Revised Corrective Measures Study for AOC A – Seneca-Cayuga Canal

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Prepared for

The Dow Chemical Company

June 2013

CH2MHILL®

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Acronyms and Abbreviations

AOC	area of concern
bgs	below ground surface
BMP	best management practice
bss	below sediment surface
canal	Seneca-Cayuga Canal
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMS	corrective measures study
COC	constituent of concern
DER	Division of Environmental Remediation
Dow	The Dow Chemical Company
facility	former Hampshire Chemical Corp. facility located at 228 East Main Street, Waterloo, New York
ft/ft	feet per foot
HASP	health and safety plan
HAZWOPER	hazardous waste operations
HCC	Hampshire Chemical Corp.
HSM	health and safety manager
LEL	low effects level
LEL-Q	low effects level quotient
mg/L	milligrams per liter
MMP	material management plan
NTU	nephelometric turbidity unit
NYCRR	New York Codes, Rules and Regulations
NYSCC	New York State Canal Corporation
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration

PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pH	hydrogen (ion) potential
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
SCG	standards, criteria, and guidance
SEL	severe effects level
SFPC	Seneca Falls Power Company
site	former Hampshire Chemical Corp. facility located at 228 East Main Street, Waterloo, New York
SPDES	State Pollutant Discharge Elimination System
SVOC	semivolatile organic compound
TCL	target compound list
TMV	toxicity, mobility, or volume
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

SECTION 1

Introduction

This revised corrective measures study (CMS) for the former Hampshire Chemical Corp. (HCC) facility Area of Concern (AOC) A – Seneca-Cayuga Canal has been prepared pursuant to a Second Amended Order on Consent executed between HCC and the New York State Department of Environmental Conservation (NYSDEC), Index Number 8-20000218-3281, dated August 12, 2011 (NYSDEC 2011a) to conduct Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) and appropriate corrective measures at the site, which is located at 228 East Main Street, Waterloo, New York (hereafter referred to as facility or site; Figure 1). HCC is a wholly owned subsidiary of The Dow Chemical Company (Dow). 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.

Several AOCs, including AOC A, have been included in the RFIs (Figure 2). In a meeting on March 2, 2011, NYSDEC requested the development of a CMS to address impacted areas at AOC A. The first CMS submittal was titled *Corrective Measures Study for AOC A – Seneca-Cayuga Canal, Former Hampshire Chemical Corp. Facility, Waterloo, New York,* and was submitted to NYSDEC on May 31, 2012 (CH2M HILL 2012a). After negotiations with project stakeholders, including the New York State Canal Corporation (NYSCC) and Seneca Falls Power Company (SFPC), it became apparent that the dewatered (dry conditions) required for the removal as proposed in the May 2012 document would not be achievable. Accordingly, HCC is presenting this revised CMS, which presents options for working in watered (or wet conditions) and a subset of the dry alternatives previously developed as a basis for comparison. The remaining dry condition alternatives originally proposed in the May 2012 document were removed from the revised CMS.

This revised CMS generally follows the procedures outlined in the NYSDEC Division of Environmental Remediation (DER)-10/Technical Guidance for Site Investigation and Remediation (NYSDEC 2010a) in accordance with NYSDEC's e-mail request dated March 23, 2011 (NYSDEC 2011a), and letter dated April 19, 2012 (NYSDEC 2012b). DER-10 is an NYSDEC program policy that provides guidance for DER and regulated entities on how to conduct investigation and remediation at applicable sites.

1.1 Purpose and Objectives

This CMS identifies and evaluates potential corrective measures for the sediment target area at AOC A, as identified by various phases of investigation, and proposes a remedy for removing the defined target areas. The objective for corrective measures at AOC A is to remove the target areas of sediment agreed upon with NYSDEC.

1.2 Site Description and Background

The site is located at 228 East Main Street, Waterloo, Seneca County, New York. 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 (canal). The site is surrounded by residential properties (north, east, and southwest), commercial businesses (west), and the Seneca-Cayuga Canal (south). South of the canal are some residences, warehouses, and further downstream is the village wastewater treatment plant. Bruno Bock also owns a vacant lot on the northern side of East Main Street and a property on the eastern side of Gorham Street that is used as a parking lot.

The facility consists of 8.3 acres of industrially developed land, containing several interconnected buildings which house offices; a quality control (QC) laboratory; manufacturing, maintenance, and shipping/receiving operations; and a wastewater treatment plant. The site also includes outside drum storage areas and several aboveground storage tanks.

Within the defined remedial target area, the canal ranges from approximately 130 to 150 feet wide, and has water depths in the center channel between 14 and 16 feet deep (CH2M HILL 2010a). The canal consists primarily of a bedrock/cobble substrate, but near the facility, the shoreline has been modified with riprap and other fill material. The canal is used primarily for pleasure craft and has a series of locks that maintain pool elevations between each and maintain the water levels within Seneca and Cayuga Lake. The pool elevation at the site is approximately 429 feet above mean sea level (amsl).

1.2.1 Site History

The facility was first owned and operated by the Waterloo Woolen Manufacturing Company, which had 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 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 1800s, some of which are still standing, others of which were subsequently demolished. The canal and raceway system was much more extensive in the 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 2 depicts the current facility configuration.

[1] The oldest standing onsite building dates from 1839; however, there are indications buildings were onsite prior to 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 Operations

No detailed information is available related to the operations, processes used, or waste management practices at the former woolen mill. However, the available information suggests that Building 4 was the main production building and contained a pit that was used for wool dyeing. Liquid waste from this process was discharged to the canal via historical pipes. Many of the compounds of interest in the canal are believed to be related to the woolen mill operational time.

The primary chemicals manufactured at the facility are thioglycolic acid, thiodipropionate esters, and mercaptopropionic acid. Most of the chemicals are produced using batch operations. Chemical raw materials used in the processes include acids, acrylonitrile, alcohols, alkalis, ammonia, and metals (iron and zinc[3]).

Cooling water is obtained from the Seneca-Cayuga Canal Raceway, which runs along the northern portion of the facility. As part of the manufacturing process, a considerable volume of contact (process) and noncontact (non-process) cooling water passes through the facility. The contact cooling water may contain small concentrations of the chemicals and byproducts used and produced at the facility.

From 1975 to 2000, hot wells received contact cooling water from the steam jet vacuum systems connected to the reactors and condensers, and this water drained to the canal through various outfalls.

In 2000, aboveground stainless steel tanks were installed to receive noncontact cooling water, before being discharged through the former hot well floor openings and underground piping to State Pollutant Discharge Elimination System (SPDES) permitted Outfalls 001, 004, 005, and 008 at the canal in accordance with Permit Number NY0001406 (Figure 2). The facility SPDES permit has been effective since 1975. Other waste streams, including contact cooling water, are routed to the onsite biological treatment system before discharge at Outfall 013.

During the manufacturing processes and operation of the facility, several waste streams are generated, including acidic and alkaline wastes, wash water, spent solvents and paint thinners, and various nonhazardous wastes. Before installation of the Phase I waste treatment system in 1975, waste streams reportedly were discharged directly to the canal via the sewer system, Solid Waste Management Unit 29.

1.2.3 Uses of Canal

The Seneca-Cayuga Canal also is known as the Seneca River and is part of the New York State canal system. It connects the Erie Canal to Cayuga Lake and Seneca Lake, and is approximately 20 miles long. The canal was created when three sets of locks and dams were installed to support navigation through a series of rapids.

Today, NYSCC, a subsidiary of the New York State Thruway Authority, operates the canal, which includes a 25- to 50 foot-wide right-of-way along both sides of the canal. The canal is important for water control and recreation. It provides water control for flood mitigation of the 5,100 square miles of the Oswego River watershed. The hydroelectric power plants at

[3] Zinc has not been used at the site since 1993 (CH2M HILL 2006)

Waterloo and Seneca Falls, which are owned and operated by SFPC, also are used to maintain water levels in Seneca Lake and for power generation. Recreational cruising is allowed from approximately May 1 to November 15.

1.2.4 Locks

AOC A is between Lock CS4 in Waterloo and Lock CS2/3 in Seneca Falls (Figure 3). Lock CS4 raises and lowers boats 14.5 feet. Locks CS2 and 3 are combined without a pool of water between them. The two locks lift and lower boats a combined 49 feet, varying from 381.5 to 430.5 feet amsl.

1.2.5 Raceways

Canal raceways on the facility property historically connected to the canal and have been present in the area since the 1800s. By 1948, most of the facility raceways were filled and covered, with the exception of one raceway (Seneca-Cayuga Canal Raceway), which currently exists on the northwestern side of the facility along East Main Street (Figure 2). The source of the water is upgradient of Lock 4. This raceway provides cooling water to the facility for site operations.

1.2.6 Historical and Current Discharges to Canal

Before 1975, various wastewater streams from the facility's process buildings were discharged to the canal through the outfalls. The area of the canal, which is south of the facility, was identified as an AOC because of these former discharges to the canal. Some of the outfalls were abandoned then later removed. Currently, a network of pipes discharge noncontact cooling water from processes at the facility to the canal through the SPDES permitted outfalls (Figure 2) under Permit Number NY0001406. Historically, discharges to the canal were conveyed through as many as nine outfalls. Outfalls 001, 004, 005, and 008 discharge noncontact cooling water, and Outfalls 009, 010, and 012 discharge stormwater runoff to the canal. Process waste streams including contact cooling water are routed to the onsite biological treatment system before discharge at Outfall 013.

Piping from abandoned Outfalls 002, 006, and 007 was plugged and left in place. In 2010, the piping at abandoned Outfalls 002 and 007 was removed (CH2M HILL 2011a). Abandoned Outfall 006 was not removed because it is under existing facility structures.

Apart from the outfalls, water from the Village of Waterloo sewage treatment plant and from Silver Creek (Figure 3) also is discharged to the canal. It is estimated that approximately 84 cubic feet per second (cfs) of water is discharged from Silver Creek to the canal. Water discharge rates from the Village of Waterloo sewage treatment plant were not available at the time of this report.

The Bayard Street culvert is approximately 3 miles downstream of the facility in Seneca Falls, Seneca County, New York. The culvert serves to discharge water from Benton Creek to the canal. Benton Creek is a collection point for stormwater runoff from the surrounding residential area. NYSCC reported having historical issues with the Bayard Street Culvert when the canal water level previously was drawn down for maintenance. The wet removal approaches evaluated herein will allow the culvert to remain in a submerged state; similar to existing conditions; NYSCC will be responsible for regulating the canal water level in a manner that protects its infrastructure.

1.3 Report Organization

This CMS report is organized into the following sections:

- **Introduction:** Briefly describes the regulatory framework, purpose and objectives, site description and background, and report organization.
- **Description of Current Conditions:** Summarizes the regional and site geology, hydrogeology, RFIs, and nature and extent of impacted areas for corrective measures.
- **Remedial Action Objective (RAO):** Defines the RAO and volume of sediment to be removed from each of the areas that require corrective measures.
- **Remedial Alternatives and Technologies:** Presents the general description of each technology, and its advantages and disadvantages.
- **Recommendation of the Corrective Measure:** Evaluates the corrective measures and recommends a final corrective measure alternative.
- **Performance and Operations Monitoring:** Summarizes the purpose and types of monitoring programs, and monitoring documents that will be developed.
- **Public Notice of CMS:** Describes the regulatory framework that will be used to develop a citizen participation plan.
- **Permits:** Lists and describes the purpose of permits that will be needed to implement the corrective action measure and the associated regulatory agencies that will receive and process the permit application.
- **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.
- **Project Schedule:** Provides a schedule that shows milestones for the deliverables, submittal dates, and regulatory review timeframe.
- **References:** Provides the references cited in the report.

SECTION 2

Description of Current Conditions

2.1 Site Geology and Hydrogeology

Several environmental investigations have been performed at the site. The following presents a summary of the regional and local geology and hydrogeology.

2.1.1 Regional Geology

The site lies in glacial deposits consisting of lacustrine silts and clays from proglacial Lake Iroquois, a more extensive predecessor of Lake Ontario. These deposits overlie gray marls, shales, and egasite deposits of gypsum and salt, which are part of the Onondaga Limestone formation of Lower to Middle Devonian Age. Below the Onondaga Limestone lie Lower Devonian deposits consisting of the Manlium Limestone and the Rondout Dolomite, which overlie Silurian-age shales, dolomites, and sandstone. Below the Silurian sequence are the Ordovician-age shales, sandstones, and limestones, which cap the Upper Cambrian dolomites and sandstones, and the Precambrian basement comprised of gneiss, marble, and quartzite at depths of 5,000 feet below ground surface (bgs; Van Tyne 1974, as summarized in Saroff 1987).

2.1.2 Site Topography and Geology

The site topography slopes gently southward toward the canal with elevations ranging from 457 to 429 feet amsl at the canal bank, and to 415 feet amsl at the bottom of the canal. South of the facility, the canal consists of steep rocky sides, with a relatively flat bottom consisting largely of sand and rock in the center of the canal, and sediment deposits adjacent to the canal bank. Riprap material also is present at some areas of the canal bank and bottom. The uplands portion of the site is underlain by historical anthropogenic fill. Beneath the historical anthropogenic fill, three distinct natural soil lithologic units are present: soft native deposits (silt and clay), glacial till (very hard silt and clay), and bedrock (Onondaga Limestone). Anthropogenic fill was placed over the native deposits across most of the site. The fill material generally consists of silt, sand, and gravel with varying amounts of brick fragments, cinder, ash, ceramic, glass and plastic bottles, wood, shoes, copper wires, and tires.

