buildings on the site contain offices; a quality control laboratory; manufacturing, maintenance, and shipping/receiving operations; and a chemical treatment plant. The site also includes outside drum storage areas and several aboveground storage tanks.

SWMU 1 Site Background

SWMU 1 is in the southwestern corner of the facility property. It is bounded to the east by the facility, to the south by the Seneca-Cayuga Canal, to the west by East Water Street, and to the north by the Seneca-Cayuga Canal Raceway and an asphalt access road into the facility. A former residence that was constructed around 1974 near the southwest corner of

SWMU 1 and adjacent to the canal is still present, although the house is no longer a residence and is owned by HCC. Figure 1 shows the location and configuration of SWMU 1 relative to the surrounding features and the facility boundaries.

Sanborn fire insurance maps of the site indicate the area along the western side of SWMU 1 and near some of the historical raceways was identified as the Village of Waterloo Dump as early as October 1918. The *RCRA Facility Assessment Report* (A.T. Kearney 1993) indicates the former Village of Waterloo Dump was probably in operation at the western edge of the site until 1951 (O'Brien and Gere Engineers, Inc. [OBG] 2003). This suggests an operational period for the dump of at least 33 years, during which the Village of Waterloo placed debris, soil, and refuse in this area. As indicated by facility personnel, additional soil material may have been placed over the filled former raceways in the late 1990s that was derived from excavation activities during construction on the upgrades to the on-site wastewater treatment system.

Previous Investigations

Test pits excavated during previous environmental investigations at SWMU 1 identified various types of municipal waste and fill, including glass and plastic fragments, scrap metal, ash, ceramics, shoes, brake pads, copper wire, and vehicle tires (CH2M HILL 2004, 2006, 2010). Construction debris including cobbles, bricks, wood, and metal scrap also was identified in the test pits. Intact bottles, both empty and containing liquids, were identified in test pits located near the access roadway as well as along the right-of-way near the canal (CH2M HILL 2006, 2010). The results of the test pit excavations show that fill materials extend onto the canal right-of-way. From the test pit investigation, it was estimated that approximately 2,500 cubic yards of fill material are present within the canal right–of-way (CH2M HILL 2010).

Further details regarding the previous environmental and geotechnical investigations conducted at SWMU 1 are in the RFI (CH2M HILL 2006), the RFI Addendum (CH2M HILL 2008), visual subsurface technical memorandum (CH2M HILL 2010), and geotechnical investigation report (CH2M HILL 2012b).

Objectives

The general objective of this investigation is to further delineate the extent of fill material in the southwest area of SWMU 1. This investigation was conducted to:

- Evaluate whether any fill activities or areas of disturbance can be observed in the vicinity of the former residence and in the southwestern area of SWMU 1 based upon a review of historical aerials
- Evaluate the presence or absence of fill material in the subsurface in the southwestern area of SWMU 1
- Determine whether the extent of waste boundary for SWMU 1 needs to be revised based upon the findings of this investigation.

Field Activities

CH2M HILL mobilized to the site in July 2012 for utility clearance and soil sampling activities. The fieldwork was completed in July-August 2012. During this period, seven soil borings were advanced to refusal, a maximum depth of 11 feet below ground surface (bgs). The coordinates and surface elevations of the boring locations were established by a land survey. The following sections describe the sequence of field activities that took place during the July-August 2012 field investigation.

Utility Clearance

The drilling subcontractor, Parratt-Wolff, contacted Dig Safely of New York to clear the public utility lines in the work area before mobilizing to the site. Additionally, CH2M HILL retained a third-party utility locating service to survey the work area and locate underground utilities within the investigation area.

Soil Borings via Direct-Push Technology

Seven soil borings (BS-15 to BS-21) were advanced on July 31-August 1, 2012 using a direct-push technology (DPT) drill rig. At each boring location, the DPT rig collected continuous soil cores from the ground surface down to sampler refusal (maximum depth of 11 feet bgs). A CH2M HILL geologist documented the soil lithology using the Unified Soil Classification System (American Society for Testing and Materials [ASTM]-422D). Boring logs are provided in Attachment 1.

Continuous air monitoring was performed during drilling activities. Each soil core was screened for organic vapors using a photoionization detector.

At the conclusion of each boring, the drilling subcontractor abandoned each borehole by filling it with bentonite chips to the ground surface.

Survey of Boring Locations

A New York-registered professional land surveyor conducted a survey of the seven soil borings. Existing suitable and new control points were used to develop coordinates (X and Y) to the nearest 0.1 foot and elevations (Z), to the nearest 0.01 foot.

Management of Investigation-Derived Waste

Personal protective equipment, disposable sampling equipment, drill cuttings and investigation-derived waste liquids were accumulated in 55-gallon drums at the site. CH2M HILL coordinated offsite landfill disposal of the waste created during the investigative activities with a waste management and disposal company.

Results

Review of Sanborn Maps and Historical Aerials

Sanborn fire insurance maps of the former HCC facility dating from 1886 to 1962 were reviewed to identify any activities near the western side of SWMU 1 (Attachment 2). The old West Mill and canal/raceway and lock system that crossed east-west through the center of SWMU 1 is present on the Sanborn maps until approximately 1948. The 1962 Sanborn map for the facility shows that the old West Mill is no longer present and the east-west canal/raceway that crossed through SWMU 1 was no longer present up to western edge of the old lock. The 1962 Sanborn map of the western area of SWMU 1 identified the east-west raceway as being filled-in to the western edge of the old lock and that the former Village (of Waterloo) Dump being located immediately north of where the canal/raceway had been filled. In addition, the 1962 Sanborn map also shows two building structures, including a woodman/general repair shop and a boat storage, are present in the area of the site adjacent to the canal and where the former residence is located (Attachment 2).

In a 1992 correspondence by W.R. Grace & Co. to the United States Environmental Protection Agency (USEPA), a site map also identifies the Former Village of Waterloo Dump within the general vicinity of SWMU 1 where the east-west canal/ raceway had crossed through the site (W.R. Grace 1992). In addition, the site map extends the limits of the Former Village of Waterloo Dump adjacent to the canal on what is currently the New York State Canal Corporation (NYSCC) right-of-way (Attachment 3). The former residence and garage are shown on this site map adjacent to the canal (identified as a "Private Home"); however, the home is outside the limits of the Former Village of Waterloo Dump.

A review of historical aerial photographs taken in 1938 and 1957 of the former HCC facility shows areas of disturbance in the southwestern portion of SMWU 1 (Figures 2 and 3). The former residence and boathouse that are currently near the southwestern corner of SWMU 1 were not present in 1938 or 1957; the house was reportedly constructed around 1974. On the 1938 aerial (Figure 2), no trees are present and the ground surface is exposed near the southwestern corner of SWMU 1. Since a former raceway crossed east-west through this area, the exposed ground surface observed in the aerial (light-colored area) could be the fill material that was being used to fill in the raceway (Figure 2). Fill material covers the southwestern portion of SMWU 1 and continues to the west across East Water Street. The area north of the filled raceway is covered by a wooded area and to the south by grass and a few trees.

The area of fill material/exposed ground surface shown in the 1938 photograph is covered with grass and no longer visible in 1957 (Figures 2 and 3). An access road begins at East Water Street, proceeds east, and ends with a turnaround area at approximately the same area where the former residence is now located (Figure 3). The trees near the Seneca-Cayuga Canal are no longer present, and it appears there is some fill material along the river at the end of the access road.

Soil Boring Evaluation

The seven soil borings advanced near the former residence in August 2012 were located within the general area of disturbance as observed on the historical aerials. In addition, the borings were advanced to help delineate the extent of waste within the southwestern area of SWMU 1. Waste debris was delineated to the southwestern area by borings BS-15 and BS-16, both of which did not report any waste in their respective soil cores. Soils at both BS-15 and BS-16 consisted predominantly of silt and sand; bedrock material was encountered at 10.75 feet bgs at BS-15 and at 6.5 feet bgs at BS-16.

Small amounts of waste debris were reported in the soil borings just west and northwest of the house. Trace amounts of brick and glass were reported at 2 feet bgs and 4 feet bgs in borings BS-17 and BS-21, respectively, with the remaining soils consisting of silty sands, sandy clay, and gravels. Trace amounts of brick and glass were reported in boring BS-18 from 2 to 3 feet bgs, with the remaining soils predominantly silt, sand, and clay. At locations BS-17, BS-18, and BS-21, bedrock was encountered from 6.4 to 8 feet bgs.

Greater vertical extents of waste debris were encountered along the eastern side of the house. Brick, glass fragments, and gravel were generally observed from 1.5 to 9 feet bgs at boring BS-19, with the soils predominantly a sandy silt. At boring BS-20, glass fragments and gravel were observed from the ground surface down to 6 feet bgs, along with brick fragments from 6 to 8 feet bgs. Soils at BS-20 were predominantly clayey sands and silty sands. Bedrock material was encountered at approximately 8.3 to 9.7 feet bgs at locations BS-20 and BS-19, respectively.

A summary of the waste identified in the soil borings is provided in Table 1.

TABLE 1
Waste Descriptions in SWMU 1 Soil Borings
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Soil Boring ID	Waste Description
BS-15	No waste material
BS-16	No waste material
BS-17	Traces of brick and glass fragments at approximately 2 feet bgs
BS-18	Traces of brick and glass fragments at approximately 2 to 3 feet bgs
BS-19	Traces of brick and glass fragments at approximately 1.5 to 3 feet bgs and 4 to 9 feet bgs; gravel was encountered throughout the soil core mixed with the brick and glass fragments
BS-20	Trace glass fragments visible a few inches bgs, followed by a gravel layer and some additional glass fragments down to 6 feet bgs; brick fragments were found from 6 to 8 feet bgs
BS-21	Traces of brick fragments at approximately 4 feet bgs

Conclusions

The following conclusions have been determined from the results of the data collected during the July-August 2012 SWMU 1 delineation investigation:

- Review of the historical Sanborn maps (1918 through 1962) of the site indicated that the filling activities occurred within the east-west canal/raceway that crossed through SWMU 1 sometime in between 1948 and 1962. This area of filling would have been immediately north of the location of the former residence. In addition, this area of filling is also in the same general area where the historical Sanborn maps and site maps identify the location of the Former Village of Waterloo Dump (Attachments 2 and 3).
- Review of the 1938 and 1957 aerial photographs of the site also indicated an area of disturbance (exposed ground surface and turnaround area for an access road) near the former residence and before the house was built in approximately 1974 (Figures 2 and 3).
- No fill material was identified in either of the two western-most soil borings (BS-15 and BS-16).

- Soil borings BS-17 and BS-18, located north and northwest of the house, both reported traces of brick and glass fragments at approximately 2 feet bgs. Soil boring BS-21, located southwest of the house, reported traces of brick fragments only at approximately 4 feet bgs.
- Soil borings BS-19 and BS-20, both located just west of the current extent of waste boundary and along the eastern side of the former residence, reported greater depths of fill material that included brick, glass, and gravel. Fill depths ranged from 3 to 9 feet bgs at BS-19 and 0 to 8 feet bgs at BS-20.
- The fill waste appears to extend beyond the original boundary and includes the area beneath the footprint of the former residence. However, the fill waste pinches out in depth from the eastern side of the house, where there is 6- to 8-foot-thick fill at soil borings BS-19 and BS-20, to the western side of the house, where there is only trace amounts of brick and glass at select depths at soil borings BS-17, BS-18, and BS-21.
- The extent of waste material is greater than originally proposed near the southwestern corner of SWMU 1. The delineation of the waste has been extended further to the west-southwest and includes the area around the former residence. The extent of waste boundary at SWMU 1 has now been revised to include borings BS-17, BS-18, BS-19, BS-20, and BS-21 (Figure 1).

References

A.T. Kearney. 1993. *RCRA Facility Assessment Report, Hampshire Chemical Corporation (formerly W.R. Grace), Waterloo, New York.* May.

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CH2M HILL. 2008. *RCRA Facility Investigation Report Addendum, Former Hampshire Chemical Corp., Waterloo, New York*. November, revised February 2010.

CH2M HILL. 2009. *Quality Assurance Project Plan, Former Hampshire Chemical Corp Facility, Waterloo, New York*. September, revised 2010.

CH2M HILL. 2010. *Final Technical Memorandum Work Plan – Visual Subsurface Investigation at the Former Village of Waterloo Dump Site (SWMU 1) Former Hampshire Chemical Corp Facility, Waterloo New York.* February.

CH2M HILL. 2012a. *Health and Safety Plan, Former Hampshire Chemical Corp Facility, Waterloo, New York.* July.

CH2M HILL. 2012b. *2011 SWMU 1 Investigation Report, Former Hampshire Chemical Corp. Facility, Waterloo, New York*. April.

O'Brien & Gere Engineers, Inc. (OBG). 2003. *Sampling Visit Report, RCRA Facility Assessment, Hampshire Chemical Corporation Facility, Waterloo, New York.* September.

W.R. Grace & Co. 1992. Correspondence to the USEPA Region II on comments to the Draft RCRA Facility Assessment Report for the Evans Chemetics Facility. December 18.

Figures

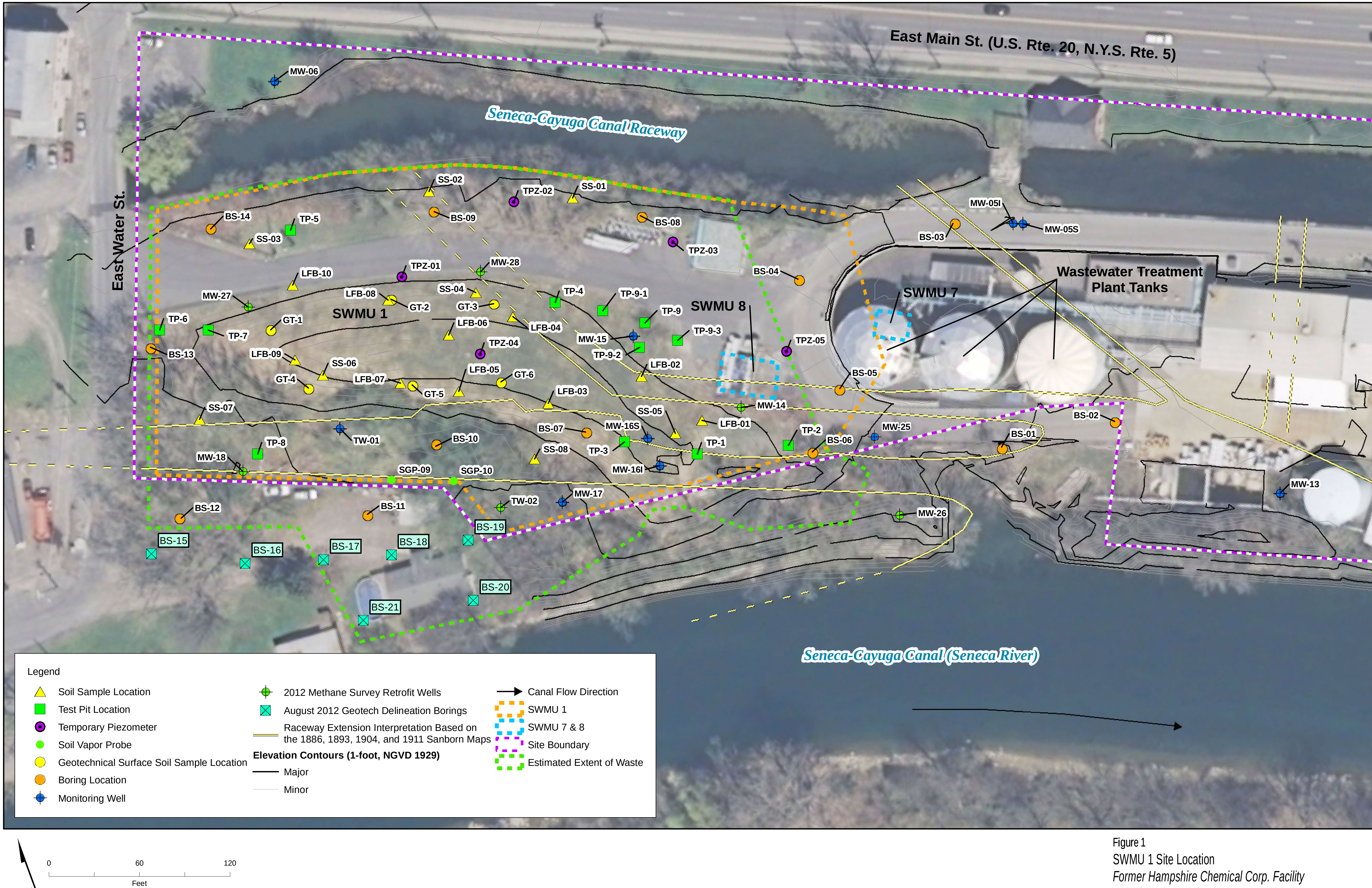


Figure 1
SWMU 1 Site Location
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2013\TCLPSAMPLINGOFNORTHSHOREDEPOSITWP\MAPFILES\FIGURE 01 - SWMU 1 SITE LOCATION.MXD JHANSEN1 6/27/2013 4:18:12 PM

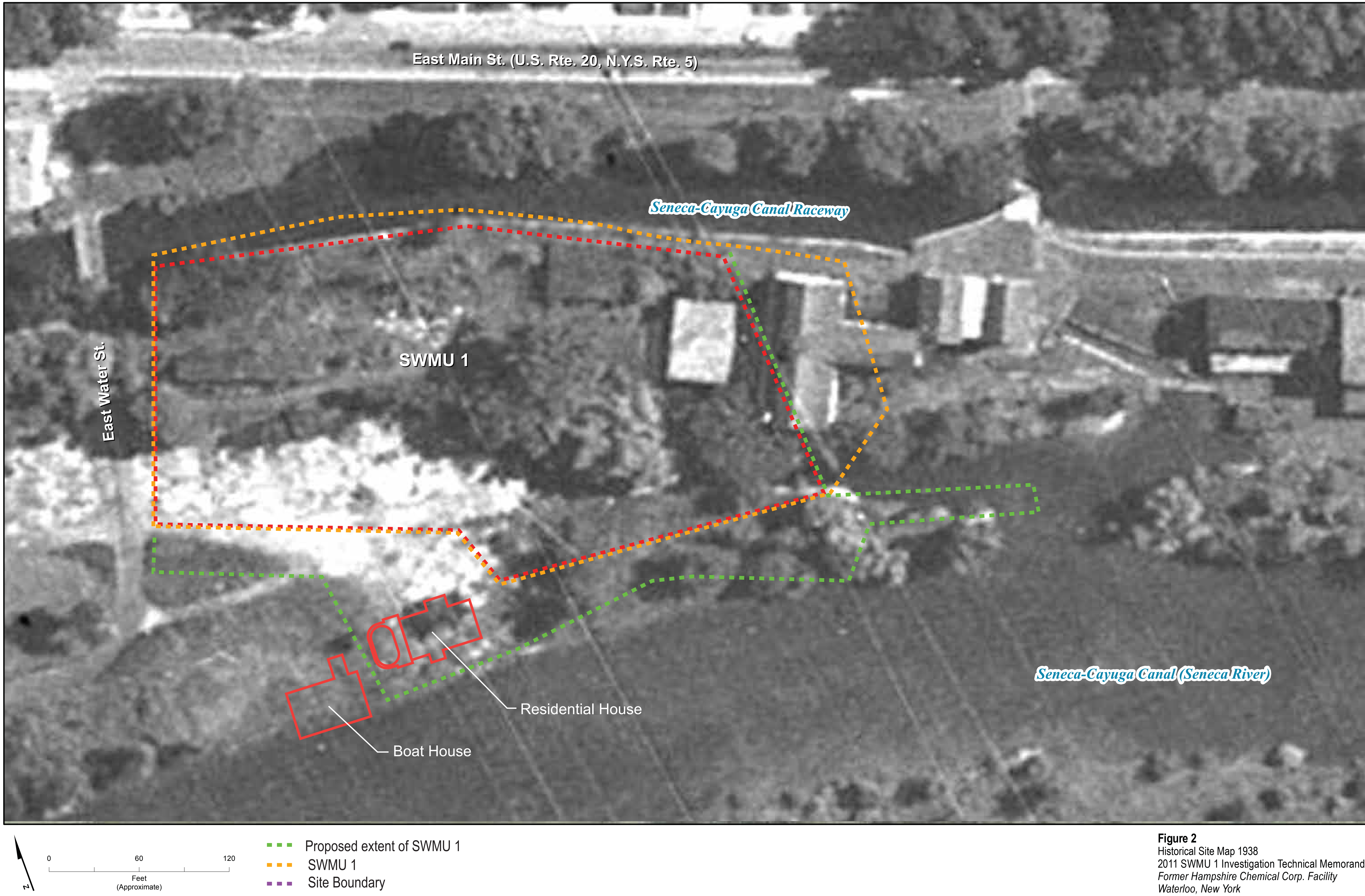


Figure 2
Historical Site Map 1938
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL.

ES012712152229GNV Waterloo_SWMU1_Site_Figure-2_1938_rev2.ai 05/30/2013 LED

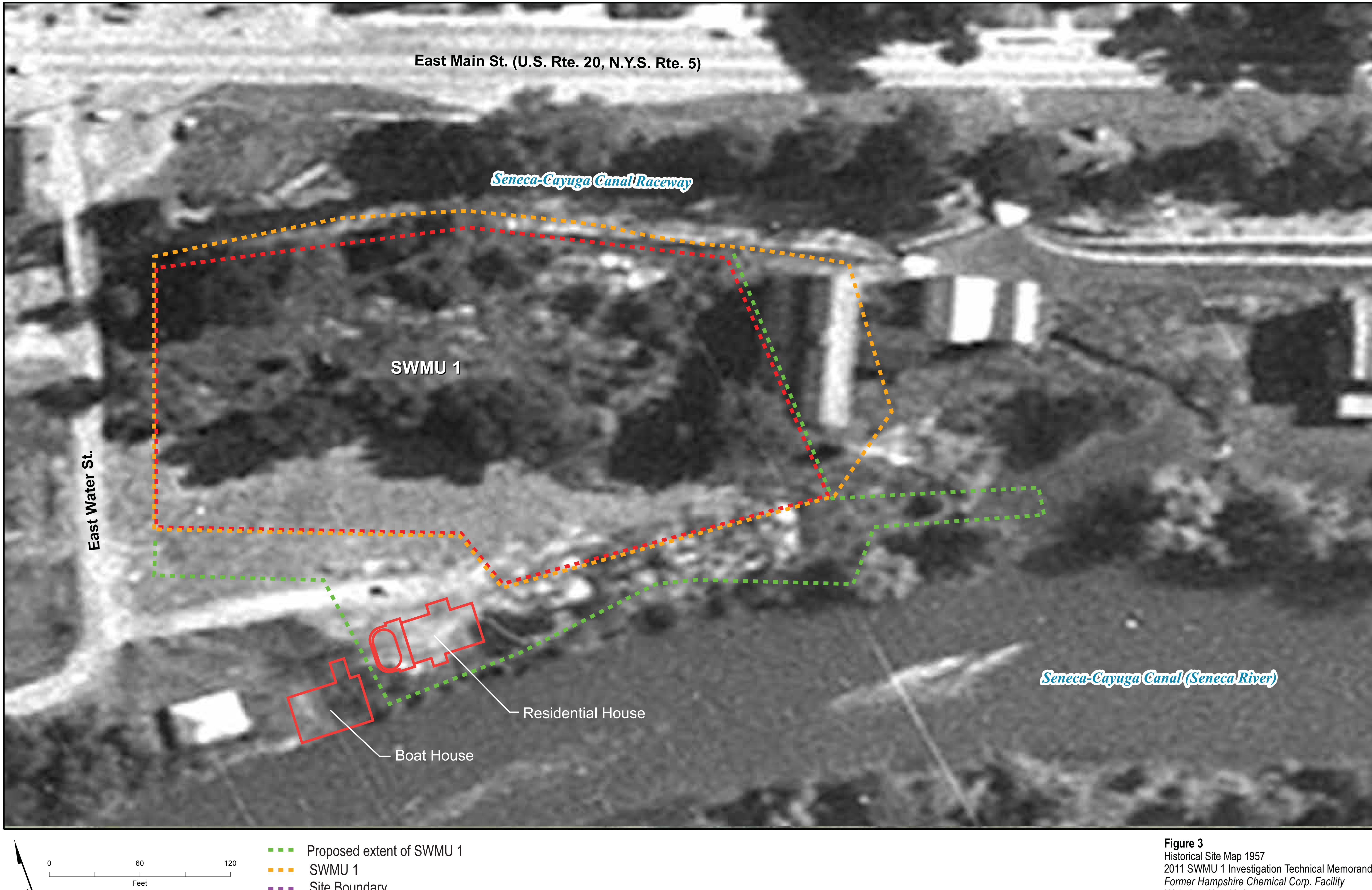


Figure 3
Historical Site Map 1957
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL.

ES012712152229GNV Waterloo_SWMU1_Site_Figure-3_1957_rev2.ai 05/30/2013 LED

Attachment 1
Soil Boring Logs

PROJECT NUMBER:	BORING NUMBER:
439926.01.FS	BS-15 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation LOCATION : Waterloo, NY

ELEVATION : DRILLING CONTRACTOR : Parratt-Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners

WATER LEVELS : --- START : 7/31/12 15:30 END : 7/31/12 16:15 LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft) INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0				**Organic Sand with Silt (OL)** 0.0-0.5' - Brown, Roots throughout, trace fine to medium angular gravel			
0.0–4.0	3.0			**Sandy silt (SP-SM)** 0.5-3.5' - Light brown, Sandy silt with medium to coarse angular gravel, Rock fragments at 2.5' BGS			BZ = 0.2, AH = 0.2
4.0				**Silty Sand (SM)** 3.5-7.0' - Dark gray/black, with fine to coarse angular gravel. Rock fragments at 5.0' BGS			BZ = 0.2, AH = 0.2
5	3.0						BZ = 0.2, AH = 0.2
8.0				**Sandy silt (SP-SM)** 7.0-9.0' - Light brown, fine sandy silt, with some fine to coarse angular gravel			BZ = 0.2, AH = 0.2
	3.0			**Clayey silt (CL-ML)** 9.0-10.0' - Brown/Red-brown, with trace fine angular gravel, trace rock fragments		0.75	
10				**Silty Clay (ML-CL)** 10.0-10.75' - Red brown, cohesive, soft			BZ = 0.2, AH = 0.2
11.0				**Weathered rock** 10.75-11.0'			Refusal at 11.0 ft below ground surface, bent geoprobe tube
				Bottom of Core at 11.0 ft below ground surface on			
15							
20							

PROJECT NUMBER:	BORING NUMBER:
439926.01.FS	BS-16 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation
LOCATION : Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt-Wolff, Inc.
DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners
WATER LEVELS : ---
START : 7/31/2012
END : 7/31/2012
LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0 – 4.0	4.0			**Organic sand with silt (OL)** 0.0-0.5' - Dark brown, roots throughout, trace fine to medium angular gravel		BZ = 0.2, AH = 0.2 BZ = 0.2, AH = 0.2
					Sandy silt (SM) 0.5-1.0' - Dark brown, some medium to coarse angular gravel		BZ = 0.2, AH = 0.2
					Silty sand (SM) 1.0-5.0' - Light brown, Silty fine sand, trace fine to coarse angular gravel; Tree root at 3 ft BGS		
5	4.0 – 8.0	4.0			**Sandy silt (SM)** 5.0-6.5' - Brown, Trace clay, some medium to coarse angular gravel and rock fragments		BZ = 0.2, AH = 0.2
					Weathered rock 6.5-8.0' - White		Refusal at 8.0' BGS; bent geoprobe tube BZ = 0.2, AH = 0.2
10					Bottom of Core at 8.0 ft below ground surface on		
15							
20							

PROJECT NUMBER: 439926.01.FS	BORING NUMBER: BS-17	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation LOCATION : Waterloo, NY

ELEVATION : DRILLING CONTRACTOR : Parratt-Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners

WATER LEVELS : --- START : 8/1/12 08:25 END : 8/1/12 08:45 LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0				**Clayey sand (SC)** 0.0-0.75' - Dark brown, wet, Clayey coarse sand and fine to coarse gravel		BZ = 0.0, AH = 0.0
					Rock inclusion (MH) 0.75-1.0'		
		3.0			**Sandy silt (SM)** 1.0-3.0' - Dark brown, Some fine to medium angular gravel; trace brick and glass fragments at 2.0' BGS		BZ = 0.0, AH = 0.0
	4.0				**Silty sand (SM)** 3.0-6.0' - Light brown, Silty fine sand		BZ = 0.0, AH = 0.0
5							
		3.0			**Gravel (GW)** 6.0-6.25' - fine to medium angular gravel inclusion		BZ = 0.0, AH = 0.0 BZ = 0.0, AH = 0.0
					Sandy clay (SC) 6.25-7.75' - Red brown, moist		
	8.0				**weathered rock** 7.75-8.0'		BZ = 0.0, AH = 0.0 Refusal at 8.0' BGS on rock
					Bottom of Core at 8.0 ft below ground surface on		
10							
15							
20							