2.1.3 Hydrogeology

The facility is within the watershed of the Seneca River, which is an easterly flowing New York State Class "C" stream. A New York State Class "C" stream supports fisheries and is suitable for noncontact activities (NYSDEC 2009).

As part of the sitewide monitoring program at the facility, 44 groundwater monitoring wells, and the Building 4 sump pit (BLDG-4-SSP-Pit) are sampled annually. Surface water elevations also are recorded at one stilling well (SG-2). Sitewide groundwater measurements indicate groundwater flow is generally to the south toward the canal, which is consistent with historical conditions observed at the site (CH2M HILL 2011b).

Groundwater depths for onsite wells generally vary between 2 and 5 feet bgs upgradient of the North Shore Deposit, and between 5 and 8 feet bgs upgradient of the Gorham Street Deposit. Groundwater depths for the adjacent canal bank area at the South Shore and Downstream deposits are unknown because monitoring wells have not been required in these areas, based on groundwater conditions.

The horizontal hydraulic gradient in the western portion of the site was calculated to be 0.02 feet per foot (ft/ft). The horizontal hydraulic gradient in the eastern portion of the site was calculated to be 0.05 ft/ft. The vertical hydraulic gradient calculated at the MW-5S/5I couplet ranged from -0.16 ft/ft (April 2010) to -0.18 ft/ft (November 2010). The vertical hydraulic gradient calculated at the MW-11S/11I couplet was -0.2 ft/ft during the 2009 and 2010 monitoring events (CH2M HILL 2011b). The negative vertical hydraulic gradient indicates a downward flow of groundwater.

NYSCC monitors canal water levels, and water depths in the center channel vary between 14 and 16 feet. Historically, NYSCC has lowered these water levels for maintenance activities.

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 that have been submitted to NYSDEC. This section summarizes the results of the RFI activities performed at AOC A.

2.2.1 AOC A - Seneca-Cayuga Canal

A series of four sediment characterization studies have been completed in the canal in the area of the site. These investigations delineated the extent of depositional sediment in the canal near the facility and then characterized the nature and extent of chemical contamination in that sediment. Data from all phases of investigation were compared to NYSDEC sediment quality values (NYSDEC 1999), specifically the low effects level (LEL) and severe effects level (SEL). In addition, an ecological impact assessment was performed in portions of two of the deposit areas (South Shore and Downstream deposits). The overall study area (Figure 4) has been defined as four depositional areas:

- North Shore Deposit
- Gorham Street Deposit
- South Shore Deposit
- Downstream Deposit

Pre-RFI and Initial RFI

The initial sediment characterization activities conducted in 2001 (pre-RFI) and 2004 (initial RFI) consisted of collecting 38 sediment samples from shallow (less than 1 foot below sediment surface [bss]) and deeper (1 to 2 feet bss) intervals. The sediment samples were collected from 10 background locations, upgradient of the site and from the north shore of the canal, adjacent to the facility. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and target analyte list metals (O'Brien and Gere Engineers, Inc. 2003; CH2M HILL 2006). The data indicated sediment was impacted

primarily with PCBs, polycyclic aromatic hydrocarbons (PAHs), and metals, including arsenic, cadmium, copper, lead, mercury, and zinc.

Phase I Sediment Investigation

Phase I of the canal sediment characterization was conducted in November 2007 and consisted of evaluating the distribution (vertical and horizontal extent) of soft sediment within the canal adjacent to the site. Sediment thickness was measured using a combination of manual probing methods and acoustic sub-bottom profiling. The acoustic sub-bottom profiling was performed along three overlapping transects running parallel to the shore and 24 transects located at approximately 60-foot intervals between the western end of the site and approximately 150 feet downstream of the Gorham Street Bridge. Manual probing consisted of using a push rod at a series of stations along transects running bank-to-bank and perpendicular to the north bank.

Sediment deposits were identified in the North Shore Deposit, South Shore Deposit and part of the Gorham Street Deposit, and represented a volume of 936 cubic yards based on comparison of top and bottom of sediment contours. The results indicated soft sediment was predominantly located along the southern side of the canal (across from the facility). Overall, measurable sediment thicknesses ranged from 0.1 to 3.7 feet (CH2M HILL 2009a).

Phase II Sediment Investigation

Phase II of the canal characterization was conducted in October 2009 and consisted of additional sediment probing to delineate soft sediment deposits identified during Phase I. The probing conducted during the Phase II sediment investigation consisted of higher-density probing locations compared to Phase I to facilitate the delineation of the soft sediment deposits. In addition, Phase II sediment investigation activities included collecting surface sediment grab samples (0 to 6 inches bss), subsurface sediment (greater than 6 inches bss) via vibracoring, and surface water sampling. The surface sediment samples were collected from 48 locations within AOC A and 12 locations upstream of the site (background). In addition, sediment cores were collected at 43 locations to evaluate constituent concentrations at depth. In all cases, sediment was analyzed for metals, SVOCs, VOCs, and PCBs. Samples also were analyzed for total organic carbon, and a subset was analyzed for grain size.

Surface water samples were collected during Phase II from eight locations and analyzed for SVOCs, PCBs, total metals, dissolved metals, total suspended solids (TSS), and hardness. In addition, field measurements were performed on the samples for water temperature, hydrogen (ion) potential (pH), specific conductance, dissolved oxygen, and turbidity.

In addition to the sediment and chemical data collected, water flow velocity was measured at three points along four transects (adjacent to the surface water sampling locations) within the study area. Water velocity was measured at mid-depth at each location where a water sample was collected as well as in the thalweg.

The results of the Phase II sediment investigation were reported in the *Phase II Sediment Investigation Data Report* (CH2M HILL 2010a). Metals results along the North Shore, Gorham Street, and South Shore deposits indicated site-related constituents were present above background concentrations and respective LELs. As with the metals results, PAHs and PCBs primarily were encountered above background concentrations and respective

LELs within the North Shore Deposit, in localized areas within the Gorham Street Deposit, and at a limited number of stations within the South Shore Deposit.

The only detected constituent to exceed the screening value in surface water was cadmium. None of the detected PAHs (2-methylnapthalene, acenaphthene, and naphthalene) in surface water was encountered at concentrations above their respective screening value.

Based on the data collected during the pre-RFI, initial RFI, and Phase I and II sampling, HCC concluded that corrective measures were required for the North Shore and Gorham Street deposits.

Phase III Sediment Investigation

The Phase III sediment investigation was conducted in November 2010 and focused on areas downstream from the easternmost extent of the Phase II investigation area (CH2M HILL 2010b). The investigation consisted of sediment probing along seven transects to delineate depositional sediment, and collecting surface and subsurface sediment samples at 18 stations. During the Phase III investigation, 88 samples were collected from the 18 stations for analysis of total metals, SVOCs, VOCs, PCBs, total organic carbon, and grain size.

The results of the Phase III investigation were reported in the *Phase III Sediment Investigation Data Report* (CH2M HILL 2011c). The results indicated concentrations of metals (including arsenic, cadmium, copper, lead, mercury, and zinc), PCBs, and PAHs in surface and subsurface sediment were above NYSDEC LELs within portions of the Downstream Deposit. At the eastern end of the study area, constituent concentrations were at or below concentrations detected in the background samples. Therefore, additional sediment characterization downstream from the eastern extent of the Downstream Deposit was not conducted during the Phase III sediment characterization.

Ecological Impact Assessment Investigation

The ecological impact assessment investigation was conducted in August 2011 and focused on an area within the South Shore and Downstream deposits (CH2M HILL 2011d). The investigation consisted of collecting sediment samples for chemical analyses and toxicity testing from stations in and around the areas in the South Shore and Downstream deposits identified as potential hot spot locations by NYSDEC's LEL approach. NYSDEC also defined the area for investigation based on the LEL quotient (LEL-Q). The categorization criteria for the mean LEL-Q was provided by NYSDEC (NYSDEC 2011c) and is as follows:

- If LEL-Q equals 1 or less, categorize as non-impacted.
- If LEL-Q is greater than 1 and less than 1.5, categorize as undetermined.
- If LEL-Q equals 1.5 or greater, categorize as potentially impacted.

These categories were used to classify the sample stations. A sample station was classified as non-impacted, undetermined, or potentially impacted using the following decision criteria:

- Non-Impacted
  - All sample intervals non-impacted.

  - Less than three undetermined intervals and non-impacted within the surface sediment interval (or if undetermined within the surface sediment interval and adjacent stations are classified as non-impacted).
  - One potentially impacted interval and remainder are non-impacted, and the potentially impacted interval is below the 6- to 12-inch interval and not adjacent to stations with potentially impacted intervals within top 12 inches.
- Undetermined
  - All sample intervals undetermined.
  - One potentially impacted interval (not within top two intervals) and remainder undetermined.
- Potentially Impacted
  - Two or more potentially impacted intervals.
  - One potentially impacted and multiple undetermined intervals not meeting the above exception.

Five surface sediment and four subsurface sediment samples were collected from the South Shore Deposit, and 17 surface sediment and 16 subsurface sediment samples were collected from the Downstream Deposit.

To provide a measure of upgradient or background conditions, surface sediment samples were collected from seven additional locations upstream from the facility. On August 23 and 24, 2011, NYSDEC verbally agreed upon the general locations (NYSDEC 2011d).

The ecological impact assessment report presented a comprehensive review of existing sediment chemistry and toxicity data from AOC A (CH2M HILL 2012b). The report presented a multiple-lines-of-evidence approach and site-specific data to evaluate potential biological effects associated with site-related constituents in the South Shore and Downstream deposits. This approach included a comprehensive evaluation of upstream background conditions, and the results were used to guide recommendations for sediment management decisions regarding the portions of the South Shore and Downstream deposits that NYSDEC defined as requiring additional investigation.

Summary

Data from the overall sediment characterization for the North Shore and Gorham Street deposits indicate these areas have increased potential for toxicity and could potentially adversely affect benthic invertebrates. HCC previously acknowledged this conclusion and committed to developing a CMS for these two deposits.

The overall conclusion drawn from the impact assessment for the South Shore Deposit is that the site-specific chemical and toxicity test data indicate sediment in this deposit do not cause adverse biological effects compared to upstream reference conditions, and no corrective action is required. In a letter dated April 19, 2012, NYSDEC concurred with this conclusion (NYSDEC 2012a), and discussion of corrective measures for the South Shore Deposit is not required as part of this CMS report.

HCC concluded in the impact assessment that no action also was needed for the Downstream Deposit area, which also was presented to NYSDEC in a meeting on April 24, 2012. NYSDEC did not concur with the conclusion for the Downstream Deposit which recommended that no corrective actions were required (NYSDEC 2012a). HCC submitted a response to comment letter on April 27, 2012, which proposed a rationale for a 1- to 2-foot removal of a limited area in the western portion of the Downstream Deposit (HCC 2012). NYSDEC concurred with this limited removal approach in a letter dated May 1, 2012 (NYSDEC 2012b).

HCC does not agree that corrective measures are required in the western edge of the Downstream Deposit, for the reasons set forth in the multiple lines of evidence in its prior submissions. Nevertheless, HCC has agreed to perform certain work that it believes may not be warranted strictly based on ecological impacts from constituents from the former HCC facility (both in the Downstream Deposit and in other deposits) in order to meet the deadlines and accomplish the synergies and mutual benefits of the project. HCC, NYSDEC, and NYSCC have been working in a collaborative manner to coordinate a project that will meet several goals and provide benefits to the community (HCC 2012).

2.3 Nature and Extent of Impacted Areas for Corrective Measures

This section describes the nature and extent of the sediment target areas, as agreed on with NYSDEC, in AOC A. The remedial target areas are defined as the North Shore, Gorham Street, and portions of the Downstream deposits as shown on Figure 5. The rationale for defining these target areas is discussed in the Impact Assessment Report (CH2M HILL 2012b). As mentioned in Section 2.2.1, HCC concluded in the impact assessment that no action was needed for the Downstream Deposit area, which also was presented to NYSDEC in a meeting on April 24, 2012. NYSDEC did not concur with the conclusion for the Downstream Deposit, which recommended that no corrective actions were required (NYSDEC 2012a). HCC submitted a response to comment letter on April 27, 2012, which proposed a rationale for a 1- to 2-foot removal of a limited area in the western portion of the Downstream Deposit (HCC 2012). NYSDEC concurred with this limited removal approach in a letter dated May 1, 2012 (NYSDEC 2012b).

The determination of the extent of target areas was based on chemical analyses, toxicity testing and comparison with background concentrations. A brief discussion is presented in Section 2.2.1.