PROJECT NUMBER: 439926.01.FS	BORING NUMBER: BS-18	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation LOCATION : Waterloo, NY
ELEVATION : DRILLING CONTRACTOR : Parratt-Wolff, Inc.
DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners
WATER LEVELS : --- START : 8/1/12 08:50 END : 8/1/12 09:05 LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0				**Clayey sand (SC)** 0.0-0.5' - Dark brown, Clayey coarse sand and fine to coarse gravel, trace organics (roots and grass)		BZ = 0.0, AH = 0.0
		3.0			**Sandy silt (SM)** 0.5-3.5' - Dark brown, moist, some fine to medium angular gravel; trace glass and brick fragments at 2-3' BGS		BZ = 0.0, AH = 0.0
	4.0				**Sandy clay (SC)** 3.5-5.0' - Brown, Little fine to medium angular gravel		BZ = 0.0, AH = 0.0
5		3.0			**Silty sand (SM)** 5.0-7.25' - Light brown, wet, silty fine sand		BZ = 0.0, AH = 0.0
	8.0				**Silty clay (CL)** 7.25-8.0' - Red brown, moist, soft		BZ = 0.0, AH = 0.0
	8.7	1.7			**Weathered rock** 8.0-8.7'		Refusal at 8.7' BGS on rock BZ = 0.0, AH = 0.0
					Bottom of Core at 8.7 ft below ground surface on		
10							
15							
20							

PROJECT NUMBER:	BORING NUMBER:
439926.01.FS	BS-19 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation

LOCATION : Waterloo, NY

ELEVATION :

DRILLING CONTRACTOR : Parratt-Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners

WATER LEVELS : ---

START : 8/1/12 09:15

END : 8/1/12 09:50

LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0				**Silty sand (SM)** 0.0-0.75' - Dark brown, trace clay, some fine to medium angular gravel		BZ = 0.0, AH = 0.0
					Gravel (GP) 0.75-1.5' - inclusion		
		3.0			**Sandy silt (SM)** 1.5-3.0' - Dark brown, with brick and glass throughout		BZ = 0.0, AH = 0.0 BZ = 0.0, AH = 0.0
					Gravel (GP) 3.0-4.0' - inclusion		
	4.0						
5		3.0			**Sandy silt (SM)** 4.0-9.0' - Brown and gray-brown, some fine to coarse angular gravel, brick and glass fragments throughout		BZ = 0.0, AH = 0.0
	8.0						
		1.7			**Silty clay (GW-GC)** 9.0-9.7' - Red brown, silty clay and weathered rock		BZ = 0.0, AH = 0.0 Refusal at 9.7' BGS
10	9.7				Bottom of Core at 9.7 ft below ground surface on		
15							
20							

PROJECT NUMBER: 439926.01.FS

BORING NUMBER: BS-20 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation

LOCATION : Waterloo, NY

ELEVATION :

DRILLING CONTRACTOR : Parratt-Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners

WATER LEVELS : ---

START : 8/1/12 10:35

END : 8/1/12 11:00

LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft) INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0 – 4.0	3.0			**Clayey sand (SC)** 0.0-1.25' - Dark brown, some fine to coarse angular gravel, trace organics (roots), trace glass fragments		BZ = 0.1, AH = 0.1
				Gravel (GP) 1.25-1.5' - Rock fragment inclusion		BZ = 0.1, AH = 0.1
				silty sand/sandy silt (SM) 1.5-6.0' - Brown/light brown, some fine to coarse angular gravel, trace glass fragments		BZ = 0.1, AH = 0.1
4.0 – 8.0	3.0			**FILL (FILL)** 6.0-6.25' - Brick inclusion		BZ = 0.1, AH = 0.1
				silty clay (CL) 6.25-7.5' - Dark gray/brown, trace fine rounded gravel		
				FILL (FILL) 7.5-8.0' - Brick inclusion		
8.0 – 8.3	0.3			**Silty clay (CL)** 8.0-8.3' - Gray-brown, Weathered rock in tip	0.75	BZ = 0.1, AH = 0.1 Refusal at 8.3' BGS
				Bottom of Core at 8.3 ft below ground surface on		

5

10

15

20

PROJECT NUMBER: 439926.01.FS	BORING NUMBER: BS-21 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : DOW Waterloo Gorham Street Delineation — LOCATION : Waterloo, NY

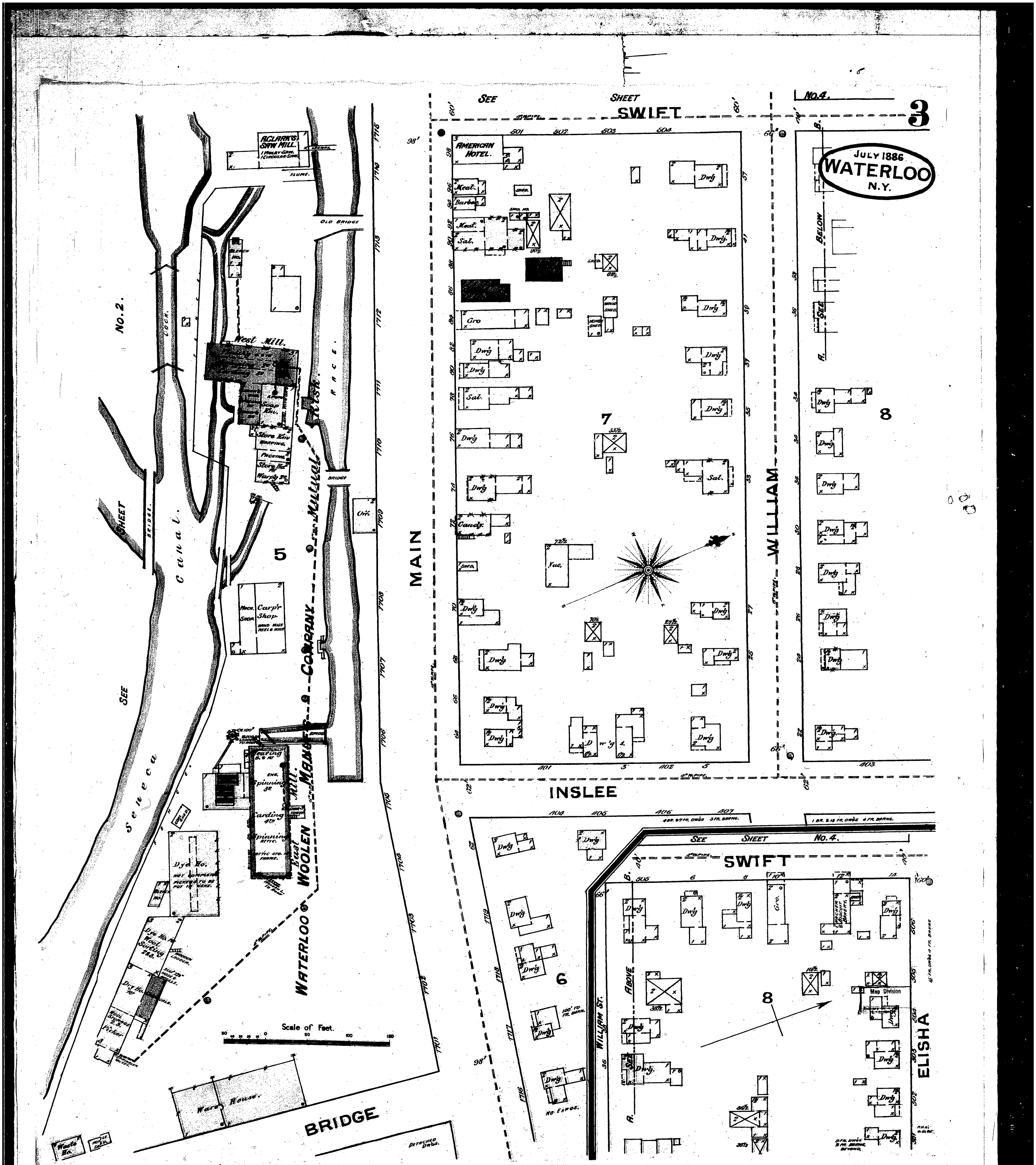
ELEVATION : — DRILLING CONTRACTOR : Parratt-Wolff, Inc.

DRILLING METHOD AND EQUIPMENT : 6620 DT Geoprobe, with 4 ft acetate liners

WATER LEVELS : --- START : 8/1/12 11:10 END : 8/1/12 11:25 LOGGER : N. Loos

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0				**Silty Sand (SM)** 0.0-1.0' - Brown, moist, Trace clay, trace organics (roots and grass)		
		3.5			**Silty Sand (SM)** 1.0-2.75' - Brown, dry, Little fine to medium angular gravel		BZ = 0.1, AH = 0.1 BZ = 0.1, AH = 0.1 BZ = 0.1, AH = 0.1
					Gravel (GP) 2.75-3.25' - Gravel/rock fragment inclusion		BZ = 0.1, AH = 0.1
	4.0				**Sandy Silt (SM)** 3.25-4.0' - Brown, dry, Trace clay, some fine to coarse angular gravel, trace brick fragments at 4' BGS		BZ = 0.1, AH = 0.1
5		2.3			**Fine Sandy Silt (SM)** 4.0-5.0' - Light brown, dry, some fine to coarse angular gravel		BZ = 0.1, AH = 0.1
					Organics 5.0-5.25' - Tree root		
	6.3				**Silty fine sand (SM)** 5.25-6.0' - Light brown, dry		Refusal at 6.4' BGS on rock
					Gravel (GP) 6.0-6.3' - Gray/white, Rock		
					Bottom of Core at 6.4 ft below ground surface on		
10							
15							
20							

Attachment 2
Historical Sanborn Maps



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Year EDR Research Associate

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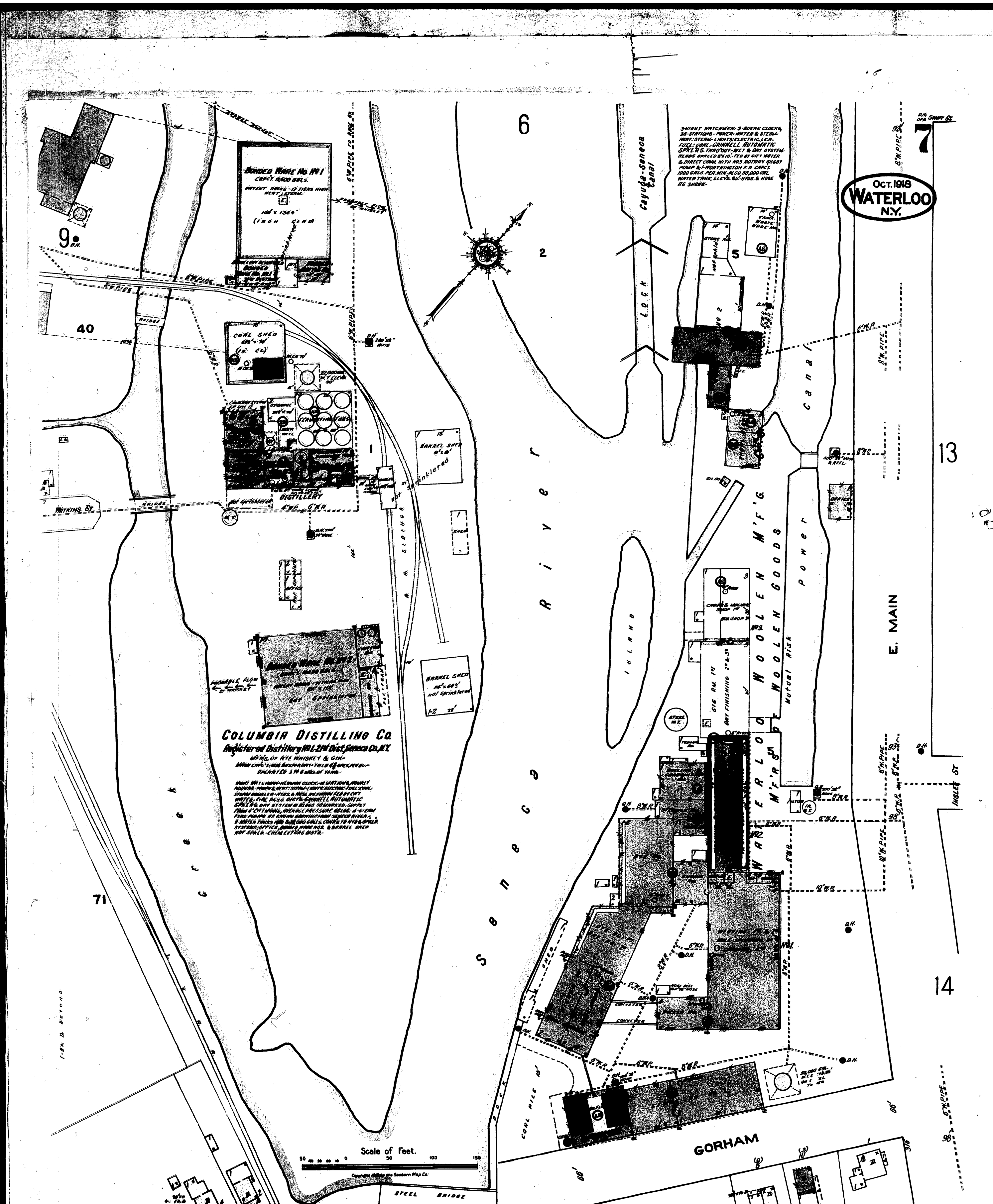

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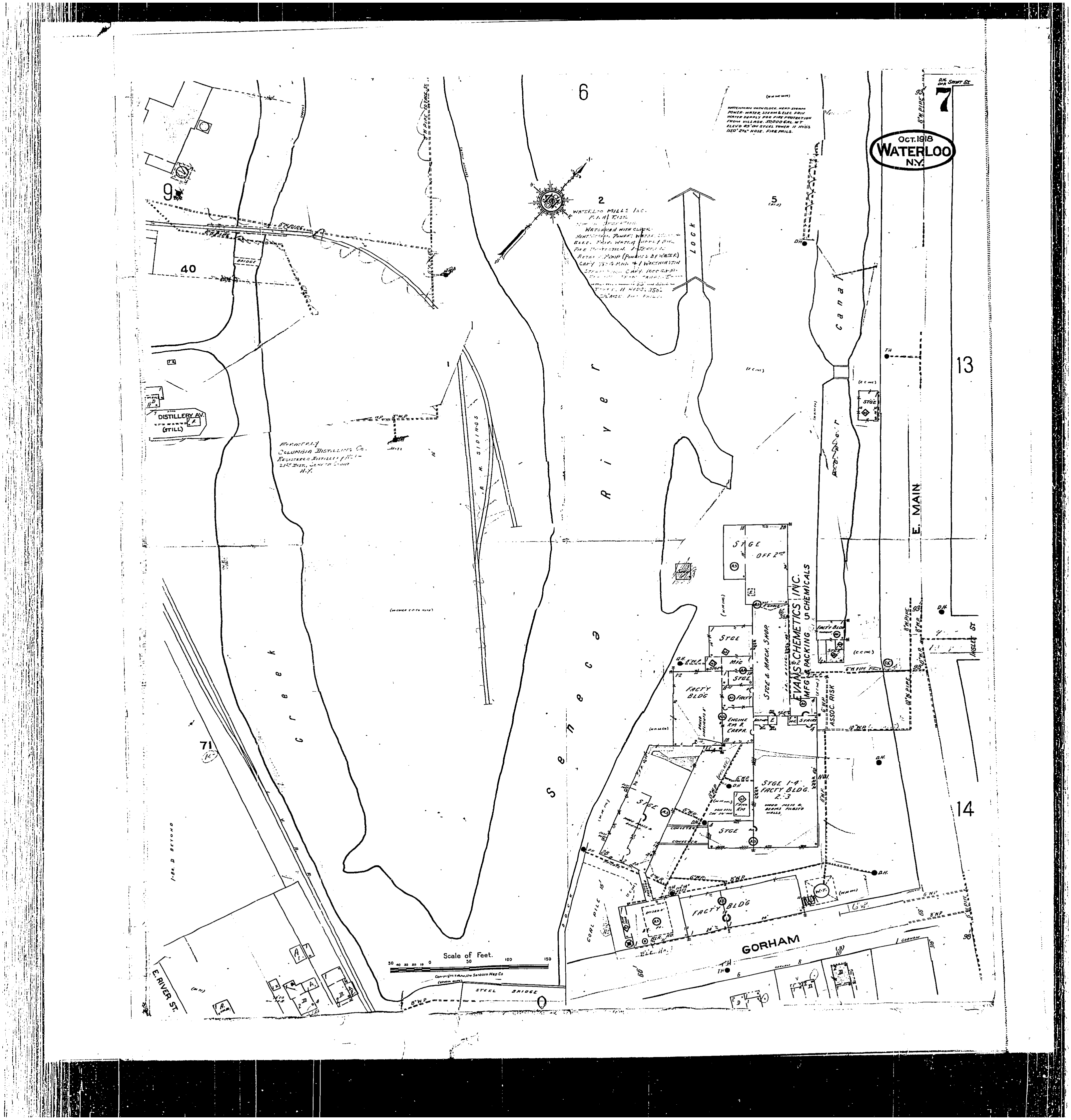

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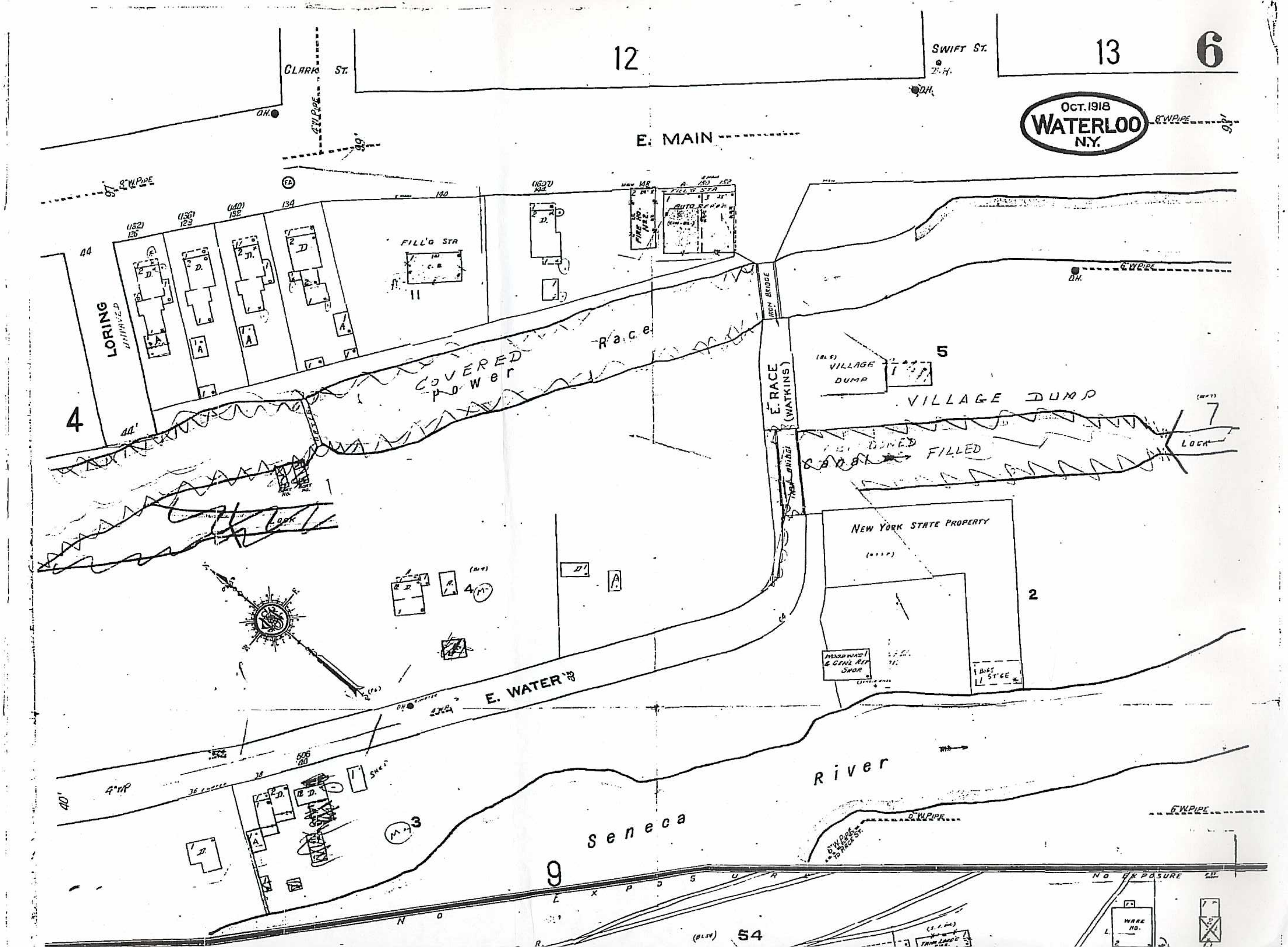
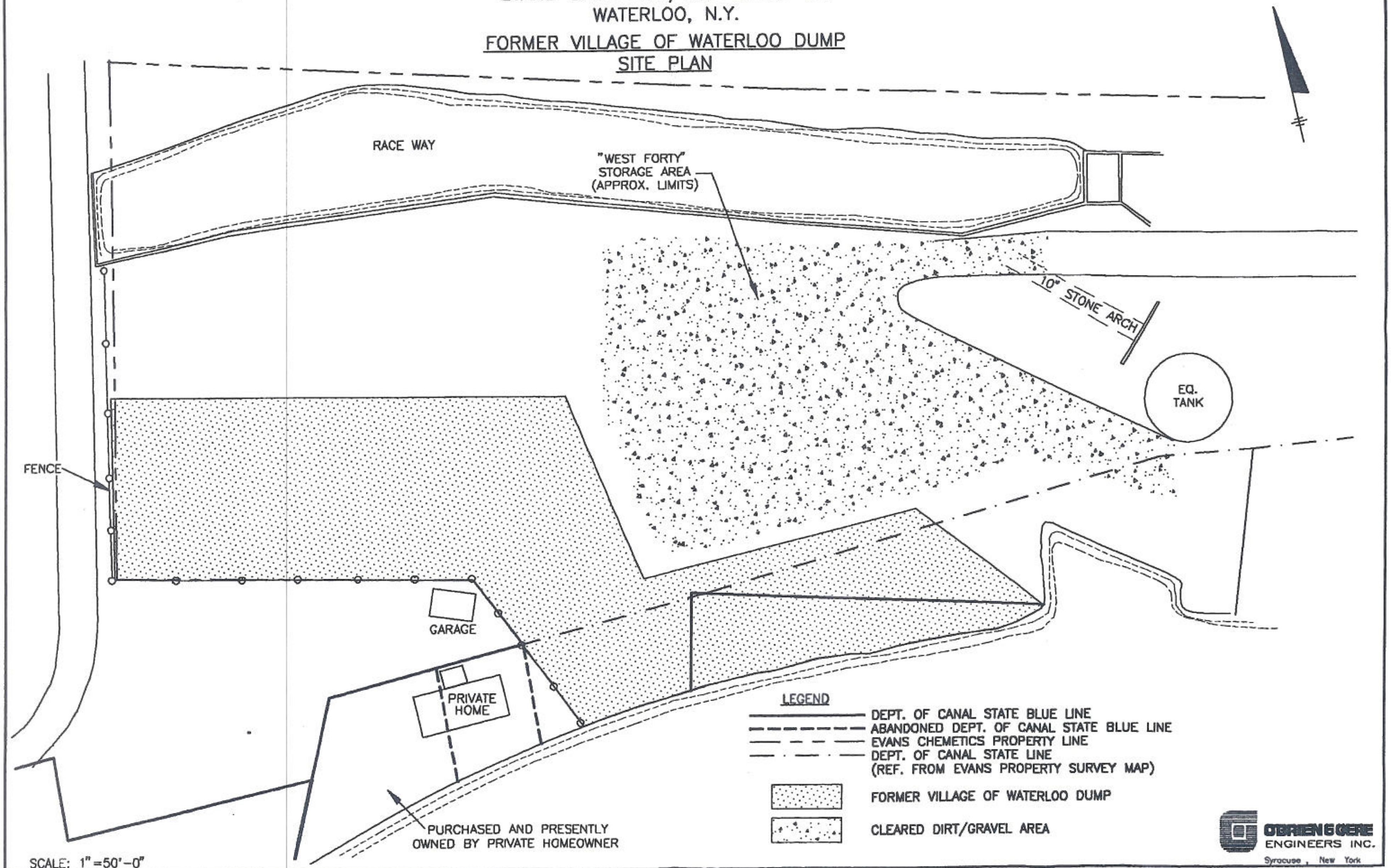

6
12
13
CLARK ST.
SWIFT ST.
OCT. 1918
WATERLOO
N.Y.
E. MAIN
8" W. PIPE
LORING
UNPAVED
FILL'G STA
FIRE HO.
AUTO
IRON BRIDGE
COVERED
Power
Race
E. RACE
(WATKINS)
VILLAGE DUMP
VILLAGE DUMP
5
7
LOCK
FILLED
CANAL
LOCK
4
NEW YORK STATE PROPERTY
2
WOODWAY & GEN'L REP SHOP
E. WATER
3
Seneca
River
6"W.PIPE
9
NO EXPOSURE
NO EXPOSURE
54
WARE HO.

Attachment 3
Historical Site Maps

FIGURE 4

EVANS CHEMETICS/W.R. GRACE CO.
WATERLOO, N.Y.

FORMER VILLAGE OF WATERLOO DUMP
SITE PLAN



Appendix D

SWMU 1 Methane Survey Technical Memorandum

SWMU 1 Methane Survey, Former Hampshire Chemical Corp. Facility, Waterloo, New York

PREPARED FOR: The Dow Chemical Company

PREPARED BY: CH2M HILL

DATE: July 1, 2013

Introduction

This technical memorandum reports the results of the October and November 2012 methane survey performed at the former Hampshire Chemical Corp. (HCC) Facility Solid Waste Management Unit 1 (SWMU 1) in Waterloo, New York. The methane survey activities were conducted during October and November 2012 using six existing groundwater monitoring wells at the former HCC facility, now known as the Evans Chemetics Facility (the facility or site). The site is regulated under Title 6 of the New York Code of Rules and Regulations (NYCRR) Part 373 and the Resource Conservation and Recovery Act (RCRA), with the New York State Department of Environmental Conservation (NYSDEC) as the lead agency. RCRA facility investigations (RFIs) have been performed at the facility since 1993 to evaluate the nature and extent of releases to the environment.

This investigation was conducted in October and November 2012 in support of the selection of an interim corrective measure (ICM) at SWMU 1. The purpose of this investigation was to evaluate whether methane is present within the subsurface related to the former landfill. The findings of this investigation will be used to evaluate the need for methane venting and/or a methane monitoring program for inclusion in the final corrective measures at SWMU 1.

Background

SWMU 1 Site Background

SWMU 1 is in the southwestern corner of the facility property; bounded to the east by the facility, to the south by the Seneca-Cayuga Canal (canal), to the west by East Water Street, and to the north by the Seneca-Cayuga Canal Raceway (raceway). An asphalt road accesses the facility on the west side near East Water Street and crosses over SWMU 1. Figure 1 shows the location and configuration of SWMU 1 relative to the surrounding features and the facility boundaries.

Sanborn fire insurance maps of the site indicate the area along the western side of SWMU 1 and near some of the historical raceways was identified as the Village of Waterloo Dump as early as October 1918. The *RCRA Facility Assessment Report* (A.T. Kearney 1993) indicates the former Village of Waterloo Dump was probably in operation at the western edge of the site until 1951 (O'Brien and Gere Engineers, Inc. [OBG] 2003). This suggests an operation period for the dump of at least 33 years, during which the Village of Waterloo placed debris, soil, and refuse in this area.

The 1964 Sanborn map for the facility shows that the canal and raceways were filled to the western edge of the old lock, and the area is identified as the Village of Waterloo Dump (OBG 2003). As indicated by plant personnel, additional material was placed over the filled former raceways in the early 1980s that was derived from soil excavated during plant construction projects, mainly the wastewater treatment plant at the site.

Previous Investigations

Test pitting conducted during previous environmental investigations at SWMU 1 have identified various municipal waste fill including glass and plastic fragments, scrap metal, ash, ceramics, shoes, brake pads, copper wire, and vehicle tires. Construction debris including cobbles, bricks, wood, and metal scrap also was identified in the test pitting. Intact bottles, both empty and containing liquids, also have been identified in test pits located near the access roadway as well as down along the right-of-way near the canal (CH2M HILL 2006, 2009). The results of the test pit excavations show that fill materials extend onto the canal right-of-way in the area. From that investigation, it has been estimated that approximately 2,500 cubic yards of fill material are present within the canal right–of-way (CH2M HILL 2009).

A soil vapor investigation was conducted within the vicinity of SWMU 1 in December 2007 as part of the RFI Addendum (CH2M HILL 2008). Soil vapor data collected at two locations, SGP-9 and SGP-10, and within the boundary of SWMU 1 were compared to historical SWMU 1 soil and groundwater data to evaluate if the reported soil vapor volatile organic compounds (VOCs) were related to site activities and a subsurface release. The constituents detected in the soil vapor samples historically were not detected in nearby monitoring wells. Based on data evaluation and a review of multiple lines of evidence, it was concluded that none of the reported VOCs in SWMU 1 soil vapor are likely to present a vapor intrusion concern. However, methane was not analyzed during the 2007 soil vapor investigation.