Approximately 4,500 to 7,200 cubic yards of soft sediment is anticipated to be removed from the three remedial target areas (RTAs). The range of removal volumes for each RTA is approximate and defined as follows:

- North Shore Deposit: 530 to 1000 cubic yards
- Gorham Street Deposit: 3,300 to 5,000 cubic yards
- Downstream Deposit: 670 to 1,200 cubic yards

The impacted soft sediments will be excavated, to the extent practical, up to the till layer or bedrock, whichever is encountered first. However, for the Downstream Deposit, a portion of the sediment deposits will be removed up to 2 feet below the existing sediment surface

and another portion will be removed up to 1 foot below the existing sediment surface. Sediment removal will be performed using mechanical dredging equipment; hand shovels, power washers, or vacuum trucks will not be used to remove any de minimis amounts of sediment remaining. It is noted that sediment volumes are estimates and final quantities of sediment available for removal are dependent on canal bottom site conditions and industry-accepted equipment limitations. Pre- and post-removal surveys will be conducted in accordance with a Sediment Removal Verification Plan and will be presented as part of the sediment removal design.

2.3.1 North Shore Deposit

The North Shore Deposit extends approximately 650 feet toward the west from the Gorham Street Bridge and approximately 60 feet toward the south or center of the canal from the northern bank (Figure 5). Measurable soft sediment thicknesses ranged from less than 1 foot to approximately 5 feet bss.

Corrective measures will be completed to target all of the soft sediment at the North Shore Deposit (Figure 5).

2.3.2 Gorham Street Deposit

The Gorham Street Deposit is within the reach of the canal between the Gorham Street Bridge and extends up to approximately 830 feet downstream from the Gorham Street Bridge. The results indicate soft sediment was predominantly localized along the northern bank with a lateral extent of 830 feet and along the southern bank with a lateral extent of approximately 380 feet. The soft sediment also extends approximately 40 feet toward the center channel on the eastern area of the deposit (Figure 5). The soft sediment thicknesses observed in the Gorham Street Deposit ranged from less than 1 foot to 7 feet bss.

Corrective measures will be completed to target all of the soft sediment at the Gorham Street Deposit (Figure 5).

2.3.3 Downstream Deposit

Sediment thickness in the portion of the Downstream Deposit where corrective measures will be completed extends approximately 620 feet west from the Silver Creek (Figure 5) and approximately 90 feet toward the center of the channel from the northern bank.

The corrective action is required to target a section of the soft sediment at the Downstream Deposit west of Silver Creek to a depth of up to 1 foot in one section and up to 2 feet in another section only in the areas shown on Figure 5.

As stated in Section 2.2.1, HCC does not agree that corrective measures are required in the western edge of the Downstream Deposit, for the reasons set forth in the multiple lines of evidence in its prior submissions. Nevertheless, HCC has agreed to perform certain work that it believes may not be warranted strictly based on ecological impacts from constituents from the former HCC facility (both in the Downstream Deposit and in other deposits) in order to meet the deadlines and accomplish the synergies and mutual benefits of the project. HCC, NYSDEC, and NYSCC have been working in a collaborative manner to coordinate a project that will meet several goals and provide benefits to the community (HCC 2012).

SECTION 3

Remedial Action Objective

RAOs are medium or operable-unit-specific objectives for the protection of 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 2010b).

The RAO for AOC A is to remove the impacted soft sediment from the North Shore and Gorham Street deposits and a limited area west of Silver Creek in the Downstream Deposit as described in Section 2.3.

No additional areas require corrective measures at AOC A.

SECTION 4

Remedial Alternatives and Technologies

This section presents remedial technologies for sediment removal and evaluates the technologies against the RAO presented in Section 3. The detailed analysis of alternatives presents the information needed to compare the sediment remedial alternatives assembled for AOC A. It follows the development and screening of alternatives, and precedes the proposed corrective measure for AOC A. This analysis is based on available data and types of remedial technologies evaluated. The alternatives analysis consists of evaluating each alternative against the DER-10 evaluation criteria (NYSDEC 2010a) followed by a comparative evaluation.

Provisions of DER-10 require that each alternative be evaluated against nine criteria (NYSDEC 2010a). 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 AOC A. 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 toxicity, mobility, or volume (TMV) through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. Land use
9. Community acceptance

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 are 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 criterion is community acceptance. This is evaluated following public comment and may be used to modify selection of the recommended alternative.

4.1 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 SGCs have been defined through the NYSDEC guidance levels for sediment (LEL and SEL), and as agreed on with NYSDEC from the toxicity testing results (CH2M HILL 2012b). However, because soft sediment will be removed from the RTAs to the maximum extent practicable using dredging methods, post-excavation sampling will not be completed, and it is anticipated that the chemical-specific SCGs will be met. It should be noted that the Downstream Deposit is an exception where depth-based removals will be performed. NYSDEC has agreed that no post-excavation confirmation sampling needs to be performed within any deposits where toxicity data adequately define the horizontal and vertical extents of removal (NYSDEC 2012b). The chemical-specific SCGs will be achieved as per discussions with NYSDEC.

Location-Specific SCGs

Location-specific SCGs will include a review of specific standards or guidance based on the location. 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. Additional information on the agencies that will be contacted is presented in Appendix C.

Action-Specific SCGs

The RCRA program is the action-specific SCG for impacted sediment at the site during sediment handling and disposal and for worker protection during remediation activities.

Impacted sediment generated during remediation activities will be characterized, managed, and disposed of in accordance with the material management plan (MMP; CH2M HILL 2010c) and applicable RCRA regulations. It is anticipated that no hazardous waste will be generated during the removal action. Composited sediment samples from each of the deposit areas of the canal have been characterized as nonhazardous waste; therefore, the sediment will be managed as nonhazardous waste and disposed of in accordance with the

MMP (CH2M HILL 2010c). If hazardous waste is encountered, the MMP will be updated to address hazardous waste handling and disposal. If excavated sediment cannot be appropriately dewatered to meet disposal facility requirements, a drying agent will be added to these sediments before offsite disposal at an approved landfill. Hazardous waste, if generated, will be managed and disposed of in accordance with 40 Code of Federal Regulations (CFR) 262 (U.S. Environmental Protection Agency [USEPA] 1980).

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 constituents of concern (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 determined (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 sediment and soil potentially contaminated with arsenic, cadmium, chromium, lead, and mercury.

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.

Following the site-specific *Community Air Monitoring Plan* (CH2M HILL 2009b), atmospheric monitoring will be performed at the source, in the employees breathing zone, and at the perimeter, as needed. 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.

4.2 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 institutional controls.

Reduction of TMV through Treatment (Criterion 4)

The statutory preference is a remedial action that employs treatment to reduce the TMV of substances of concern. 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 determined 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) 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 RAO 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 community.

4.3 Modifying Criteria

Community Acceptance (Criterion 9)

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

4.4 Remedial Alternatives

Six remedial alternatives were evaluated and compared to the criteria described above. The purpose of this CMS, and based on discussions with NYSCC, no alternatives were included or evaluated that considered complete dewatered conditions in the canal. Each of the alternatives were developed using the information provided by NYSCC on the volume of water that will need to be managed during the removal effort. When applicable, the alternatives have considered the advantages of NYSCC's ability to drop the water levels approximately 5 feet during the non-navigation season. The alternatives are as follows:

- Alternative 1: No Action

- Alternative 2: Mechanical Dredging with Select Landside Removal
- Alternative 3: Hydraulic Dredging with Select Landside Removal
- Alternative 4: Mechanical Excavation Following Isolation Using Portadam or Similar Water Divertment Structure Under Watered Conditions
- Alternative 5: Mechanical Excavation in Dry Conditions Following Isolation with Sheet Piles
- Alternative 6: Mechanical Excavation with Upstream and Downstream Dam and Bypass Pumping

Alternative 1 is a general corrective measure used to provide a baseline for comparison against other alternatives. All of the other alternatives involve excavation and offsite disposal of the sediment target areas, which is a well-proven remedial technology for remediating impacted sediment. These alternatives all involve removing sediment, but the removal and water management methods are different across the range of alternatives.

All of the remaining alternatives include at least 10 feet of water within the canal to be managed during the removal. Alternatives 2 and 3 involve mechanical and hydraulic dredging, respectively and use the 5 feet of dewatering during the non-navigation season. Alternatives 4, 5, and 6 involve diverting water around the removal areas and using backhoes, front loaders, continuous excavators, scrapers, and other equipment after the area for removal is dry. For all of the alternatives, excavated material may be staged temporarily in stockpiles and/or rolloff containers for dewatering before transporting to an approved offsite landfill.

Appendix A presents a brief description of the six alternatives in terms of the proposed technology, its advantages and disadvantages, and design component assumptions. Each technology is screened against, threshold criteria, balancing criteria, modifying criteria, long-term risks, uncertainties, and its sustainability.

Note that the alternatives discussed below have been conceptually evaluated as part of this CMS. Certain assumptions were made for each alternative based on the current knowledge of site conditions and the engineering involved for each; these assumptions are subject to change as additional design is completed.

4.4.1 Alternative 1: No Action

This alternative is evaluated as a baseline for other alternatives and does not involve any remedial actions or monitoring activities for the site. Natural processes, such as dilution, dispersion, and biodegradation would be expected to occur in the sediment with the potential to reduce constituent concentrations over time. Table 4-1 contains a detailed evaluation of Alternative 1.

TABLE 4-1
Individual Analysis of Alternative 1 – No Action
CMS for AOC A – Seneca-Cayuga Canal

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.
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.

TABLE 4-1
Individual Analysis of Alternative 1 – No Action
CMS for AOC A – Seneca-Cayuga Canal

COSTS	
Cost	None
LAND USE	
Land Use	Not protective of current and future land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Unlikely. Minimal issues with canal boat traffic.

The no action alternative does not include institutional controls or active corrective measures to remove or treat the areas of impact or to reduce the concentrations of COCs in sediment. The lack of an active remedy could affect canal users and benthic wildlife that may be exposed to the COCs. This alternative has no costs or actions to implement; however, a no action alternative is not expected to be acceptable to the community and regulators.

Alternative 1 is not retained for further evaluation because no action results in unfavorable conditions.

4.4.2 Alternative 2: Mechanical Dredging with Select Landside Removal

This alternative involves conventional mechanical dredging from a floating barge supporting an excavator equipped with an environmental bucket, or equivalent. This alternative also includes some sediment removal to be completed in the North Shore Deposit using a long-reach excavator before the beginning of the mechanical dredging phase of removal. This landside removal while the canal water level is lowered approximately 5 feet (non-navigation season) will allow for a visual verification of removal in a nearshore area of the North Shore Deposit that has been reported to contain high concentrations of site-specific COCs.

Before sediment removal of the areas outside the area within the North Shore Deposit that will be removed with 5 feet of dewatering, timber, large rocks, and large debris will be moved or removed from the work areas to allow for maximum exposure to soft sediment. In some cases, uncontaminated debris may be segregated and replaced within the canal. Care will be taken to maintain boulders and rocks that may support the shoreline, banks, and other canal features. Work areas will be enclosed with a turbidity or silt curtain to minimize transport of suspended sediment. The mechanical landside excavation of the sediment will likely be performed with a large track-mounted hydraulic excavator.

Landside Removal

Following debris removal and during the non-navigation season, sediment will be excavated from an area of the North Shore Deposit using long-reach track-mounted hydraulic excavators. These select sediment areas will be exposed because of lowered water levels of up to 5 feet and will allow for removal in dry or mostly dry conditions

(approximately less than 12 inches water depth). If possible, excavated materials will be direct-loaded into trucks for disposal, or loaded into watertight scow barges and transported to the staging/dewatering area. Landside removal will be completed using hydraulic excavators, and there will be no manual removal completed by hand (shovels, power washers, or vacuum equipment). Sediment removal along the upper bank area with an excavator while the water level has been lowered by 5 feet will allow for visual verification of removal in these areas.

Based on the canal channel configuration and the water level to be dropped, it is anticipated that approximately 20 to 25 percent of the soft sediment in the North Shore Deposit will be removed under these conditions. This area constitutes the area of highest impacts from past investigation activities and the sediment surrounding the historical outfalls, which are the areas where the original discharges are believed to have occurred. Removal of sediment in the select landside removal of the North Shore Deposit area will be observed and documented visually (real-time and photographic).

Conventional Mechanical Dredging

The remaining sediment material outside the North Shore Deposit landside removal area, including the Gorham Street and Downstream deposit areas, will be excavated using a barge-mounted excavator. This phase of removal likely will be completed during both the non-navigation and navigation seasons and after water level has returned to normal elevations (approximately 15 to 16 feet in center of the canal). Immediate work areas will be enclosed with a turbidity or silt curtain to minimize transport of suspended sediments. The barge-mounted excavator equipped with an environmental bucket will remove sediments to the extent possible and place the material into adjacent scows. These scows, when full, will travel downstream to the sediment offloading area at the Village of Waterloo property (pending approval by the Village). This property will serve as the sediment staging and processing area for the material before transporting for offsite disposal. As needed, sediments will be dewatered with a pozzolanic material such as lime or Portland cement so landfill disposal requirements for water content can be met. Dewatered material then will be loaded onto trucks for offsite landfill disposal.