Further details regarding the previous environmental and geotechnical investigations conducted at SWMU 1 are in the RFI and RFI Addendum and technical memorandums (CH2M HILL 2006, 2008, 2009, and 2012).

Landfill Gases

Landfill gas, if present, will be mostly comprised of methane and carbon dioxide by volume, but also can consist of smaller amounts of many other gases. Three processes, including bacterial decomposition, volatilization, and chemical reactions can create landfill gases in the subsurface. Waste characteristics and composition and other environmental factors will influence the rate and volume of landfill gas produced at a landfill (Agency for Toxic Substances and Disease Registry [ASTDR] 2001). In general, the more organic material that is buried in the landfill, the more landfill gas will be produced by bacterial decomposition. Organic landfill waste will decompose by bacteria through phases as the subsurface transitions from aerobic to anaerobic conditions. Methane is only produced in the subsurface when oxygen is no longer present since methanogenic bacteria (methane producing) are generally only active under anaerobic conditions (ATSDR 2001).

In addition, the age of the buried waste material also will affect landfill gas production. Waste that has been buried more recently (less than 10 years) will generally produce more landfill gases than waste that is older (buried more than 10 years) (ATSDR 2001). Maximum gas production for organic waste materials through bacterial decomposition, volatilization, or chemical reactions is generally 5 to 7 years after the waste has been buried. Based upon documentation of when waste materials were last disposed in SWMU 1 (early 1950s according to the *RCRA Facility Assessment Report* [A.T. Kearney 1993]), the waste has been buried for more than 60 years.

Objectives

The methane survey was performed at SWMU 1 to determine if methane monitoring or collection would be required for the ICM.

Screening Criteria

The lower explosive limit (LEL) for methane is 5 percent (methane by volume in air at standard temperature and pressure). Conditions favorable for an explosive environment could have methane levels above the LEL. Following the requirements discussed in Title 6, NYCRR Section 360-2.17(f), the concentration of methane at the property boundary of a sanitary landfill is not to exceed the LEL. Therefore, the LEL of 5 percent (methane by volume) was used for the screening criteria for the survey.

Field Activities

Six shallow monitoring wells were identified for the methane screening and included MW-14, MW-18, MW-27, MW-28, and TW-02 located within the boundary of SWMU 1, and MW-26 located outside the boundary of SWMU 1 (Figure 1). All six of the wells are constructed of 2-inch inside diameter, Schedule 40 polyvinyl chloride (PVC). Screen lengths on the six wells range from 5 to 10 feet. The six wells are screened across the water table and have a portion of the well screen open (not submerged by groundwater) to allow for soil gasses to enter the well and into the headspace above the water column. Well construction logs for the six wells are provided in Attachment 1. General well construction and recorded groundwater levels from October 2012 are provided in Table 1.

The first round of methane measurements were collected October 25–26, 2012, and the second round of measurements were collected November 28, 2012. The following section describes the field activities completed during both mobilizations.

Well Headspace Volume Determination

Before installing the gas sampling caps, groundwater measurements were collected on October 15, 2012, at each of the six wells (MW-14, MW-18, MW-26, MW-27, MW-28, and TW-02) using a water-level meter. The depth to water measurements confirmed that in each well a portion of the screened interval was above the water table (Table 1). The depth to water measurements collected were used to calculate the headspace volume in each well and the headspace purge time required for sampling (Table 2). Once the groundwater measurements were collected from the six wells, the well cap retrofits were installed. Groundwater level measurements were not collected before the second round of sampling because the caps remained on the well heads during the first and second sampling events.

Monitoring Well Cap Retrofits

Sampling well caps were constructed to fit on existing groundwater monitoring wells with a rubber and PVC fittings and with a labcock valve at the top of the cap to allow for sample collection.

PICTURE 1
Well Cap Retrofit

These caps were designed to provide an airtight cap that would allow for easy sampling. The caps were attached on the top of the six wells by seating the flexible coupling over the top of the PVC well and secured by tightening down a hose clamp with a small crescent wrench. The well caps were installed on October 17, 2012, one week before the first field sampling to allow time for the soil gasses to equilibrate within the wells.

PICTURE 2
MW-18 with Well Cap Retrofit Installed

Landfill Gas Measurements

A GEM 2000 Plus landfill gas meter was used to both purge and collect the landfill gas (methane, carbon dioxide, and oxygen) concentrations and pressure readings from each of the six wells. The monitoring activities were conducted in accordance with the CH2M HILL *Standard Operating Procedure – Landfill Gas Monitoring* (Attachment 2). The GEM 2000 was used to monitor the following parameters within the well head: static pressure (pressure or vacuum present within the well head), differential pressure (pressure within the well head relative to the ambient pressure), ambient temperature, methane (percent by volume), carbon dioxide (percent by volume), and oxygen (percent by volume).

The GEM 2000 was calibrated in accordance with manufacturer's recommendations, and all readings and calibration gas information were recorded. The inlet hose from the pressure monitor of the GEM 2000 was attached to the sampling port well cap labcock, the valve opened, and the pressure (static and differential) readings in inches water column were recorded. Negative pressure readings indicated there was a vacuum present within the well head, and positive pressure readings indicated there was a positive pressure present within the well head.

The well headspace was purged using the GEM 2000 pump at approximately 250 milliliters per minute, and one headspace volume was purged. Upon completing purging and when all parameters were stable, the readings were recorded on the field data sheet.

PICTURE 3
Methane Screening at MW-18 using GEM 2000

Results

The landfill gas and pressure readings that were collected at the six wells during the October and November 2012 survey events are presented in Table 3. The measured methane values were compared to the LEL of methane. A summary of the results are provided below:

- Methane readings did not exceed 0.1 percent by volume in any of the six wells during the October 2012 survey event. Values of 0 percent by volume were observed at MW-14 and MW-26. Methane levels that were reported (0.1 percent by volume) were significantly lower than the LEL (5 percent by volume).
- Methane readings in all six wells were reported at 0 percent by volume for the November 2012 survey event.
- Oxygen levels were recorded in five of the six sampling locations during both field events, ranging from 4.8 to 14.4 percent by volume in October 2012 and 7.6 to 18.6 percent by volume in November 2012. The levels of oxygen as measured at the sampling locations appear to indicate SWMU 1 is in an aerobic phase of decomposition. Methanogenic bacteria generally are not active under aerobic conditions. However, oxygen was not measured at MW-28 during the October and November 2012 field events.
- Carbon dioxide levels were recorded at all six sampling locations during both field events, ranging from 4.8 to 15.2 percent by volume in October 2012 and 2.5 to 14.0 percent in November 2012. Carbon dioxide levels measured in the subsurface are higher than atmosphere conditions but lower than a mature landfill and are consistent with the aerobic phase of decomposition.

Conclusions

The following conclusions were developed from the evaluation of data collected during the October and November 2012 SWMU 1 methane survey:

- The current methane, oxygen, and carbon dioxide levels measured at each of the SWMU 1 sampling locations appear to indicate aerobic conditions that would not favor the production of methane. In addition, since the duration of time that the waste has been buried at SWMU 1 (greater than 60 years) is significantly beyond the peak of landfill gas production (generally 5 to 7 years after burial), the presence of methane in the subsurface because of waste decomposition would not be expected.
- Since the methane levels in all six monitoring locations were not greater than 0.1 percent by volume and significantly lower than the LEL (5 percent by volume), subsurface conditions are not favorable for explosive conditions at SWMU 1.

References

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Tables

TABLE 1
Groundwater Level Measurements at SWMU 1, October 2012
Former Hampshire Chemical Corp., Waterloo, New York

Monitoring Well ID	Top of Screen (ft btoc)	Bottom of Screen (ft btoc)	Depth to Water (ft btoc)
MW-14	6.0	16.0	13.56
MW18	6.7	12.7	11.57
MW-26	6.61	16.21	11.42
MW-27	3.0	13.0	11.28
MW-28	6.0	16.0	12.57
TW-02	7.72	12.72	11.54

ft btoc – feet below top of casing

Table 2
Headspace Volumes and Groundwater Elevation Measurements
October 15, 2012
Former Hampshire Chemical Corp Facility, Waterloo, New York

Well Number	Date	Ground Elevation (ft amsl)	Inner Casing Elevation (ft amsl)	Depth to Water (feet bTIC)	Groundwater Elevation (feet amsl)	Headspace Height (feet)	Headspace Volume (in3)	Headspace Volume (ml)	Headspace Purge Time (min)
MW-14	10/15/2012	444.10	443.48	13.56	429.92	13.56	510.9	8374	33.5
MW-18	10/15/2012	441.14	441.14	11.57	429.57	11.57	436.0	7145	28.6
MW-26	10/15/2012	437.95	440.16	11.42	428.74	11.42	430.3	7053	28.2
MW-27	10/15/2012	444.44	444.09	11.28	432.81	11.28	425.0	6966	27.9
MW-28	10/15/2012	444.83	444.55	12.57	431.98	12.57	473.6	7763	31.1
TW-02	10/15/2012	437.84	440.06	11.54	428.52	11.54	434.8	7127	28.5

Notes:
Purge time calculated based upon a 250 cc/min pumping rate of the GEM-2000
All wells were surveyed to the New York Central state plane coordinate system (NAD 1983).
amsl - above mean sea level
BGS - below ground surface
NM - not measured
bTIC - below top of inner casing

Table 3
Parameters for the SWMU 1 Methane Survey
October and November 2012
Former Hampshire Chemical Corp Facility, Waterloo, New York

GEM ID	Monitoring Location	Date/Time	Initial Static Pressure (inches H2O)	Differential Pressure (inches H2O)	Ambient Temp (F)	Purge Rate (cc/min)	CH4 % by vol	CO2 % by vol	O2 % by vol	Bal Gas % by vol
October 2012										
WATMW14	MW14	10/25/2012 1525	-0.4	0.069	72	250	0.0	12.0	4.8	83.2
WATMW18	MW18	10/26/2012 0945	-0.1	-0.300	58	250	0.1	9.1	13.6	77.2
WATMW26	MW26	10/25/2012 1445	-0.1	-0.069	72	250	0.0	4.8	14.3	80.9
WATMW27	MW27	10/26/2012 0910	-0.1	0.0	55	250	0.1	12.9	5.9	80.6
WATMW28	MW28	10/26/2012 0830	-0.1	-0.13	53	250	0.1	15.2	0.0	84.7
WATTW02	TW02	10/26/2012 1035	0.1	-0.61	62	250	0.1	7.0	14.4	78.3
November 2012										
WATMW14	MW14	11/28/2012 1415	0.0	8.80	33	250	0.0	6.9	12.3	80.8
WATMW18	MW18	11/28/2012 1026	-0.5	0.04	34	250	0.0	7.7	14.4	77.9
WATMW26	MW26	11/28/2012 1343	0.0	8.80	34	250	0.0	2.5	18.6	78.9
WATMW27	MW27	11/28/2012 1104	-5.6	0.05	34	250	0.0	11.6	7.6	80.8
WATMW28	MW28	11/28/2012 1145	0.0	0.04	32	250	0.0	14.0	0.0	86.0
WATTW02	TW02	11/28/2012 1514	-8.2	0.04	31	250	0.0	8.1	14.7	78.2

Notes:
F = Fahrenheit
cc/min = cubic centimeters per minute
% = percent

Figures

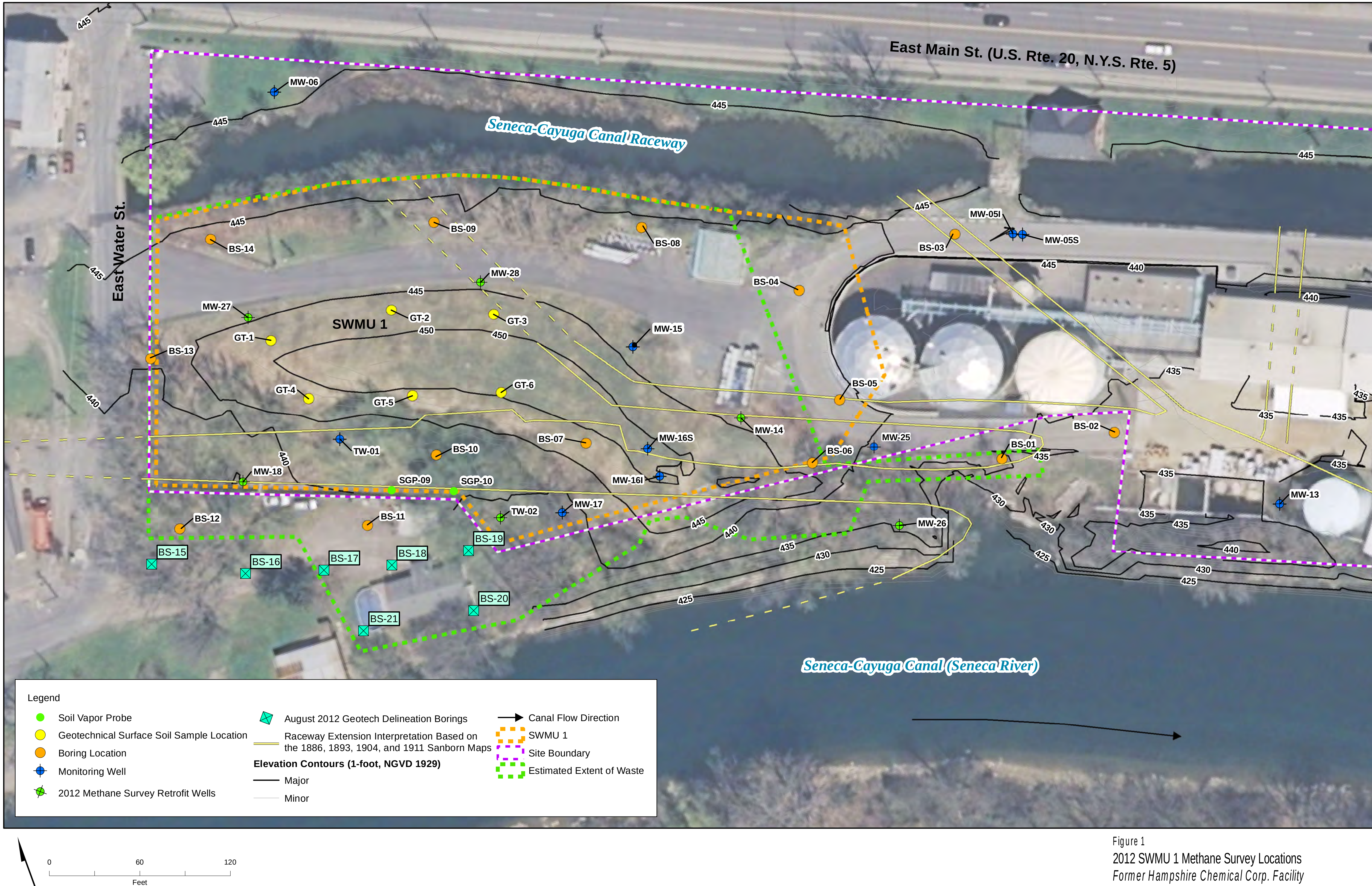

Figure 1

2012 SWMU 1 Methane Survey Locations

Former Hampshire Chemical Corp. Facility

Waterloo, New York

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MKE \\LAKEFRONT\PROJ\GIS\DOW\WATERLOO\REPORTS\2013\SWMU01_ICM_WP\MAPFILES\FIGURE01_SWMU1METHANESURVEYLOCATIONS.MXD JCARR3 1/22/2013 12:42:17 PM