Additional verification of soft sediment removal in the remaining areas of the North Shore, Gorham Street, and Downstream deposits will be confirmed by comparing and evaluating pre-excavation and post-excavation bathymetric surveys (in accordance with the Sediment Removal Verification Plan as part of the final sediment removal design).

Depending on the volume of water generated during removal, a determination will be made to either treat onsite or dispose of offsite. An additional evaluation of the amount of water generated during mechanical dredging will be included as part of the intermediate design. If it is shown to be more cost-effective to treat onsite, collected water will be pumped to a temporary onsite water treatment system for treatment of suspended solids and the treated water sampled before direct discharge to the canal. A temporary water treatment system is anticipated to be constructed on the Village of Waterloo property (tax map parcel No. 12-2-22), which also will serve as a staging and offloading area. For costing purposes, it is assumed that water treatment for TSS will be performed onsite.

During excavation in the North Shore Deposit, water from permitted facility outfalls may be rerouted by installing piping or a series of pipes to the existing outfalls to extend the

discharge point and reroute the water to the canal at a point downstream of the work areas. At this time, it is anticipated that no changes to the permitted outfall's sampling location will be needed because the location of the outfall discharge points will not be relocated, just temporarily extended further into the center of the canal during the removal effort.

Figure 6 shows the approximate surrounding property boundaries, and the potential sediment offloading and dewatering areas and equipment storage areas. Table 4-2 contains a detailed evaluation of Alternative 2.

TABLE 4-2
Individual Analysis of Alternative 2 – Mechanical Dredging with Select Landside Removal
CMS for AOC A – Seneca-Cayuga Canal

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 2 will achieve RAO which will be protective of human health.
Environmental Protection	Mechanical excavation of impacted areas will protect the environment by removing impacted sediment from the canal bottom and will prevent sediment migration to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Will meet action-specific SCGs.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Virtually all of the impacted soft sediment in RTAs will be removed. A small amount of sediment may remain because of the limitations of the hydraulic removal as well as through resuspension.
Adequacy and Reliability of Controls	Turbidity curtains are a dredging best management practice and are adequate and reliable for the uneven canal bottom conditions. This will ensure long-term success of the corrective measure in protecting environmental receptors.
Individual Technical Components	Excavators, trucks, scows, pug mill, dewatering pad(s), water treatment system for solids, and disposal staging areas.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	None. The excavated sediment will be only dewatered and transported to an approved waste disposal facility. The dewatering is not considered treatment.
Amount of Impacted Material Destroyed or Treated	None. The excavated sediment will be transported to an approved waste disposal facility.
Expected Reduction in TMV	Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.
Irreversibility of Treatment	Removal of sediment is not reversible.
Type and Quantity of Treatment Residual	None. Soft sediment will be removed.

TABLE 4-2
Individual Analysis of Alternative 2 – Mechanical Dredging with Select Landside Removal
CMS for AOC A – Seneca-Cayuga Canal

SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Turbidity curtains are a dredging best management practice and are adequate and reliable for the uneven canal bottom conditions. Appropriate US Coast Guard procedures will be implemented to notify canal traffic and boating public for work conducted during the navigation season. DOT-approved transporters will be used for taking the waste materials to the landfill.
Protection of Workers During Remedial Action	Appropriate procedures will be implemented for work near and on water including the use of life jackets, throwable personal floatation devises, and a chase boat.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may disturb or remove the natural benthic habitats in the enclosed area, introduce minimal foreign matter to environment, and there is the potential of sediment resuspension during excavation activities.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Feasible. Land constraints may limit dewatering processing rates and thus control schedule.
Reliability of Technology	Reliable, but susceptible to frequent maintenance of dredging equipment.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based the availability of qualified workers, and on attainability of permits and agreements.
COSTS	
Capital Cost	Medium to high.
LAND USE	
Land Use	Protective of current and future land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Likely. Minimal issues with canal boat traffic.

Primary advantages to this alternative include:

- Sediment removal is not dependent on water levels or water flow rates in the canal other than for the landside removal phase. Water fluctuations can be accommodated, generally not causing disruption to the work.
- Sediment removal will be performed during both the navigation and non-navigation season of the canal, allowing for a phased approach and more flexibility in executing the work.

- Generally, water management from outfalls in and adjacent to removal areas is minimized because rerouting of outfalls is limited. Additionally, overall generation of construction water during the removal is minimized, resulting in lower water management costs.
- Removal of sediment in the select landside removal of the North Shore Deposit area will be observed and documented visually (real-time and photographic), thus eliminating the need for sampling after removal.
- Infrastructure support generally requires a smaller land area for staging and processing of sediments.
- Setup, execution, and completion likely can be completed in less than one season.

Primary disadvantages of this alternative include:

- Significant large debris removal is needed before beginning mechanical removal. Timber, large rocks, and debris can result in delayed dredging because the bucket cannot effectively close around the sediment.
- Daily canal traffic will need to be monitored during the navigation season phase of the work and managed so boats, barges, and other water vessels can move downstream unimpeded.
- Silt curtains will need to be maintained around the immediate work areas to control resuspension and transportation of suspended sediments downstream.

Alternative 2 is retained for further evaluation because it implementable and allows for some visual confirmation of the RAO with reported high concentrations of site-specific COCs.

4.4.3 Alternative 3: Hydraulic Dredging with Select Landside Removal

This alternative is the same phased approach for sediment removal as discussed in Alternative 2, except the removal method is hydraulic dredging using a pontoon hydraulic dredge rather than mechanical dredge. This alternative also includes some select landside dredging to be completed in the North Shore Deposit using a long-reach excavator as discussed in Alternative 2. This phased approach of a landside removal while the canal water level is lowered approximately 5 feet (non-navigation season, only) will allow for a visual verification of removal in a select nearshore area of the North Shore Deposit that has been reported to contain high concentrations of site-specific COCs.

Before sediment removal, timber, large rocks, and debris will be moved or removed from the work areas to allow for maximum exposure to soft sediments. In some cases, uncontaminated debris may be segregated and replaced within the canal. Care will be taken to maintain boulders and rocks that may support the shoreline, banks, and other canal features. Immediate work areas will be enclosed with a turbidity or silt curtain to minimize transport of suspended sediments. The hydraulic removal of the sediment will be performed from a pontoon hydraulic dredge.

Landside Removal

Following debris removal and during the non-navigation season, sediments will be excavated from a select area of the North Shore Deposit from the land using long-reach, track-mounted hydraulic excavators. These select sediment areas will be exposed because of lowered water levels of up to 5 feet and will allow for removal in dry or mostly dry conditions (less than 12 inches of water). Excavated sediments will be direct-loaded into lined dump trucks and transported to the sediment staging area for mixing for dewatering. Landside removal will be completed using hydraulic excavators and there will be no removal completed by hand (shovels, power washers, or vacuum equipment). Landside removal will allow for visual verification of removal in these areas.

Hydraulic Dredging

The remaining sediment material outside the North Shore Deposit landside removal including the Gorham Street and Downstream deposit areas will be removed using a pontoon hydraulic dredge with a movable arm capable of being raised and lowered to the canal floor. The arm has an 8-inch cutter head for "vacuuming" sediments and then pumping the slurried sediment (1,000 to 1,500 gallons per minutes) to a sediment staging and dewatering area. Slurried sediments would then be pumped through dewatering tubes before offsite disposal. The sediment staging and dewatering area includes a dewatering pad for the dewatering tubes, lined with sand and a flexible geomembrane or other impervious surface. A water collection sump will be maintained at a low area adjacent to the dewatering pad to collect water for treatment of suspended solids and discharged back to the canal. After the sediment has dewatered sufficiently in the dewatering tubes, the sediment will be loaded for offsite disposal at an approved landfill.

Removal of sediment in the select landside removal of the North Shore Deposit area will be observed and documented visually (real-time and photographic). Additional verification of soft sediment removal in the remaining areas of the North Shore, Gorham Street, and Downstream deposits will be confirmed by comparing and evaluating pre-excavation and post-excavation bathymetric surveys.

Water generated during the hydraulic removal will be treated onsite at a temporary water treatment facility system for suspended solids and then discharged back to the canal (allowable by permit). A temporary water treatment system is anticipated to be constructed on the Village of Waterloo property (tax map parcel No. 12-2-22), which also will serve as a staging and offloading area.

During excavation in the North Shore Deposit, water from permitted facility outfalls may be rerouted by installing piping or a series of pipes to the existing outfalls to extend the discharge point and reroute the water to the canal at a point downstream of the work areas. At this time, it is anticipated that no changes to the permitted outfall's sampling location will be needed.

Figure 6 shows the approximate boundaries of the surrounding property boundaries, and the laydown and equipment storage areas. Table 4-3 contains a detailed evaluation of Alternative 3.

TABLE 4-3
Individual Analysis of Alternative 3 – Hydraulic Dredging with Select Landside Removal
CMS for AOC A – Seneca-Cayuga Canal

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	Dredging of sediment will protect the environment by removing impacted sediment. Controls such as turbidity curtains will be needed to prevent migration of COCs to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Will meet action-specific SCGs.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	Virtually all of the impacted soft sediment in RTAs will be removed. A small amount of sediment may remain because of the limitations of the hydraulic removal through resuspension.
Adequacy and Reliability of Controls	Turbidity curtains are a dredging best management practice and are adequate and reliable for the uneven canal bottom conditions. This will ensure long-term success of remedial action in protecting environmental receptors.
Individual Technical Components	Hydraulic dredge, sediment pipeline and sediment dewatering tubes, water treatment system for suspended solids, and disposal staging areas.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	Hydraulic dredge discharges sediment through a pipeline to sediment dewatering tube. Waters collected from dewatering processes require treatment for suspended solids by an onsite temporary water treatment system.
Amount of Impacted Material Destroyed or Treated	None. The excavated sediment will be transported to an approved landfill.
Expected Reduction in TMV	Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.
Irreversibility of Treatment	Removal of sediment is not reversible.
Type and Quantity of Treatment Residual	Unknown.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Turbidity curtains are a dredging best management practice and are adequate and reliable for the uneven canal bottom conditions. Appropriate US Coast Guard procedures will be implemented to notify canal traffic and boating public for work conducted during the navigation season. DOT-approved transporters will be used for taking the waste materials to the landfill.

TABLE 4-3
Individual Analysis of Alternative 3 – Hydraulic Dredging with Select Landside Removal
CMS for AOC A – Seneca-Cayuga Canal

Protection of Workers During Remedial Action	Appropriate procedures will be implemented for work near and on water including the use of life jackets, throwable personal floatation devises, PPE, and a chase boat.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may disturb or remove the natural benthic habitats in the enclosed area, introduce minimal foreign matter to environment, and there is the potential of sediment resuspension during excavation activities.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Feasible.
Reliability of Technology	Reliable, but susceptible to frequent maintenance of dredging equipment.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based on the availability of specialized dredge and dewatering staff and based on attainability of permits and agreements.
COSTS	
Capital Cost	Medium to high.
LAND USE	
Land Use	Protective of current and future land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Likely. Minimal issues with canal boat traffic.

Primary advantages to this alternative include:

- Sediment removal is not dependent on water levels or water flow rates in the canal other than for the landside removal phase. Water fluctuations can be accommodated, generally not causing disruption to the work.
- Sediment removal will be performed during both the navigation and non-navigation season of the canal, allowing for a phased approach and more flexibility in executing the work.
- Generally, water management from outfalls in and adjacent to removal areas is minimized because rerouting of outfalls is limited.
- Removal of sediment in the select landside removal of the North Shore Deposit area will be observed and documented visually (real-time and photographic).
- Setup, execution and completion likely can be completed in less than one season.

Primary disadvantages of this alternative include:

- Overall generation of construction water during the removal is high, necessitating the need for a temporary water treatment facility system for suspended solids.
- Significant medium to large debris removal is needed before beginning mechanical removal. Timber, medium to large rocks, and debris can result in delayed dredging because the cutter head cannot effectively pull or vacuum around or below debris.
- Daily canal traffic will need to be monitored and managed so boats, barges, and other water vessels can move downstream unimpeded.
- Silt curtains will need to be maintained around the immediate work areas to control resuspension and transportation of suspended sediments downstream.

Infrastructure support generally requires greater than a 2 acre area for staging and processing of sediments. Alternative 3 is retained for further evaluation because it implementable and allows for some visual confirmation of the RAO.

4.4.4 Alternative 4: Mechanical Excavation Following Isolation Using Portadam or Similar Water Divertment Structure Under Watered Conditions

This alternative involves installing a Portadam along the length of the canal from the western end of the North Shore Deposit to the eastern end of the Gorham Street Deposit, splitting the canal in the middle and enclosing the work areas up to the northern shoreline. Portadam is a type of cofferdam or water retaining system based on a temporary, watertight enclosure that would be installed in the canal allowing water depth conditions of 6 to 8 feet on one side of the barrier, and would support dry conditions within the work area on the other side of the barrier.

The Portadam technology uses a freestanding steel support system and impervious fabric membrane, which allows installation in most configurations and over uneven bottoms of water bodies. This technology eliminates the need for internal bracing which obstructs the work area. It has a flexible system framework with a pliable liner and sealing apron extensions, which produces a watertight seal on many surfaces and prevents saturation. Several enclosures would need to be constructed for each area for remedial action.