Attachment 1

Well Construction Logs

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING MW-14
Client: Hampshire Chemical Proj. Loc: Waterloo, NY File No.: 29424	Drill Method: 4.25" H. S. A. Sampler: 2 inch split spoon Hammer: 140 lb Fall: 30 inches	Page 1 of 1 Location: Start Date: 12/21/01 End Date: 12/21/01
Boring Company: Parratt-Wolff, Inc. Foreman: Jim Lansing Drill Rig: Diedrich D-90 OBG Geologist: Chawn O'Dell		Screen = Grout \ Riser Sand Pack Steel // Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	PID over spoon (ppm)	PID head space (ppm)
0	1	2	3-2 4-8	2.0/0.5	6	Dusky brown 5YR 2/2, damp, loose, SILT some fine to coarse gravel (angular), little brick and concrete fragments			RAIN/ SNOW	0.0
2	2	4	11-10 8-7	2.0/0.5	18	Dusky brown 5YR 2/2, damp, loose, SILT some fine to coarse gravel (angular), little brick and concrete fragments (push gravel/concrete fragments)			NA	0.0
4	3	6	7-4 11-6	2.0/1.0	15	Grayish brown 10 YR 3/2, damp, medium dense, SILT, some fine sand, little brick and concrete fragments, little gravel (ang)			NA	0.0
6	4	8	11-11 8-5	2.0/1.0	19	Grayish brown 10 YR 3/2, damp, medium dense, SILT, some fine to coarse gravel (angular), little fine sand, trace clay			NA	0.0
8	5	10	11-6 6-7	2.0/1.0	12	Grayish brown 10 YR 3/2, damp, medium dense, SILT, some fine to coarse gravel (angular), little fine sand, trace clay			NA	0.0
10	6	12	5-4 4-5	2.0/0.0	8	No recovery			NA	0.0
12	7	14	6-4 4-7	2.0/1.5	8	Pale yellowish brown 10YR 6/2, saturated, firm, SILT and fine SAND, some clay			NA	0.0
14	8	16	3-2 2-2	2.0/2.0	4	Pale brown 5 YR 2/2, saturated, soft SILT, some clay, little fine gravel (angular)			NA	0.0
16	9	18	6-3 3-5	2.0/2.0	6	Pale brown 5 YR 2/2, saturated, soft SILT, some clay, little fine gravel (angular)			NA	0.0

Notes: Well installation details: 2 inch x 0.010 inch slotted PCV screen: 16.0 - 6.0 ft; sand pack: 16.0 - 4.0 ft; bentonite seal: 4.0 - 2.0 ft; cement/bentonite grout: not installed
The well was completed as a flush mount.

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING MW-18
Client: Hampshire Chemical Proj. Loc: Waterloo, NY File No.: 29424	Drill Method: 4.25" H. S. A. Sampler: 2 inch split spoon Hammer: 140 lb Fall: 30 inches	Page 1 of 1 Location: Start Date: 12/20/01 End Date: 12/20/01

Boring Company: Parratt-Wolff, Inc.
Foreman: Jim Lansing
Drill Rig: Diedrich D-90
OBG Geologist: Chawn O'Dell

Screen = ; Riser ; Steel // ; Grout ; Sand Pack ; Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	PID over spoon (ppm)	PID head space (ppm)
0	1	2	6-4 6-5	2.0/1.0	10	Grayish brown 5YR 3/2, damp, medium dense, SILT, little fine to coarse sand, trace fine gravel (angular)			0.0	0.0
2	2	4	7-6 6-7	2.0/1.2	12	Grayish brown 5YR 3/2, damp, medium dense, SILT and fine SAND, little fine gravel (angular), little glass/brick/metal fragments			0.0	0.0
4	3	6	7-7 8-8	2.0/1.5	15	Pale brown 5YR 5/2, damp, medium dense, trace fine gravel (angular)			0.0	0.0
6	4	8	9-12 10-25	2.0/1.5	22	Grayish orange 10YR 7/4, damp, medium dense, SILT, some fine sand			0.0	0.0
8	5	10	3-5 26-24	2.0/1.0	31	Grayish brown 5YR 3/2, damp to saturated (top portion of sample), hard, SILT, little fien to coarse gravel (angular), little fine sand, trace clay (boney augering)			0.0	0.0
10	6	10.6	26 50/0.1	0.6/0.6	76 +	As above. Spoon/auger refusal at 10.6 ft			0.0	0.0

Notes: Well installation details: 2 inch x 0.010 inch slotted PCV screen: 10.5 - 4.5 ft; sand pack: 10.5 - 2.5 ft; bentonite seal: 2.5 - 1.0 ft; cement/bentonite grout: not installed
The well was completed as an above grade.

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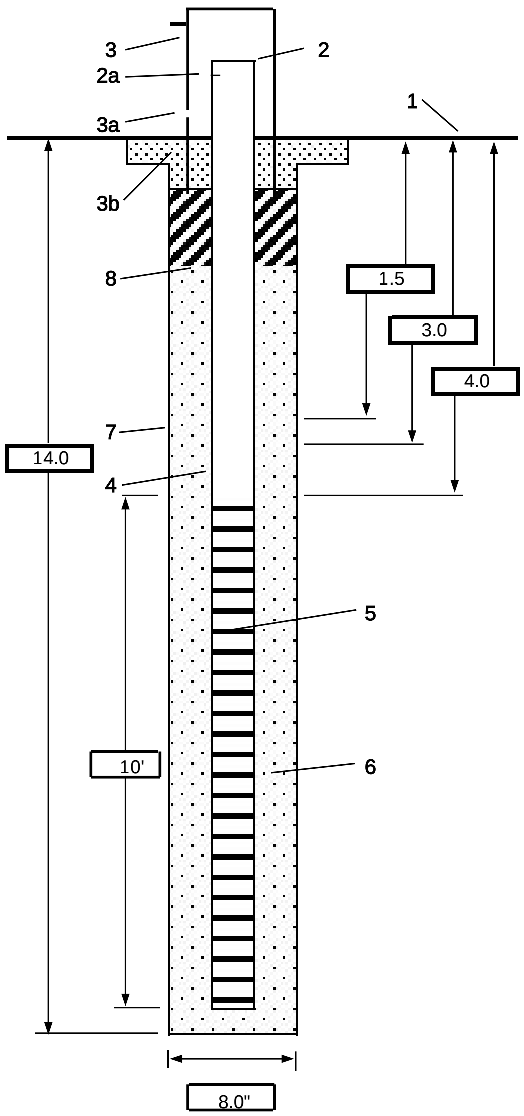
PROJECT NUMBER	BORING NUMBER		
405368	MW-26	SHEET 1	OF 1

Near pool of Dow house-western of two TW locations

WELL COMPLETION DIAGRAM

PROJECT : The Dow Chemical Company - Additional RCRA Investigation LOCATION : 228 East Main Street, Waterloo, New York
ELEVATION : 437.95 ft amsl (ground) DRILLING CONTRACTOR : Parratt Wolf, Inc.
DRILLING METHOD AND EQUIPMENT USED : truck mounted HSA Rig: 4.25" ID HSAs
WATER LEVELS : 11 ft TIC Date: 12/9/2010 START : 10:30 END : 11:05 LOGGER : A. Harclerode



1- Ground elevation at well 437.95 ft amsl

2- Top of casing elevation 440.16 ft amsl
a) vent hole?

3- Wellhead protection cover type Stickup
a) weep hole? None
b) concrete pad dimensions 2 ft diameter

4- Diameter/type of well casing 2" Schedule 40 PVC

5- Type/slot size of screen 10 slot: 0.010 in

6- Type screen filter "# 0" QUARTZ/SILICA SAND - (4.5) 50 lb
a) Quantity used bags

7- Type of seal enviroplug medium bentonite chips
a) Quantity used (2) 50 lb bags

8- Grout
a) Grout mix used NA - bentonite to surface
b) Method of placement
c) Quantity of well casing grout

Development method surge/purge

Development time 25 minutes

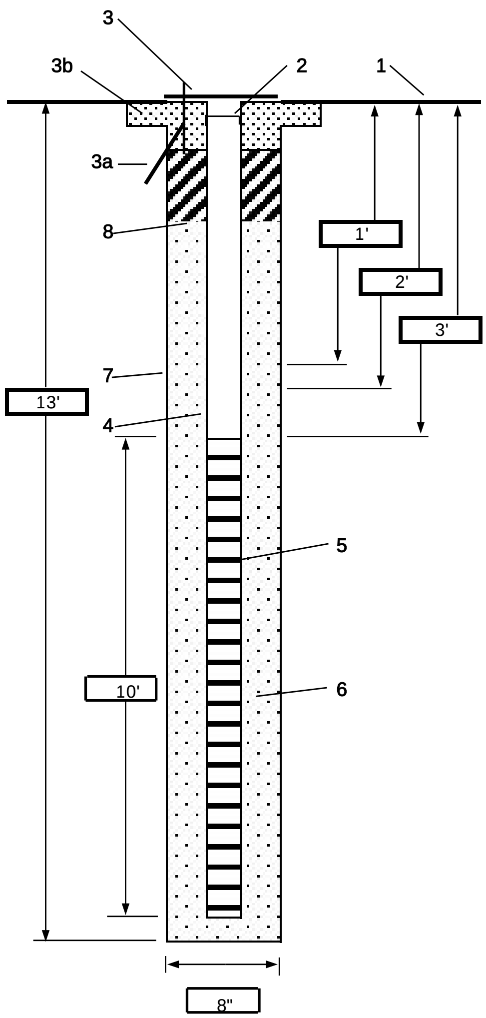
Estimated purge volume 30 gallons

Comments

PROJECT NUMBER 405368	BORING NUMBER MW-27	SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : The Dow Chemical Company - Additional RCRA Investigation LOCATION : 228 East Main Street, Waterloo, New York
ELEVATION : 444.44 ft amsl (ground) DRILLING CONTRACTOR : Parratt Wolf, Inc.
DRILLING METHOD AND EQUIPMENT USED : truck mounted HSA rig. 4.25" ID HSAs
WATER LEVELS : 10 ft TIC Date: 12/8/2010 START : 10:50 END : 11:30 LOGGER : A. Harclerode



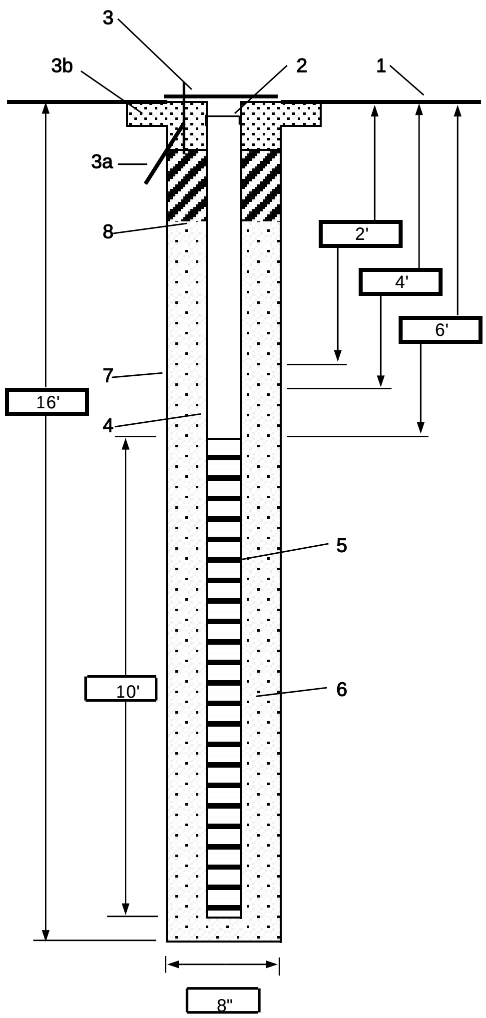
1- Ground elevation at well 444.44 ft amsl
2- Top of casing elevation 444.09 ft amsl
3- Wellhead protection cover type Steel manhole
a) weep hole? Sand base "weep" area under box
b) concrete pad dimensions 2 ft diameter
4- Diameter/type of well casing 2-inch schedule 40 PVC
5- Type/slot size of screen 10 slot 0.010
6- Type screen filter
a) Quantity used "#0" sand
7- Type of seal enviroplug-medium bentonite chips
a) Quantity used UNK
8- Grout
a) Grout mix used sand base for road box b/c well screened shallow
b) Method of placement NA
c) Quantity of well casing grout NA

Development method surge and purge w/whale pump
Development time 0 (low recharge)
Estimated purge volume 1.5 gallons
Comments

PROJECT NUMBER	BORING NUMBER		
405368	MW-28	SHEET 1	OF 1

WELL COMPLETION DIAGRAM

PROJECT : The Dow Chemical Company - Additional RCRA Investigation LOCATION : 228 East Main Street, Waterloo, New York
ELEVATION : 444.83 ft amsl (ground) DRILLING CONTRACTOR : Parratt Wolf, Inc.
DRILLING METHOD AND EQUIPMENT USED : truck mounted HSA rig. 4.25" ID HSAs
WATER LEVELS : 11 ft TIC Date: 12/7/2010 START : 14:45 END : 15:50 LOGGER : A. Harclerode



1- Ground elevation at well 444.83 ft amsl

2- Top of casing elevation 444.55 ft amsl

3- Wellhead protection cover type Steel manhole
a) weep hole? Sand base "weep" area under box
b) concrete pad dimensions 2 foot diameter

4- Diameter/type of well casing 2-inch schedule 40 PVC

5- Type/slot size of screen 10 slot 0.010

6- Type screen filter
a) Quantity used "#0" sand

7- Type of seal
a) Quantity used enviroplug-medium bentonite chips

8- Grout
a) Grout mix used NA (Sand)
b) Method of placement NA
c) Quantity of well casing grout NA