The Portadam at the Downstream Deposit will either continue from the Gorham Street enclosure, or will be constructed as a separate enclosure. For the CMS, it was assumed the water diversion structure would begin at a point upstream of the work area, and end at a point downstream of the work area. The Portadam alignment also would need to be determined in consideration with property access agreements, utilities, etc. Based on the rocky and uneven topography of the canal bottom, rock and large debris will be removed to facilitate an adequate seal for the Portadam installation. Silt barriers will be installed to restrict transport of resuspended sediment during installation of the barrier. After isolating the removal areas by use of a Portadam, water is pumped over the Portadam to create a dry "cell" where sediment is manually removed with traditional excavation equipment.

The system will isolate the work area from the canal water and keep the work area dry or otherwise free from flowing canal waters from the SFPC and other sources. Natural

dewatering will be encouraged for a period of time by creating a pit or trenches and placement of sumps in low spots to collect water. Water that accumulates in the non-active excavation area from the other sources such as seepage or surface runoff will be managed by a gravity flow temporary diversion system. For this CMS, it was assumed that water that enters and contacts the active excavation area will be pumped from the work area for treatment of suspended solids before discharging into the bypass channel or to the canal downstream. The water treatment needs to maintain dewatered conditions in the work area will be further assessed during the design.

The mechanical excavation of the sediment likely will be performed with a large track-mounted hydraulic excavator or similar equipment. Appropriate methods will be used to move large rocks and debris to expose soft sediment near and below them. It is expected that large rock and debris will not be removed, but will be segregated during the excavation process and placed back near their original locations as sediment removal proceeds. Care will be taken to maintain boulders and rocks that may support the shoreline, banks, and other canal features. Soft sediment will be removed only by the excavators or equivalent heavy machines; no hand shovels, power washers, or vacuum equipment will be used to remove any de minimis amounts of sediment remaining in the canal following excavation equipment removal.

Excavated materials will be direct-loaded into offsite transport vehicles, if possible, or loaded into off-road dump trucks and transported to the sediment staging area for dewatering and then loaded out for disposal to appropriate landfill.

The Portadam would be constructed around the RTAs; however, it will be unsafe to install by diver assistance with a canal water column of up to approximately 10 feet (installed in the non-navigation season after the water level has been lowered by 5 feet). In general, Portadams cannot be designed and installed effectively and with an acceptable factor of safety to manage conditions of 10 feet or more water column depths. They can be used in limited situations in water depths of 8 to 10 feet, but are significantly limited with having enough free-board and adequate factor of safety if there are any potential changes in water elevations. This temporary water divertment structure would direct the canal water, precipitation water, and other base flows from the canal, via gravity around the enclosed excavation areas. Canal water, surface runoff, and groundwater seepage that accumulate within the enclosure and do not enter in contact with the active excavation area would be allowed to flow via gravity, or be pumped, downstream of the work area.

Water from facility outfalls would be rerouted by installing a series of pipes to the existing outfalls to extend the discharge point and reroute the water to the canal at a point downstream of the work areas. Table 4-4 contains a detailed evaluation of Alternative 4.

TABLE 4-4
Individual Analysis of Alternative 4 – Mechanical Excavation Following Isolation Using Portadam or Similar Water Divertment Structure Under Watered Conditions
CMS for AOC A – Seneca-Cayuga Canal

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 4 will achieve RAO which will be protective of human health.
Environmental Protection	Mechanical excavation of impacted areas following isolation using Portadam technology will protect the environment by removing impacted sediment from the canal bottom and will prevent sediment migration to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	May not meet the requirements for maintaining a benthic community over the dewatered area in the RTAs because of the lack of water.
Action-Specific	Will meet action-specific SCGs.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	None. All of the impacted soft sediment in RTAs will be removed because the dewatered area will be easily accessible.
Adequacy and Reliability of Controls	Cofferdams (Portadams) will need to be constructed to ensure capture of most impacted sediment. The Portadam technology is more adequate and reliable for the uneven canal bottom conditions and limestone bedrock than the sheet pile cofferdam technology. This will assist in long-term success of remedial action in protecting environmental receptors.
Individual Technical Components	Impervious fabric sealing sheet, pumps, excavators, dewatering pad(s), water treatment system for solids, and disposal staging areas.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	None.
Amount of Impacted Material Destroyed or Treated	None. The excavated sediment will be transported to an approved waste disposal facility.
Expected Reduction in TMV	Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.
Irreversibility of Treatment	Removal of sediment is not reversible.
Type and Quantity of Treatment Residual	None. Soft sediment will be removed.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Sediment may become suspended and be transported downstream during installation of the Portadams. There is an increased potential for flooding near the area where the width of the canal is decreased by the installation of the Portadam.

TABLE 4-4
Individual Analysis of Alternative 4 – Mechanical Excavation Following Isolation Using Portadam or Similar Water Divertment Structure Under Watered Conditions
CMS for AOC A – Seneca-Cayuga Canal

Protection of Workers During Remedial Action	Potential for exposure during remediation, and overflow or collapse of Portadam because of high water levels. No factor of safety for the Portadam structures with 10 feet or more of water.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may disturb or remove the natural benthic habitats in the enclosed area, introduce minimal foreign matter to environment, and there is the potential of resuspension during installation of the enclosure.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Not feasible to be performed safely in present water levels of 10-15 feet. Would likely require significantly higher divertment structures than under current watered conditions. May cause area-wide flooding if high rain or water levels are encountered during work. Challenging to install with divers in the canal.
Reliability of Technology	Will be susceptible to frequent monitoring and maintenance.
Availability of Services and Material	Available.
Administrative Feasibility	Expected to be feasible based the availability of workers specialized in the installation of Portadams, and on attainability of permits and agreements. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	Medium to high.
LAND USE	
Land Use	Protective of current and future land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain, but likely. May have community concern over are-wide flooding.

Primary advantages to this alternative include:

- Sediment removal can be under dry conditions or with little to no water in the work areas.
- Portadams can be constructed with some debris present (although debris will still need to be removed).
- Setup, execution, and completion can likely be completed in less than one season.

Primary disadvantages of this alternative include:

- Portadams cannot be designed and installed with any factor of safety to manage water depths of 10 feet or more.

- Portadams do not allow for enough free-board and adequate factor of safety under current water conditions, even if canal is dewatered up to 5 feet.
- Water management and temporary permits from outfalls in and adjacent to removal areas is required.
- South side of the Gorham Street Deposit area requires a separate and distinct mobilization and change in the Portadam alignment as water would need to be rerouted to the northern side of the canal.

Alternative 4 is not retained for further evaluation because of the lack of technical feasibility because of the unsafe conditions by using the Portadams with 10 feet of water, and concerns over the installation with 10 feet of water in the canal.

4.4.5 Alternative 5: Mechanical Excavation in Dry Conditions Following Isolation with Sheet Piles

The sheet pile cofferdam technology uses wood, steel, or concrete sheet piling to construct a reusable watertight enclosure. The sheet piles would need to be driven into bedrock because the sediment layer will not be able to hold up the structure. This may be challenging to install because of the hardness of the bedrock. Types of sheet piling include H-type, Z-type, arch-shaped/lightweight type, Larson type, and flat/straight type.

Alternative 5 consists of driving a series of interlocking prefabricated H-type sheet piles into bedrock to create a watertight retaining wall. The interlocks between sheets will form tight connections and allow minimum shift. The footing of the sheet piles would need to be sealed to control seepage of water (e.g., sand bags, clay, etc). Bracing would be required to control the hydrostatic head of approximately 15 feet. Silt or turbidity screens will be placed around the work area to minimize the upper water column dispersal of sediment from the area where the sheet piles would be driven into bedrock. Water within the enclosed area would then be pumped out to create a dry environment for mechanical excavation of sediment which will be performed similar to Alternative 4 described in Section 4.4.4. Table 4-5 contains a detailed evaluation of Alternative 5.

TABLE 4-5
Individual Analysis of Alternative 5 – Mechanical Excavation in Dry Conditions Following Isolation with Sheet Piles
CMS for AOC A – Seneca-Cayuga Canal

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 5 will achieve RAO which will be protective of human health.
Environmental Protection	Mechanical excavation of impacted areas following isolation using sheet piling will protect the environment because it is expected to target the COCs by removing impacted sediment from the bottom of the canal channel. Removal of impacted sediment will prevent sediment migration to other environmental receptors.

TABLE 4-5
Individual Analysis of Alternative 5 – Mechanical Excavation in Dry Conditions Following Isolation with Sheet Piles
CMS for AOC A – Seneca-Cayuga Canal

COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	May not meet the requirements for maintaining a benthic community over the dewatered area in the RTA because of a lack of water in the canal.
Action-Specific	Will meet action-specific SCGs.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	None. All of the impacted sediment will be removed because the dewatered area will be easily accessible.
Adequacy and Reliability of Controls	Sheet piles will have to be configured to ensure the enclosure captures impacted sediment. Sheet pile walls also have to be constructed (e.g., driven into the canal bottom, have the bedrock trenched to construct the sheet pile wall, etc) in order to accommodate varying water and wind pressures to prevent failure during remedial action. Will assist with long-term success of remedial action protecting environmental receptors.
Individual Technical Components	Sheet pile, braces, whalers, pumps, excavators, dewatering pads, water treatment for solids, sandbags, and disposal staging areas.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	None. The sediment is removed and transported to an approved waste disposal facility.
Amount of Impacted Material Destroyed or Treated	None. The excavated sediment will be transported to an approved waste disposal facility.
Expected Reduction in TMV	Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.
Irreversibility of Treatment	Removal of sediment is not reversible.
Type and Quantity of Treatment Residual	Unknown.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Sediment may reenter the water column by resuspension and be transported downstream during installation of sheet piles.
Protection of Workers During Remedial Action	Potential for exposure during remediation.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may disturb or remove the natural benthic habitats in the enclosed area, introduce minimal foreign matter to environment, and there is the potential of sediment resuspension during sheet pile installation.

TABLE 4-5
Individual Analysis of Alternative 5 – Mechanical Excavation in Dry Conditions Following Isolation with Sheet Piles
CMS for AOC A – Seneca-Cayuga Canal

IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Challenging in high water levels and constructing into bedrock. Need to determine bedrock depth required to install sheet piles to withstand varying water pressure and wind strength.
Reliability of Technology	Susceptible to frequent monitoring and maintenance.
Availability of Services and Material	Available.
Administrative Feasibility	Not expected to be feasible based the availability of workers specialized in the installation of sheet piles in uneven and rocky canal bottoms with a shallow limestone bedrock. Also not feasible based on limits in canal navigation that would result. Added requirement to obtain waiver on noise level during sheet pile installation. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	Very high because of installation costs of the sheet piles and dewatering of the enclosed area(s).
LAND USE	
Land Use	Protective of current and future land use.
COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain, especially because of noise levels.

Primary advantages to this alternative include:

- Sediment removal can be under dry conditions or with little to no water in the work areas.
- No requirement for initial debris removal before sediment excavation (although debris will still need to be removed).

Primary disadvantages of this alternative include:

- Sheet pile installation into bedrock is difficult, noisy, and time consuming.
- Sheet piles will impede or restrict daily canal traffic, which is not allowed by NYSCC.
- Water management and permitting from outfalls in and adjacent to removal areas is required.
- The southern side of the Gorham Street Deposit area requires a separate and distinct mobilization and change in the sheet pile alignment as water would need to be rerouted to the northern side of the canal.
- Setup, execution, and completion will take more than one construction season.

Alternative 5 is not retained for further evaluation because of the lack of technical feasibility because of the limitations of installing the sheet piles in the canal bottom, the length of time required for the entire corrective measure to be performed, and technical limitations of the sealing of the sheet piling.

4.4.6 Alternative 6: Mechanical Excavation with Upstream and Downstream Dam and Bypass Pumping

Implementation of this remedial alternative requires creating a dry canal by building an upstream and downstream dam with H-type sheet piles across the width of the canal, and then pumping water from the canal area enclosed by the dam structure south of the downstream dam. Sheet pile technology was discussed in Alternative 5; however, in this alternative, the technology would require more effort in the design to determine the hydrostatic load of canal water and wind pressure because the structure would be installed across the entire width of the canal. A large number of high-capacity pumps will be needed to dewater the area enclosed by the upstream and downstream dams, and to pump water around the two dams. This action would result in a dry canal bottom that would visually expose impacted sediment for removal by mechanical excavation. Table 4-6 contains a detailed evaluation of Alternative 6.

TABLE 4-6
Individual Analysis of Alternative 6 – Mechanical Excavation with Upstream and Downstream Dam and Bypass Pumping
CMS for AOC A – Seneca-Cayuga Canal

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT	
Protection of Human Health	Protective; implementation of Alternative 6 will achieve RAO, which will be protective of human health.
Environmental Protection	Mechanical excavation of impacted sediment will protect the environment and will prevent migration to other environmental receptors.
COMPLIANCE WITH SCGs	
Chemical-Specific	Complies.
Location-Specific	Complies.
Action-Specific	Will meet action-specific SCGs.
LONG-TERM EFFECTIVENESS AND PERFORMANCE	
Magnitude of Residual Impact	None. Impacted sediment will be removed from the RTAs because the dewatered area will be easily accessible.
Adequacy and Reliability of Controls	Sediment excavation is expected to reliably decrease COC concentrations to achieve the RAO, and is protective of potential receptors.
Individual Technical Components	Sheet pile dam construction, cross braces, whalers, sandbags, pumps, piping, excavators, dewatering pad(s), and disposal staging areas.

TABLE 4-6
Individual Analysis of Alternative 6 – Mechanical Excavation with Upstream and Downstream Dam and Bypass Pumping
CMS for AOC A – Seneca-Cayuga Canal

REDUCTION OF TMV THROUGH TREATMENT	
Treatment Processes Used and Materials Treated	None. The excavated sediment will be transported to an approved waste disposal facility.
Amount of Impacted Material Destroyed or Treated	None. The excavated sediment will be transported to an approved waste disposal facility.
Expected Reduction in TMV	Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.
Irreversibility of Treatment	Removal of sediment is not reversible.
Type and Quantity of Treatment Residual	None.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Minimal community exposure during remedial action. Noise levels during the pumping may need to be addressed.
Protection of Workers During Remedial Action	High potential for exposure during remediation. High potential for breaching of the dam during extreme weather conditions.
Time Until Remedial Goals Achieved	Immediately after remedial action.
Environmental Impacts	Use of this active remedy may disturb or remove the natural benthic habitats in the enclosed area, introduce minimal foreign matter to environment. Transfer of water from impacted zone may contain impacted suspended sediment and may introduce it into an unimpacted area.
IMPLEMENTABILITY	
Technical Feasibility of Operation and Construction	Dewatering by using dams across the entire width of the canal and pumping large volume of water is challenging, but once completed, mechanical excavation will be technically feasible
Reliability of Technology	Will require intensive water management, and monitoring and maintenance of pumps.
Availability of Services and Material	Available.
Administrative Feasibility	Feasible, based the availability of workers specialized in installing dams, but several permits will have to be obtained to implement technology. Several regulatory agencies may desire to perform oversight.
COSTS	
Capital Cost	High because of the costs for installing the dams, pump equipment, and monitoring and maintenance during operation of the pumps.
LAND USE	
Land Use	Protective of current and future land use.

TABLE 4-6
Individual Analysis of Alternative 6 – Mechanical Excavation with Upstream and Downstream Dam and Bypass Pumping
CMS for AOC A – Seneca-Cayuga Canal

COMMUNITY ACCEPTANCE	
Community Acceptance	Uncertain; may be negative public perception, especially given noise generated by operation of pumps.

Primary advantages to this alternative include:

- Sediment removal can be under dry conditions or with little to no water in the work areas.
- No requirement for initial debris removal before sediment excavation (although debris will still need to be removed).

Primary disadvantages of this alternative include:

- Dam installation is difficult and time consuming and will need to be overdesigned to provide an adequate factor of safety.
- Water management would be extensive and require large pumping equipment.
- Dams will restrict daily canal traffic, which is not allowed by NYSCC.
- Water management from outfalls in and adjacent to removal areas is required.
- Setup, execution, and completion would likely take more than one construction season.

Alternative 6 is not retained for further evaluation because of the lack of technical feasibility because of the safety factored needed for the dams during wet weather conditions and the large volume of water to be pumped over the work area.

SECTION 5

Recommendation of the Corrective Measure

Considering the key site characteristics described in Sections 1 and 2, as well as the site-specific RAO and remedial technologies appropriate for the canal conditions, Alternatives 2 and 3 have been brought forward from Section 4 for further evaluation based on effectiveness, implementability, and cost. These two alternatives are:

- Alternative 2: Mechanical Dredging with Select Landside Removal
- Alternative 3: Hydraulic Dredging with Select Landside Removal

Alternatives that were not compatible with site conditions, were deemed unsafe, or were determined not to achieve the RAOs were not considered for further evaluation. Appendix B presents a comparison of the different technologies that are proposed for Alternatives 2 and 3.

Both Alternatives 2 and 3 include a phased approach with some landside sediment removal to be completed in the North Shore Deposit allowing for visual verification of removal in this area with the canal water level lowered approximately 5 feet during the non-navigation season. Given this phased approach for removing sediment, both alternatives have many similarities and offer similar success and benefits. Site conditions for both are nearly equal and include:

- Dredging from the water to be completed in both the navigation and non-navigation season with landside removals completed in the non-navigation season.
- Full watered conditions with approximately 15 feet water depth in the center of the canal with water elevations lowered by up to 5 feet during the non-navigation season. Sediment removal is not dependent on water levels or water flow rates in the canal. Water fluctuations can be accommodated, generally not causing disruption to the work
- Debris removal is necessary before beginning sediment removal. Significant debris removal is needed before beginning removal. Timber, large rocks, boulders, and debris can result in delayed dredging. Debris removal methods will be determined as part of the design and based upon data collected during a bathymetric survey.
- Schedule to execute the work is 4 to 8 months. Sediment removal can be performed during both the navigation and non-navigation seasons of the canal, allowing for a phased approach and more flexibility in executing the work.
- Permitting is required to execute the work.

Final selection of the recommended alternative discussed below will highlight the primary difference between the alternatives and individual components that would make one alternative preferred over the other.

5.1 Alternative 2: Mechanical Dredging with Select Landside Removal

The primary advantage to this alternative when compared to Alternative 3 is less overall water generated during construction resulting in lower water management challenges. These construction waters include settling waters directly from the sediment after removal in the scow or during staging before load out, decontamination waters from equipment and various processes and cross contaminated waters that come into contact with sediments. Additionally, the required land area for staging, storage and sediment processing is generally compact and can be less than 3 acres.

The capital cost for Alternative 2 is approximately $6,270,000. Appendix B presents a breakdown of this cost estimate, and includes the cost for design, permits, daily performance and operations monitoring, onshore excavation, mechanical dredging, sediment removal, water disposal or treatment, sediment transportation and disposal, site preparation and restoration, and reporting.

Alternative 2 is the preferred and recommended remedial alternative for the corrective measures because it targets removal of sediment from the RTAs and is cost-effective.

5.2 Alternative 3: Hydraulic Dredging with Select Landside Removal

Alternative 3 generates significantly more water than Alternative 2 because of the slurry vacuuming at water rates of 1,000 to 1,500 gallons per minute. This necessitates the need for a temporary water treatment facility.

Additionally, the required land area for staging, dewatering, storage and sediment processing is reactively large and would be greater than 3 acres. This would require additional land access near the site, including road crossing for water pumping.

The capital cost for Alternative 3 is approximately $7,032,000. Appendix B presents a breakdown of this cost estimate, and includes the cost for design, permits, daily performance and operations monitoring, onshore excavation, hydraulic dredging, sediment removal, water treatment, sediment transportation and disposal, site preparation and restoration, and reporting.

Alternative 3 is not the preferred and recommended remedial alternative for the corrective measures because it requires more land area, increased water treatment volumes, and is not cost-effective.

5.3 Proposed Corrective Measure for AOC A

Mechanical dredging with select landside removal in the North Shore Deposit using an excavator with the canal water level lowered approximately 5 feet during the non-navigation season is the preferred and proposed corrective measure. The final selection of Alternative 2 will be determined during the ongoing design and continued discussions with NYSDEC and NYSCC.

SECTION 6

Performance and Operations Monitoring

This section provides a brief summary of the performance monitoring requirements for the proposed corrective measures. Additional details regarding field monitoring and data management will be described in the design and field implementation plan.

6.1 Air Monitoring

Air monitoring for particulate matter will be performed if there is a likely possibility of particulate matter being released during dredging activities and during the processing of sediments with dewatering reagents. Air monitoring would be completed during initial activities and during changes in operations that could result in unacceptable fugitive matter or dust.

Data collected during air monitoring will likely include particulate matter less than 10 microns in diameter, which is considered respirable and is directly applicable to human health exposure, and meteorological data to support the ambient air sampling program. Action levels for particulates will be established before starting work based on the constituents present and reagents being used. The prevailing wind direction will be monitored daily during site activities. In addition, a web site that records daily wind direction for Waterloo, New York, will be consulted, and the information will be recorded in the field logs.

USEPA guidance document *Air/Superfund National Technical Guidance Study Series: Volume IV – Guidance for Ambient Air Monitoring at Superfund Sites* (USEPA 1993) and the technical memorandum *Community Air Monitoring Plan* for the site (CH2M HILL 2009b) were used to develop the general design for an air monitoring network. In general, the wind direction at the site is from northwest to south or southeast. Data and/or sampling locations are to be determined during the design but will generally include locations adjacent to the work areas and downwind of the dredging work areas.

6.2 Noise Monitoring

Noise monitoring will be conducted periodically during mobilization and execution of the sediment removal. Background noise levels will be established before work begins. Periodic noise monitoring will be conducted during daytime hours at locations where there is the potential for levels to exceed 85 decibels (dredging operations, downstream mixing and offloading area, etc.). This monitoring will help to establish the areas where hearing protection is required, if any.

6.3 Canal Water Monitoring

To assess potential water quality impacts related to dredging activities at the site, canal water will be monitored during the removal activities to determine if water quality impacts attributable to the remedial action have occurred. In addition, monitoring will assist in

determining what, if any, mitigation measures are necessary to reduce or limit the extent of the water quality impact. Water quality criteria, based upon Title 6 of New York Codes, Rules and Regulations (NYCRR), Chapter 10, Part 703, provide the thresholds which monitoring data obtained as part of the remedial action will be evaluated against. The monitoring approach and sampling scheme have been developed based upon the NYSDEC's Technical and Operational Guidance Series 5.1.9, *In-Water and Riparian Management of Sediment and Dredge Material* (NYSDEC 2004).

Upstream and downstream monitoring locations will be used to assess potential water quality impacts attributable to the dredging operations. However, in cases when assessing multiple dredging operations is necessary, the sampling scheme will be adjusted accordingly to assess water quality impacts from each of the field operations. To simplify implementation of the monitoring program, the upstream background and downstream sampling buoys will each be located within 800 feet and no closer than 300 feet from the dredge operation(s) with an average distance of 500 feet.

Turbidity sensors will be deployed at each monitoring location at mid-depth of the canal. The sensors will be installed on small floating platforms to simplify relocation when necessary. Readings will be recorded once every 15 minutes at the each turbidity monitoring stations. The turbidity control limits will be set using a rolling average and a trigger value based initially on 100 nephelometric turbidity units (NTUs) above background.

Flow conditions will be monitored once every 6 hours while dredging activities are being performed. The dredging contractor will select one location in the canal where these flow readings will be obtained. A submersible flow meter will be lowered approximately mid-depth in the center of the canal, and the flow velocity and direction will be recorded. The monitoring buoy located in the upstream direction from dredging operations will be considered the background ambient buoy for the turbidity monitoring.

During the initial 2 weeks of dredging operations, water samples will be collected daily (i.e., a 24-hour composite sample will be generated each day from each sampling buoy for TSS). After the initial 2-week sampling period, if it is demonstrated the dredging operations do not result in TSS levels greater than 100 milligrams per liter (mg/L) above ambient background conditions (or turbidity levels 100 NTUs above ambient background, assuming a 1 mg/L to 1 NTU correlation between TSS and turbidity), the sampling frequency will be reduced to a single 24-hour composite sample from each sampling buoy per week. If sampling continues to demonstrate that dredging operations do not result in increases of over 100 mg/L in TSS concentrations above ambient conditions, then sampling frequency may be further reduced after coordination by NYSDEC.

6.3.1 Dredging Approach and Canal Water Quality

The potential to create turbidity and impact canal water quality will be minimized by adhering to the following dredging best management practices (BMPs):

- Barges will be watertight and inspected to confirm water-tightness before dredging operations and dredged material transport.
- Silt curtains will be deployed during dredging operations to address potential turbidity issues.

- Silt curtains will be established around the dredging operations. The upstream and downstream sides must be installed within 250 feet of the dredge platform on the upstream and downstream side.
- Silt curtains will be long enough to cover at least half the depth of the water column.
- An environmental clamshell bucket, or similar, will be used for mechanical dredging of sediment.
- Work on slopes will proceed from top of slope to toe of slope, as practicable.
- Positioning devices (such as global positioning system) will be used to allow the operator to be aware of the location of the dredge bucket in relation to the top of the sediment.
- An experienced environmental dredging operator capable of implementing appropriate BMPs will be used to limit re-suspension.
- The dredging operator will minimize overfilling of the dredge bucket.
- The dredging operator will adjust the rate of bucket descent and retrieval as necessary to limit sediment re-suspension.
- The dredging operator will only decant the environmental bucket by slowly releasing water that drains from the valves in the bucket at the surface.
- The dredging operator will not overfill barges with dredged material.
- Oil booms will be available for emergency use.

6.3.2 Mitigation and Response Actions

Monitoring of the canal water will be performed to verify BMPs are in use at all times and no visual deficiencies are observed during the dredging operations. The areas near the barges will be monitored for oil sheens and other visual plumes. If oil sheens are observed, oil booms will be used to control the spread of such sheens.