Development method surge and purge w/grundfos pump

Development time 2.2 hours

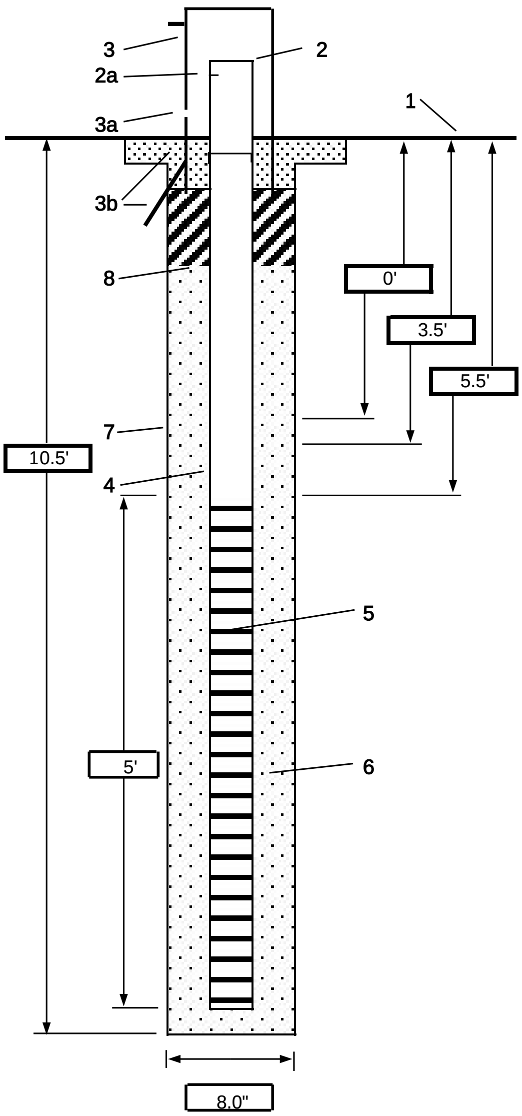
Estimated purge volume 39.5 gallons

Comments

PROJECT NUMBER	BORING NUMBER		
405368	TW-02	SHEET 1	OF 1

WELL COMPLETION DIAGRAM

PROJECT : The Dow Chemical Company - Additional RCRA Investigation LOCATION : 228 East Main Street, Waterloo, New York
ELEVATION : 437.84 ft amsl (ground) DRILLING CONTRACTOR : Parratt Wolf, Inc.
DRILLING METHOD AND EQUIPMENT USED : track mounted HSA Rig: 4.25" ID HSAs
WATER LEVELS : 11 ft TIC Date: 12/10/2010 START : 9:55 END : 10:25 LOGGER : A. Harclerode



1- Ground elevation at well 437.84 ft amsl

2- Top of casing elevation 440.06 ft amsl
a) vent hole?

3- Wellhead protection cover type None
a) weep hole? NA
b) concrete pad dimensions None

4- Diameter/type of well casing 2 inch Schedule 40 PVC

5- Type/slot size of screen 10 slot: 0.010 in

6- Type screen filter "# 0" QUARTZ/SILICA SAND - (5.0) 50 lb
a) Quantity used bags

7- Type of seal enviroplug medium bentonite chips
a) Quantity used (3) 50 lb bags

8- Grout
a) Grout mix used NA - bentonite to near surface
b) Method of placement
c) Quantity of well casing grout

Development method surge/purge

Development time 15 minutes

Estimated purge volume 5 gallons

Comments

Attachment 2

Methane Sampling
Standard Operating Procedure

STANDARD OPERATING PROCEDURE

Installation of Landfill Gas Monitoring Wells

I. Purpose and Scope

The purpose of this guideline is to describe methods for drilling and installation of landfill gas monitoring wells in unconsolidated or poorly consolidated materials.

II. Equipment and Materials

Drilling

- Drilling rig
- Hollow-stem augers

Well Riser/Screen

- Polyvinyl chloride (PVC), Schedule 40, minimum 1-inch ID, flush-threaded riser.
- PVC, Schedule 40, minimum 1-inch ID, flush-threaded, factory slotted screen.

Bottom Cap

- PVC, threaded to match the well screen.
- Centering Guides (if used).

Well Cap

- Above-grade well completion: PVC, threaded or push-on type, vented.

Aggregate

- Clean, durable, well-rounded, and washed VDOT Section 203, No. 8 aggregate, containing no organic material, anhydrite, gypsum, mica, or calcareous material.

Bentonite/Soil

- Pure, additive-free bentonite pellets.
- Pure, additive-free powdered bentonite.
- Coated bentonite pellets; coating must biodegrade within 7 days.
- Cement-Bentonite Grout: proportion of 6 to 8 gallons of water per 94-pound bag of Portland cement; 3 to 6 pounds of bentonite added per bag of cement to reduce shrinkage.

Protective Casing

- Above-grade well completion: 6-inch minimum ID steel pipe with locking cover, diameter at least 6 inches, painted with epoxy paint for rust protection; heavy duty lock; four protective posts, consisting of 3-inch inside diameter steel pipe, filled with concrete

III. Procedures and Guidelines

A. Drilling Method

Continuous-flight hollow-stem augers with a minimum 4 1/4-inch inside diameter (ID) will be used to drill landfill gas monitoring probe boreholes. The use of water to assist in hollow-stem auger drilling for monitoring probe installation will be avoided, unless required for such conditions as running sands.

Hollow-stem augers, rods, split-spoon samplers, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Split-spoon samplers and other downhole soil sampling equipment will also be properly decontaminated before and after each use. SOP Decon details proper decontamination procedures.

Drill cuttings and decontamination fluids generated during well drilling activities will be contained according to the procedures detailed in the Field Sampling Plan.

B. Landfill Gas Monitoring Probe Installation

Shallow landfill gas monitoring probes will be constructed inside the hollow-stem augers, once the borehole has been advanced to the desired depth. If the borehole has been drilled to a depth greater than that at which the well is to be set, the borehole will be backfilled with aggregate consisting of VDOT No.8 aggregate to a depth of approximately 1 foot below the intended well depth.

The appropriate lengths of well screen, with bottom cap and casing, will be joined watertight and lowered inside the augers to the bottom of the borehole. Centering guides, if used, will be placed at the bottom of the screen and above the interval in which the bentonite seal is placed.

Aggregate consisting of VDOT No.8 aggregate will be placed around the well screen. The aggregate will be placed into the borehole at a uniform rate, in a manner that will allow even placement of the aggregate. The augers will be raised gradually during aggregate installation to avoid caving of the borehole wall; at no time will the augers be raised higher than the top of the aggregate during installation. During placement of the aggregate, the position of the top of the aggregate will be continuously sounded. The aggregate will be extended from the bottom of the borehole to a minimum height of 6 inches above the top of the well screen. Heights of the aggregate and bentonite/soil seal may be modified in the field to account for the shallow water table and small saturated thickness of the surficial aquifer.

A bentonite/soil seal at least 1 foot thick will be placed above the aggregate. The bentonite pellets will be placed into the borehole in a manner that will prevent bridging. The position of the top of the bentonite/soil seal will be verified using a weighted tape measure. If all or a portion of the bentonite/soil seal is above the water table, clean water will be added to hydrate the bentonite. A hydration period of at least 30 minutes will be required following installation of the bentonite seal.

Above the bentonite/soil seal, an annular seal of cement-bentonite grout will be placed. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface through a tremie pipe. The tremie pipe must be plugged at the bottom and have small openings along the sides of the bottom 1-foot length of pipe. This will allow the grout to diffuse laterally into the borehole and not disturb the bentonite pellet seal.

Landfill gas monitoring probes will be completed above-grade. A locking steel protective casing set in a concrete pad will be installed. The steel protective casing will extend into the ground and approximately 2 feet above ground but should not penetrate the bentonite seal. The concrete pad will be square, approximately 4 feet per side. The concrete will be sloped away from the protective casing.

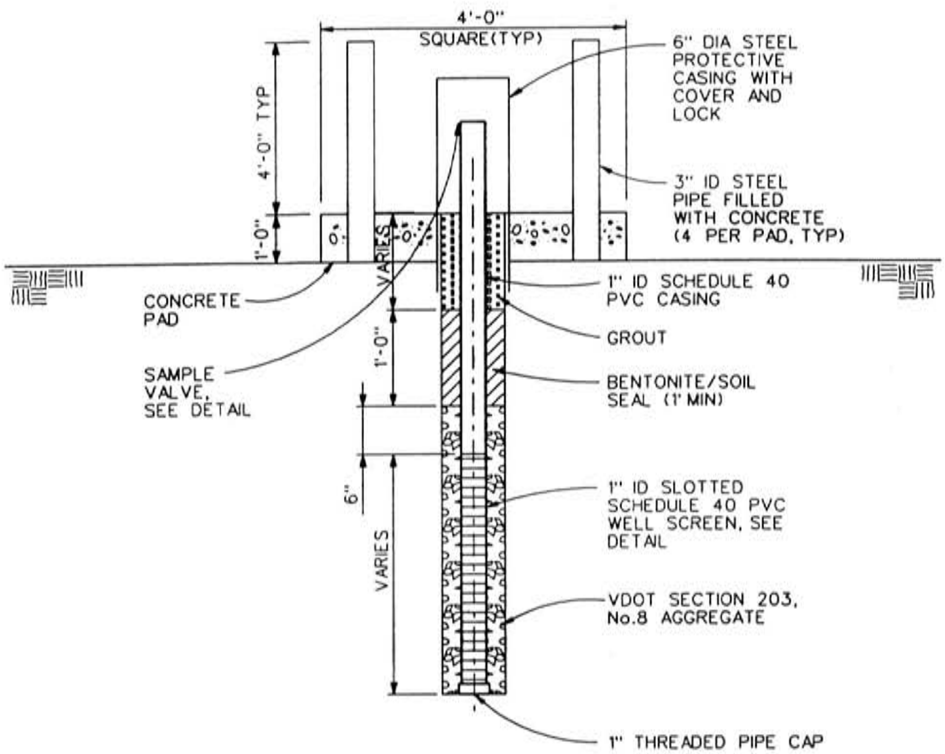
Guard posts will be installed in high-traffic areas for additional protection. Four steel guard posts will be installed around the protective casing and within the edges of the concrete pad. Guard posts will be concrete-filled, at least 3 inches in diameter, and will extend at least 2 feet into the ground and 3 feet above the ground. The protective casing and guard posts will be painted with an epoxy paint to prevent rust.

Concrete pads installed at all probes will be a minimum of 1 foot below grade. The surface of the pad should slope away from the protective casing to prevent water from pooling around the casing. Protective casing, guard posts, and flush mounts will be installed into this concrete.

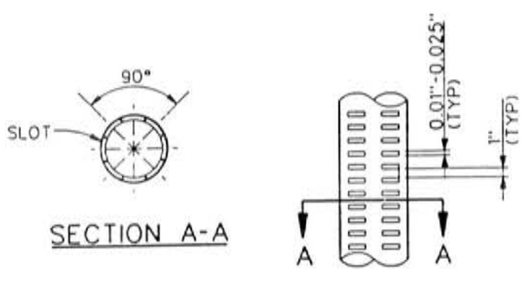
Each probe will be properly labeled on the exterior of the locking cap or protective casing with a metal stamp indicating the permanent well number.

IV. Attachments

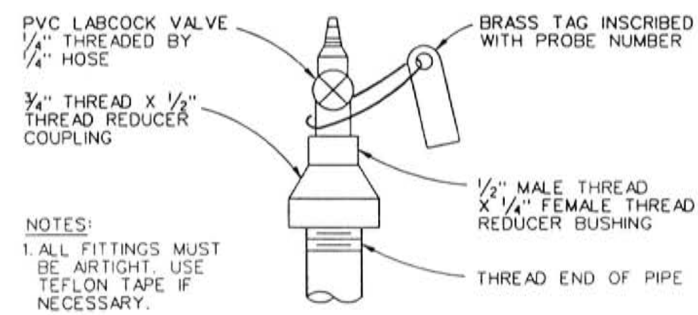
Schematic diagram of landfill gas monitoring probe construction.



GAS MONITORING PROBE DETAIL
NTS



WELL SCREEN DETAIL
NTS



SAMPLE VALVE DETAIL
NTS

Figure 3
LANDFILL GAS MONITORING PROBE DETAIL
OU2 - PARADISE CREEK DISPOSAL AREA
NORFOLK NAVAL SHIPYARD
PORTSMOUTH, VIRGINIA

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STANDARD OPERATING PROCEDURE

Landfill Gas Monitoring

I. Purpose and Scope

This procedure presents the techniques used in performing landfill gas monitoring. Materials, equipment, and procedures may vary; refer to the Field Sampling Plan and operators manuals for specific details.

II. Materials and Equipment

Materials and equipment vary depending on type of monitoring; the Field Sampling Plan should be consulted for project-specific details.

- Combustible gas indicator (e.g. Landtec Model GA90), with water trap or filter, capable of reading percent combustible gas by volume in increments of 0.1% from 0% to 100% combustible gas, equipped with a hose and a fitting allowing an airtight connection to the fitting on the gas monitoring probe.
- Pressure meter or gauge (e.g. Neotronics PDM10, or Landtec Model GA90), capable of reading pressure in increments of 0.1 inches water column (WC) from –50.1 to +50.1 inches WC, equipped with a hose and a fitting allowing an airtight connection to the fitting on the gas monitoring probe.
- Fittings, female quick-disconnect coupling, equipped with spring-operated valve that automatically opens the flow when connected and reseals when disconnected from the fitting on the gas monitoring probe.
- Calibration gas, 15% methane by volume.
- Purge pump capable of purging one probe volume of air, equipped with a drop-tube, hose and fitting, allowing an airtight connection to the fitting on the gas monitoring probe. The purge process is performed only when no measurable combustible gas is detected.
- Clean latex or surgical gloves.

III. Procedures and Guidelines

1. Meters will be calibrated daily, in accordance with the manufacturer's recommendations. The calibration gas cylinder lot number and results of the calibration check will be recorded in the field notebook.

2. Current local weather conditions will be recorded, including barometric pressure, in inches mercury (in. Hg), temperature, and precipitation conditions. These conditions will be recorded both at the beginning and end of the working day.

3. Landfill gas air monitoring will be performed according to the following procedures:

- Unlock the landfill gas monitoring probe.
- Attach the inlet hose from the pressure gauge or meter to the monitoring port.
- Record the pressure measurement, in inches WC, once the pressure measurement has stabilized, and remove the inlet hose.
- If applicable, attach the inlet hose from the purge pump to the monitoring port. Turn on the pump and purge the probe. After purging the probe, remove the inlet hose.
- Attach the inlet hose from the combustible gas indicator to the monitoring port. Turn on the instrument pump and record the methane concentration, in percent by volume (CH_4, %), once the measurement has stabilized, and remove the inlet hose.
- Lock the landfill gas monitoring probe.