If, after employing the BMPs, an exceedance of the turbidity criteria of 100 NTUs above background conditions (assuming a 1 mg/L to 1 NTU correlation between TSS and turbidity) is reported and if it is determined that the cause for the exceedance is related to the removal action, additional response actions may be employed. Possible mitigation measures may include:

- Reducing the dredging operations removal rate or temporarily suspending dredging operations.
- If silt curtains have already been established around the dredging operation(s) where the confirmed exceedance was obtained, an additional silt curtain layer could be established around the dredging operation in question.

Depending upon the situation in which the exceedance is identified, a single mitigation measure may be used to correct the issue or a combination of measures may be implemented. Mitigation measures will be coordinated with the oversight contractor. As

more data are obtained as part of the real-time turbidity monitoring, additional mitigation measures may be developed and implemented, or the additional measures suspended if values are significantly lower.

6.4 Sediment Monitoring Locations and Frequency

Verification of the removal of soft sediment, to the specified depth in the portions of the North Shore, Gorham Street, and Downstream deposits will be in accordance with a Sediment Removal Verification Plan, which will be prepared and submitted to NYSDEC as soon as possible. This plan will further define the means and methods for determining when excavation in a removal area is complete.

It is anticipated that the water levels will be lowered by up to 5 feet during the select landside removal within the North Shore Deposit area. Landside removal of sediment along the upper bank areas will be conducted using an excavator and the extent of removal will be confirmed visually.

6.5 Reporting

Reporting parameters will include collecting, photo documenting and presenting field data pertinent to the excavation activities. These parameters 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, and this 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. Weekly or periodic progress meetings with NYSDEC will be scheduled during removal activities as well as written monthly progress report 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 in the design implementation plan. Inspection frequency of these project elements will be considered in the design and operations plan.

SECTION 7

Public Notice of CMS

HCC will comply with the citizen participation plan as outlined by NYSDEC in Title 6 of NYCRR Subpart 375-1.10 (NYSDEC 2006) before implementing the corrective measures at the site. A citizen participation plan will be developed and an accessible document repository will be established to provide the public with project information and updates. This plan will address the public involvement needs for all aspects of the CMS and implementation.

A public notice and Statement of Basis on the CMS and proposed design implementation plan will be prepared by NYSDEC and published in a local newspaper. The Statement of Basis will include a description of the overall investigation/remedial process, a summary of possible impacts on the local community, and a brief description about the potential uses, available documents, and the location of the information repository.

The public will be allowed a 45-day comment period to review and comment in writing on the proposed CMS.

A public meeting will be held during the public comment period of the Statement of Basis to explain the project, answer questions, and accept comments provided by the citizens. The responses to the citizens concerns will be incorporated in the revised citizen participation plan.

At a minimum, the citizen participation plan will include the following:

- A site contact list
- The name and address of a document repository and proof of acceptance of this designation by the repository
- Overview of the site's history and contamination issues
- Identification of major issues of public concern related to the site and a description of any mitigation planned to address the issue, if appropriate
- A description and schedule of the major elements of the site's remedial program
- A description and schedule of any additional citizen participation activities needed to address public concerns

The citizen participation plan will be submitted to NYSDEC.

SECTION 8

Permits Plan

This section identifies the federal, state, and local permits that typically would be required for implementing the selected corrective measure. The process of obtaining the necessary permits and approvals for excavating sediment in the canal requires an understanding of the regulatory jurisdictions, necessary agency approvals, the application requirements, and processing times of the permits. Several agencies have been identified and contacted to discuss the permit requirements for soil disturbance, construction activities within floodplain areas, sediment dredging, stormwater management, sediment removal via mechanical excavation, impacts to wildlife and associated habitat, restoration of disturbed areas, construction activities on state-owned lands, sediment treatment, and collection and discharge of canal water. Additionally, NYSDEC has provided specific direction on required permits and exemptions in an email correspondence dated January 25, 2013. The purpose of these regulatory agencies and local authorities is to protect the physical and biological resources of the area and the public interests for use of the resources.

Permit considerations applicable to remedial action activities and the entities that have jurisdiction over these permits are listed in Appendix C. A final list of permits required for performing the fieldwork will be included in the intermediate design. Copies of the permit applications and approvals for each agency will be included in a technical memorandum that will be submitted to NYSDEC before implementation of fieldwork in March 2014.

SECTION 9

Waste Management and Disposal

This section identifies the waste management and disposal procedures for the waste that will be generated during remediation construction activities at the site. PPE, aqueous, solid, and general waste materials will be segregated, containerized, stockpiled, and managed in accordance with the revised MMP (CH2M HILL 2010c). All waste containers will be labeled appropriately to describe its contents and start date of waste generation. These containers will be inspected daily by the construction supervisor and tracked daily on the waste management tracking form. Section 4.1 provides additional information on waste management based on action-specific SCGs

Non-liquid waste such as PPE and other disposable equipment will be placed in 55-gallon drums or a rolloff container. The containerized waste will be stored in approved staging areas until transported for disposal.

Both liquid and non-liquid waste will be generated by excavating the sediment deposits that have been identified for removal from the canal bottom. Sediments may require dewatering and possibly mixing with an amendment before transport. Previous sampling has provided analytical information to characterize this sediment for disposal; an additional round of waste characterization will be performed before the remedial action. A pre-removal waste characterization work plan is being developed for submittal to NYSDEC, as discussed with NYSDEC on March 1, 2013. All necessary waste profiles and documentation will be submitted to an approved landfill for approval before commencing excavation activities. Sediment will be transported in lined trucks and managed to avoid spills or leakage onto public roadways.

Liquid waste may be generated by dewatering sediment; removing surface runoff, rainfall, or snowmelt on the dewatering/staging pad, and the decontamination of tools, equipment, and sampling materials. This liquid will be pumped out of the excavation area into drums, tanks, or other approved storage container, and shipped offsite for disposal at an appropriately permitted, Dow- and NYSDEC-approved waste management facility. Depending on the volume of water generated during removal, a determination will be made to either treat onsite or dispose of offsite. An additional evaluation of the amount of water generated during mechanical dredging will be included as part of the intermediate design. If it is shown to be more cost-effective to treat onsite, collected water will be pumped to a temporary onsite water treatment system for treatment of suspended solids and the treated water sampled before direct discharge to the canal. For costing purposes, it is assumed that water treatment will be completed.

The licenses and permits for transport and disposal of solid waste streams generated during this project will comply with applicable federal, state, and local laws, codes, and regulations. The treatment, storage, and disposal facilities will be required under the contract to provide a certification of disposal indicating final disposition of the waste and will be signed by the authorized agent of the treatment, storage, and disposal facility. This certification will indicate the following:

- Material (by item and quantity) that was disposed
- Specific method of treatment
- Date of treatment
- Manifest number of waste

Copies of waste manifests and certification of disposal will be provided to NYSDEC in a construction completion report.

SECTION 10

Project Schedule

Execution of Alternative 2 proposed in this CMS will be completed in two phases during both the navigation and non-navigation season, tentatively scheduled to begin in March 2014. In support of the schedule, Dow has submitted an implementation plan to NYSDEC on December 28, 2012, that identifies a proposed schedule for deliverables related to the selected alternative. Additionally, the implementation plan highlights proposed dates for NYSDEC review and approvals, and proposes a time for development of the Statement of Basis and public comments/meetings.

10.1 Schedule of Recommended Alternative

Pending NYSDEC comment on the implementation plan, a detailed schedule is to be determined and will be submitted as part of the revised implementation plan. Currently, the implementation of Alternative 2 is planned for February - May 2014.

10.2 Deliverables

The following documents will be submitted to HCC and the agencies for review and comments:

- Revised CMS for AOC A – Seneca-Cayuga Canal, Former HCC Facility, Waterloo, New York
- Intermediate Design
- Final Design
- Citizen Participation Plan (for information only)
- Technical Memorandum of Permit Approvals (for information only)
- Monthly Progress Reports
- Construction Completion Report

At least one copy of each deliverable will be submitted in print, as well as in an electronic format (CD or DVD) to NYSDEC. All other reviewers will receive an electronic copy of the deliverable, unless a hard copy is requested.

SECTION 11

References

CH2M HILL. 2006. *RCRA Facility Investigation Report, Evans Chemetics Facility, Waterloo, New York*. May.

CH2M HILL. 2009a. *Phase I Sediment Characterization Results/Phase II Work Plan, Waterloo, New York.* July.

CH2M HILL. 2009b. *Community Air Monitoring Plan, Former Hampshire Chemical Corp. Facility, Waterloo, New York.* November.

CH2M HILL. 2010a. *Phase II Sediment Investigation Data Report, Waterloo, New York*. July.

CH2M HILL. 2010b. *Phase III Sediment Characterization Work Plan, Waterloo, New York.* November.

CH2M HILL. 2010c. *Revised Materials Management Plan, RCRA Corrective Action Program, Hampshire Chemical Corp., Waterloo, New York, Technical Memorandum.* September.

CH2M HILL. 2011a. *RCRA Facility Investigation Outfall Investigation Summary Report, Former Hampshire Chemical Corp. Facility, Waterloo, New York.* September.

CH2M HILL. 2011b. *Groundwater Monitoring Results Report – April and November 2010 Monitoring Events, Former Hampshire Chemical Corp. Facility, Waterloo, New York*. March.

CH2M HILL. 2011c. *RCRA Facility Investigation Phase III Sediment Investigation Data Report, Waterloo, New York.* February.

CH2M HILL. 2011d. *Ecological Impact Assessment Work Plan, Former Hampshire Chemical Corp., Waterloo, New York.* July.

CH2M HILL. 2012a. *Corrective Measures Study for AOC A – Seneca-Cayuga Canal, Former Hampshire Chemical Corp. Facility, Waterloo, New York.* May 31.

CH2M HILL. 2012b. *RCRA Facility Investigation, Ecological Impact Assessment Report, Former Hampshire Chemical Corp. Facility, Waterloo, New York.* February.

Hampshire Chemical Corp. (HCC). 2012. Re: *Response to Comment Letter on the Seneca-Cayuga Canal Sediment Investigation and Ecological Assessment*. April 27.

New York State Department of Environmental Conservation (NYSDEC). 1999. *Technical Guidance for Screening Contaminated Sediment*. November 22, 1993; updated January 25, 1999.

New York State Department of Environmental Conservation (NYSDEC). 2004. Technical and Operational Guidance Series 5.1.9, *In-Water and Riparian Management of Sediment and Dredge Material*. November.

New York State Department of Environmental Conservation (NYSDEC). 2006. Title 6 of the New York Codes, Rules and Regulations Subpart 375-1.10, Environmental Remediation Programs. December.

New York State Department of Environmental Conservation (NYSDEC). 2009. *Use and Protection of Waters (6 NYCRR Part 608).* August.

New York State Department of Environmental Conservation (NYSDEC). 2010a. Division of Environmental Remediation-10/Technical Guidance for Site Investigation and Remediation. May.

New York State Department of Environmental Conservation (NYSDEC). 2010b. Letter from NYSDEC, re: *RCRA Facility Investigation Report Addendum, Former Hampshire Chemical Corporation Facility, Waterloo, New York, November 2008*. January 7.

New York State Department of Environmental Conservation (NYSDEC). 2011a. Second Amended Order on Consent, Index Number 8-20000218-3281, between Hampshire Chemical Corp. and New York State Department of Environmental Conservation. August 12.

New York State Department of Environmental Conservation (NYSDEC). 2011b. Email requesting to use the NYSDEC DER-10 guidance for developing the CMS for AOC A. March 23.

New York State Department of Environmental Conservation (NYSDEC). 2011c. Electronic mail message to Dakon Brodmerkel/CH2M HILL, Re: the analysis of the south shore and downgradient sediment samples for possible 'hot spots,' Hampshire Chemical Corp., Evans Chemetics Facility, Waterloo, New York. May 19.

New York State Department of Environmental Conservation (NYSDEC). 2011d. Meeting between The Dow Chemical Company and NYSDEC. August 23 and 24.

New York State Department of Environmental Conservation (NYSDEC). 2012a. Letter from NYSDEC, re: *Seneca-Cayuga Canal Sediment Investigation and Ecological Assessment - Draft, February 2012, Site No. 850001A.* April 19.

New York State Department of Environmental Conservation (NYSDEC). 2012b. Letter from NYSDEC, re: *Response Letter to NYSDEC Comments on the Seneca-Cayuga Canal Sediment Investigation and Ecological Impact Assessment - April 27, 2012, Former Hampshire Chemical Corp., Site No. 850001A.* May 1.

New York State Department of Environmental Conservation (NYSDEC). 2012c. E-mail from NYSDEC, re: *Proposed schedule to meet Dec. canal sediment removal.* March 30.

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

Saroff, S.T. 1987. Stratigraphy, Structure, and Nature of Gas Production and Entrapment of the Auburn Gas Field, Cayuga County, New York, M.S. Thesis, Syracuse University Department of Geology, 191p.

U.S. Environmental Protection Agency (USEPA). 1974a. *Occupational Health and Safety Administration: 29 CFR 1910.120.* June 27 unless otherwise noted.