IV. Attachments

None.

V. Key Checks and Items

- Record all data, including date, name(s) of field personnel, weather conditions, model and serial number of monitoring instrument(s), and monitoring results, in the field notebook.
- Review data to determine compliance with regulatory and permit conditions, as applicable (for example, less than 5% methane by volume (100% of the lower explosive limit (LEL) in landfill gas monitoring probes at the property boundary).
- Beware of hidden hazards.

Appendix E

Remedial Technology Screening and Process Options

Appendix E
Remedial Technology Screening and Process Options
SWMU 1 CMS
Former Hampshire Chemical Corp. Facility
Waterloo, New York

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Advantages	Disadvantages	Capital/ O&M Costs	Conclusion
No Action	No Action	No Action	No action	Easily implemented	None	No construction required	Not accepted by regulators	None	Retained for Comparison
Institutional Controls with Inspection	Access and Use Restrictions	Deed Restrictions	Deed restrictions issued for property, source area soil exceeding the clean-up goals to restrict land use	Easily implemented	Good	Limits human contact with impacted media	Poor as a stand-alone technology	Low	Retained for use in Alternative Development
		Permits	Regulations promulgated to require a permit for various activities (i.e., excavation/subsurface activities, installation of wells, etc.)	Easily implemented	Good	Requires notification for land use	Poor as a stand-alone technology	Low	Retained for use in Alternative Development
Monitoring	Monitoring of Land Use and Engineering Controls	Visual Inspections	Involves monitoring of use and conditions of engineering controls as required. It is usually utilized with alternatives that involve leaving impacts in place	Easily implemented	Good: Measureable	Allows for insurance of other technologies being implemented effectively	Poor as a stand-alone technology	Low/ Medium	Retain: Supports all other technologies

Appendix E
Remedial Technology Screening and Process Options
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General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Advantages	Disadvantages	Capital/ O&M Costs	Conclusion
Containment	Surface Controls	Grading / Consolidation	Reshape topography to control infiltration, runoff, and erosion, and consolidation of waste, debris, and impacted soil to reduce the coverage area of a cover/cap	Fair: Handling of fragile waste materials	Poor	Limited imported soil materials for construction	Stability concerns and handling of waste and debris	Low	Retained, but only to be utilized with other types of containment options
		Soil Cover	Place soil cover over debris or waste impacted soil area; includes demarcation layer, a topsoil cover layer to protect soil and canal restoration in the form of natural vegetation, gabions and/or rip-rap.	Good	Good	Eliminates human and ecological exposure	Requires importation of fill	Moderate	Retained for use in Alternative Development
		Soil Cap	Place soil cap (with low permeability to limit infiltration) over debris or waste impacted soil area; includes demarcation layer, a topsoil cover layer to protect soil and anal restoration in the form of natural vegetation, gabions and/or rip-rap.	Good	Good	Eliminates human and ecological exposure	Requires importation of fill	Moderate	Retained for use in Alternative Development
		Multi-layer Cap	Place both geosynthetics and soil over debris or waste impacted soil area; includes a geomembrane liner, drainage layer, protective soil and topsoil layer and canal restoration in the form of natural vegetation, gabions and/or rip-rap.	Good	Good	Eliminates human and Ecological Exposure	Requires importation of fill and geosynthetics	Moderate-High	Retained for use in Alternative Development
		Asphalt Cap	Place asphalt or concrete over impacted soil area	Good	Good	Existing asphalt access road currently covers a portion of the site	Requires long-term maintenance	Low-Moderate	Retained for use in Alternative Development

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Remedial Technology Screening and Process Options
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General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Advantages	Disadvantages	Capital/ O&M Costs	Conclusion
Excavation and Offsite Disposal	Excavation	Removal	Excavation of debris and waste impacted soils can use ordinary construction equipment (backhoes, bulldozers, front-end loaders). Excavation of PAH impacted soils and other soil, waste, and debris below 5 ft bgs may require excavation bracing and shoring.	Excavation combined with disposal of waste and potentially acetone impacted soil (from bottle breakages that would ensue due to transportation) is well proven and readily implementable technology.	Very effective because removes debris and waste as well as impacted soil	Removes debris, waste, and impacted soil	Longer construction time and potential worker exposure to debris, waste, and impacted soil	High	Not Retained
	Disposal	TSCA or RCRA Subtitle C Landfill	Solid hazardous wastes are permanently disposed of in a RCRA-permitted landfill.	There are suitable landfills located within close proximity of the site.	Good	Source removal	Bottle breakage and truck traffic	High	Not Retained
		Subtitle D Solid Waste Landfill or other approved non-hazardous disposal means	Solid non-hazardous wastes are permanently disposed of in a non-RCRA landfill or at another approved disposal facility.	There are several disposal options located within close proximity of the site.	Good	Source removal	Bottle breakage and truck traffic	High	Not Retained

Appendix F
Remedial Alternatives Evaluation

Proposed Remedial Alternatives Evaluation
SWMU 1 CMS
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Option	Alternative 1 No Action	Alternative 2 Soil Cover, Asphalt Cap and Institutional Controls and Monitoring	Alternative 3 Soil Cap, Asphalt Cap and Institutional Controls and Monitoring	Alternative 4 Partial Soil Cover, Asphalt Cap and Institutional Controls and Monitoring	Alternative 5 Multi-Layer Cap, Asphalt Cap and Institutional Controls and Monitoring
Description	• None	• Combination of existing asphalt cap and an extension thereof and construction of a soil cover over the impacted soil, debris and waste area	• Combination of existing asphalt cap and an extension thereof and construction of a soil cap over the impacted soil, debris and waste area	• Combination of existing asphalt cap and an extension thereof and construction of a partial soil cover over waste debris areas outside of treed areas	• Combination of existing asphalt cap and an extension thereof and construction of a multi-layer cap over the impacted soil, debris and waste area
Design Component Assumptions	• None	• Specific borrow-source requirements for topsoil and ability to preserve/improve the existing asphalt cap components	• Specific borrow-source requirements for topsoil and clay to promote positive drainage toward the canal for areas outside of the asphalt cap while preserving/improving the existing asphalt cap components	• Specific borrow-source requirements for topsoil and ability to preserve/improve the existing asphalt cap components	• Specific borrow-source requirements for topsoil and ability to preserve/improve the existing asphalt cap components
Overall Protection of Human Health and the Environment	• Not protective	• Protective	• Protective	• Less Protective due to non-covered waste/debris	• Protective
Compliance with Standards, Criteria and Guidance (SCGs)	• Does not comply with SCGs	• Complies with SCGs	• Complies with SCGs	• Complies with SCGs	• Complies with SCGs
Effectiveness	• Not effective because it does not remove or reduce exposure to impacted media	• Effective in reducing exposure to impacted media	• Effective in reducing exposure to impacted media • Reduces precipitation infiltration with the addition of the low permeability cap through the impacted soils and into the surfical aquifer.	• Effective in reducing exposure to impacted media • Does not cover all areas of identified waste/Debris	• Effective in reducing exposure to impacted media • Nearly Eliminates precipitation infiltration with the addition of the multi-layer cap through the impacted soils and into the surfical aquifer.
Reduction of Toxicity, Mobility, or Volume (TMV) through Treatment	• Does not reduce toxicity, mobility or volume through no action	• Reduces mobility through containment	• Reduces mobility through containment	• Reduces mobility through containment	• Reduces mobility through containment
Implementability	• Not applicable	• Easily implemented with adequate planning and identification of borrow source • Logistics of canal bank restoration to pose unique design/construction issues	• Easily implemented with adequate planning and identification of borrow source • Logistics of canal bank restoration to pose unique design/construction issues	• Easily implemented with adequate planning and identification of borrow source • No bank restoration concern	• Easily implemented with adequate planning and identification of borrow source • Logistics of canal bank restoration to pose unique design/construction issues
Long-term Risks	• Same as currently present	• Maintenance and monitoring of the soil cover and asphalt cap	• Maintenance and monitoring of the soil cap and asphalt cap	• Maintenance and monitoring of the soil cover and asphalt cap • Increased O&M handling fallen trees	• Maintenance and monitoring of the cap protective soils and asphalt cap
Uncertainties	• None	• Borrow source material	• Borrow source material	• Borrow source material	• Borrow source material • Geosynthetics Avaiability and Cost
Timeframe	• Not applicable	• Longer time frame for construction over Alt 4.	• Slightly longer timeframe than Alternative 2	• Shortest timeframe of construction based on alternatives	• Longest timeframe of construction based on alternatives
Schedule	• Not applicable	• Depends on regulatory approval	• Depends on regulatory approval	• Depends on regulatory approval	• Depends on regulatory approval

Proposed Remedial Alternatives Evaluation
SWMU 1 CMS
Former Hampshire Chemical Corp. Facility
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Option	**Alternative 1** **No Action**	**Alternative 2** **Soil Cover, Asphalt Cap and Institutional Controls and Monitoring**	**Alternative 3** **Soil Cap, Asphalt Cap and Institutional Controls and Monitoring**	**Alternative 4** **Partial Soil Cover, Asphalt Cap and Institutional Controls and Monitoring**	**Alternative 5** **Multi-Layer Cap, Asphalt Cap and Institutional Controls and Monitoring**
Sustainability	• Not applicable	• Reduces GHG emissions with on site cover	• Reduces GHG emissions with on site cap but increased GHG emissions over alternative 2.	• Increased sustainability with decreased GHG emissions with smaller cover area and promotes vegetation protection limiting tree removal	• Increased GHG emissions over other alternatives with multilayer cap components and increased natural resource use in manufacturing of geosynthetics.
Land Use	• Not protective of current and future land use	• Protective of current land use	• Protective of current land use	• Partially Protective of current land use	• Protective of current land use
Community Acceptance	• Probably not acceptable	• Uncertain, but likely	• Uncertain, but likely	• Uncertain and not likely	• Uncertain, but likely
Advantages	• Ineffective because no technology is used • No risk because no direct contact of impacted media with humans during construction and no change to the ecological habitat • No short-term disturbance of ecological habitat • Does not require monitoring of air quality and noise levels	• Restricts site use and access • Eliminates dermal contact through cover systems	• Restricts site use and access • Eliminates dermal contact through cap systems • Significantly reduces infiltration	• Restricts site use and access • Eliminates dermal contact through cover systems • Limited Tree Clearing/Removal	• Restricts site use and access • Eliminates dermal contact through cap systems • Significantly reduces infiltration • Increases the potential for build up of soil or landfill gas (not expected)
Disadvantages	• No regulatory acceptance • Not effective long-term • Does not promote active remediation of impacted area	• Requires monitoring of air quality and noise levels • Requires use of heavy machinery along canal bank. • Periodic maintenance of soil cover/cap and asphalt cap may be needed due to potential increase in permeability over time • Impacts site logistics • Imported soil required • Longer schedule	• Requires monitoring of air quality and noise levels • Requires use of heavy machinery along canal bank. • Periodic maintenance of soil cover/cap and asphalt cap may be needed due to potential increase in permeability over time • Impacts site logistics • Imported soil required • Longer schedule	• Requires monitoring of air quality and noise levels • Periodic maintenance of soil cover/cap and asphalt cap may be needed due to potential increase in permeability over time • Impacts site logistics • Imported soil required • Longer schedule • Does not cover all waste/debris • Increased O & M	• Requires monitoring of air quality and noise levels • Requires use of heavy machinery along canal bank. • Periodic maintenance of asphalt cap may be needed due to potential increase in permeability over time along with maintenance of multi-layer cap protective soil. • Impacts site logistics • Imported soil required • Longest Schedule •
Cost	• None • Capital Costs: - $0 • Present Net Worth: - $0	• Medium • Capital Costs: $1,621,000 • Present Net Worth: $1,773.000	• Medium • Capital Costs: $1,720,000 • Present Net Worth: $1,872,000	• Medium • Capital Costs: $1,334,000 • Present Net Worth: $1,486.000	• High • Capital Costs: $2,019,000 • Present Net Worth: $2,171,000

Appendix G

Proposed Remedial Alternative Assumptions

Appendix G

Proposed Remedial Alternative Assumptions

SWMU 1 CMS

Former Hampshire Chemical Corp. Facility

Waterloo, New York

Assumptions : Alternative 2 - Soil Cover, Asphalt Cap and Institutional Controls and Monitoring

1	Assumptions are currently based on known conditions and may need to be slightly adjusted as details of dewatering (if needed) and removal are refined.
2	Fieldwork can be completed within a 2-3 month period if started in Spring/Summer 2014
3	All applicable permits will be obtained prior to performing the fieldwork.
4	Air monitoring will be performed during the field activities.
5	Long-term monitoring will continue to be the same with the addition of cover inspections.
6	A one person management team will be onsite for construction.
7	State and local taxes are not included and must be added where applicable.
8	No special insurances are included at this time and will be added where applicable.
9	Community acceptance of remedy is obtained.
10	Field work will be performed during multiple 10 hour per day shifts, six days a week to meet the project schedule.
11	No staff will work more than 10 hours a day for more than 10 days in row without a break of at least 4 days.
12	All work will be conducted in Modified Level D personal protective equipment.
13	Asphalt Area of 20,913 SF, to be protected during construction for use as asphalt capping.
14	Work area size of approximately 2.1 acres
15	Temporary fencing around the construction area limits plant worker accessibility on the east side but is required.
16	Clear vegetated areas of approximately 1.5 acres, assumed to be along the canal bank and south of the existing access road (up to the extent of waste limits).
17	Prepared gravel and geotextile construction entrance to be placed to support haul trucks.
18	Demarcation layer assumed to be made up of 4 feet x 100 feet orange construction fencing.
19	8-inch gravel base for new asphalt cap areas for 29,310 square feet = 516 cubic yards.
20	4-inch asphalt layer at 20,913 SF = 258 cubic yards.
21	Subgrade fill is required in soil cap areas to construct minimum 3% grade of general fill, slope from center of current high point topography (approx 3,500 cubic yards).
22	2 feet of compacted soil cover approximately 3,945 cubic yards.
23	One-quarter of the volume of cover soil placement is assumed for topsoil placement and is required to be sandy loam with proper organics for growth (986 cubic yards).
24	Seeding of topsoil to occur with generic grass mix - same area as cover soils.
25	Erosion matting to be used over sloped areas to protect against erosion until vegetation is established.
26	350 feet of stabilization along the bank assumed to be restored
27	Permanent fencing and repairs for a total length of 700 linear feet.
28	Assumed 6 days of cover soil placement to be monitored with moisture/density gauge by a geotechnical sub consultant for quality control.
29	As-built and grade verifications during construction to be performed by registered surveyor.
30	Disposal of vegetative debris, PPE and other general waste debris will occur at a Subtitle D facility or other approved facility.