U.S. Environmental Protection Agency (USEPA). 1974b. *29 CFR, Part No. 1910, Subpart I: Personal Protective Equipment*. June 27 unless otherwise noted.

U.S. Environmental Protection Agency (USEPA). 1974c. *29 CFR, Part No. 1910, Subpart Z: Toxic And Hazardous Substances*. June 27 unless otherwise noted.

U.S. Environmental Protection Agency (USEPA). 1979. *29 CFR, Part No. 1926: Safety and Health Regulations for Construction*. April 6 unless otherwise noted.

U.S. Environmental Protection Agency (USEPA). 1980. 40 *CFR 262: Standards Applicable to Generators of Hazardous Waste*. May 19 unless otherwise noted.

U.S. Environmental Protection Agency (USEPA). 1993. *Air/Superfund National Technical Guidance Study Series: Volume IV – Guidance for Ambient Air Monitoring at Superfund Site*

Van Tyne, A. 1974. Geology and Occurrence of Oil and Gas in Chantauqua County, in Peterson, D.H. (ed.), New York State Geol. Association Guidebook, 36th Ann. Meeting, p. H1-H9.

Figures

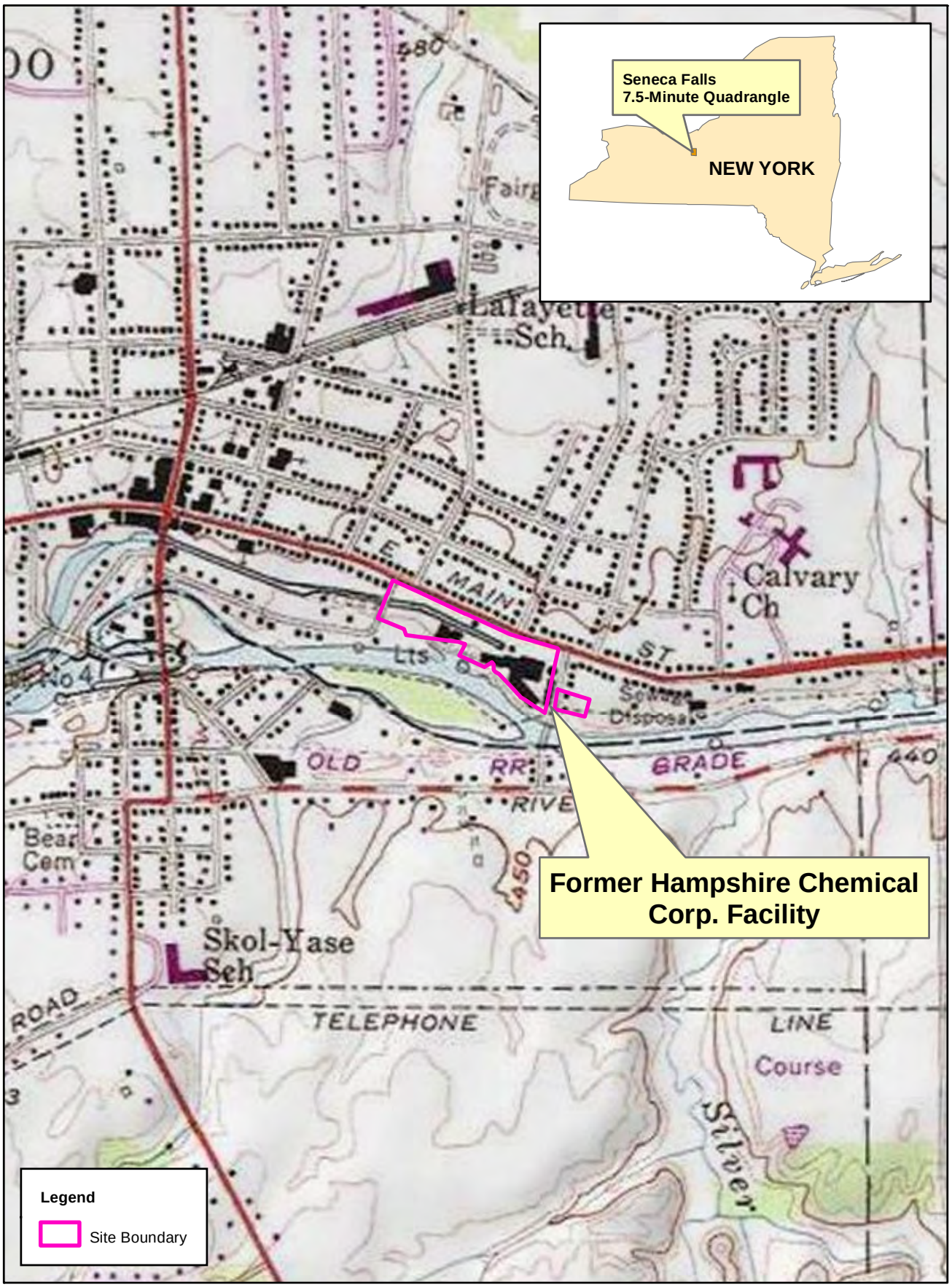

Figure 1
Facility Location Map
Corrective Measures Study for AOC A - Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

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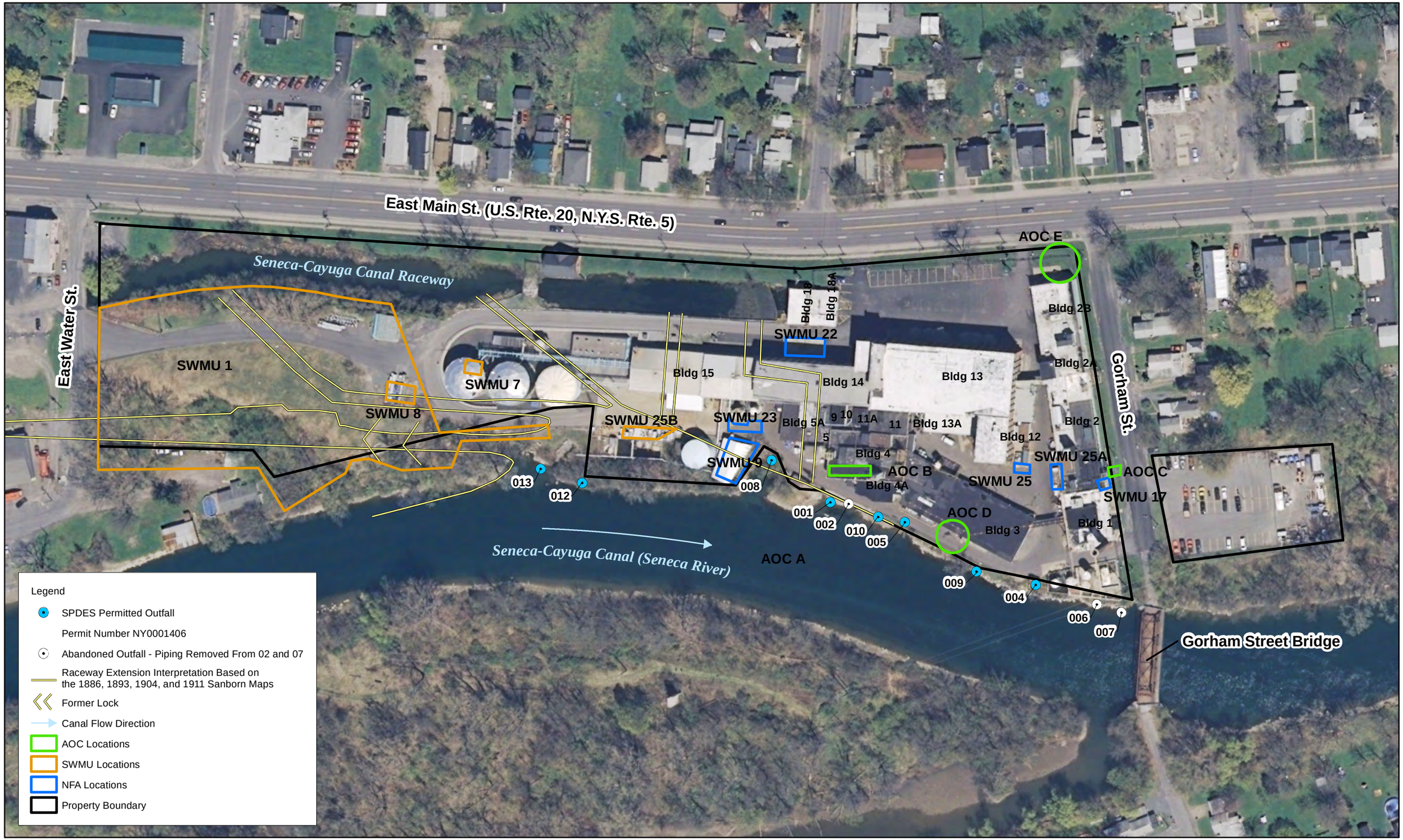

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Notes:
NFA - No further action
NFA issued by NYSDEC on Dec. 2, 2003.
SWMU 28 (NFA) - Wash Water Sewer System (Buildings 2, 3, 4, 9, 13, 14 and 16)
SWMU 29 (NFA) - SPDES Sewer System (Buildings 1, 2, 2A, 2B, 3, 4, 5, 14 and Reactor)

Figure 2
SWMU and AOC Locations
Corrective Measures Study for AOC A - Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility
Waterloo, New York

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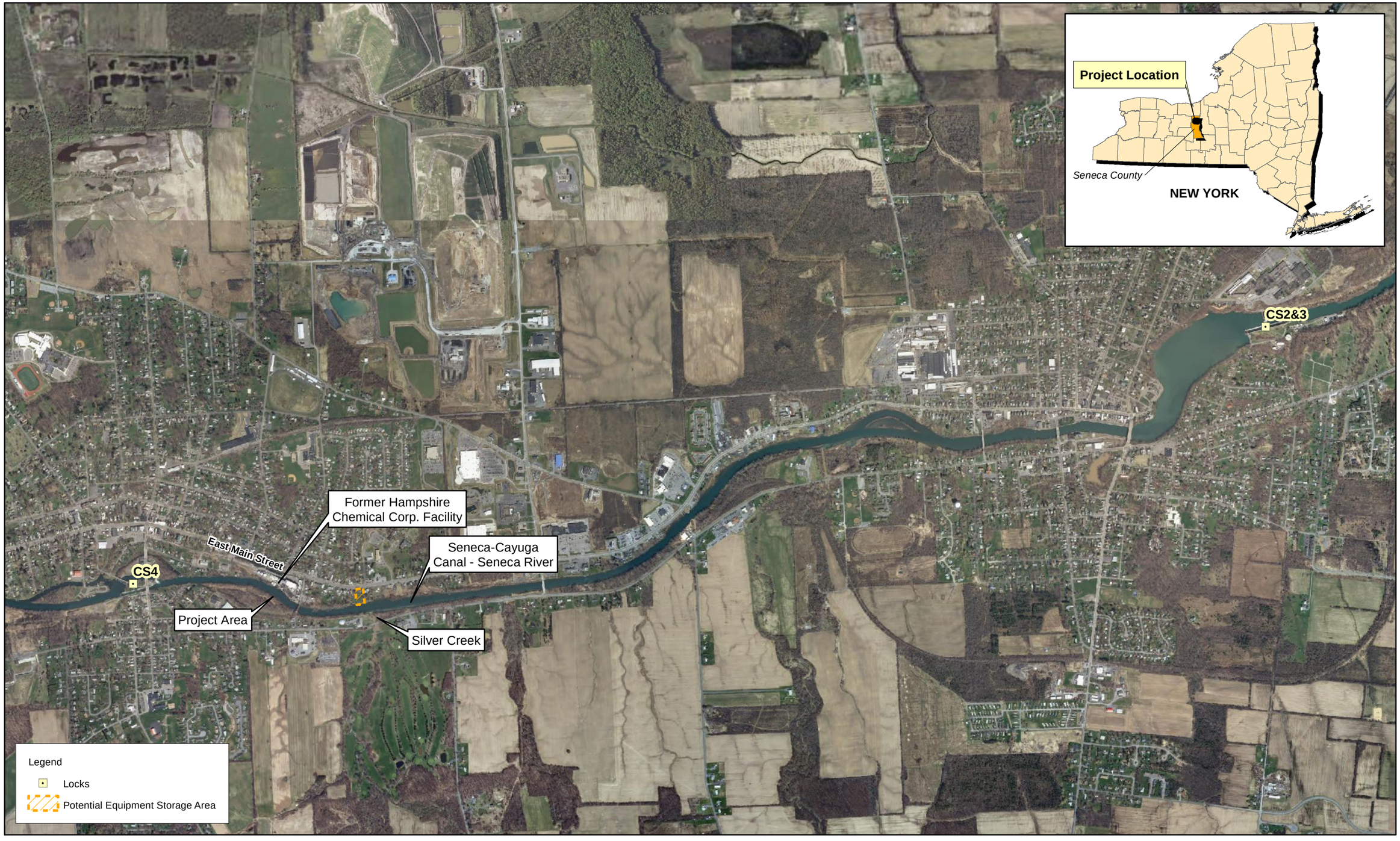

Figure 3
Seneca-Cayuga Canal Locks
Corrective Measures Study for AOC A - Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

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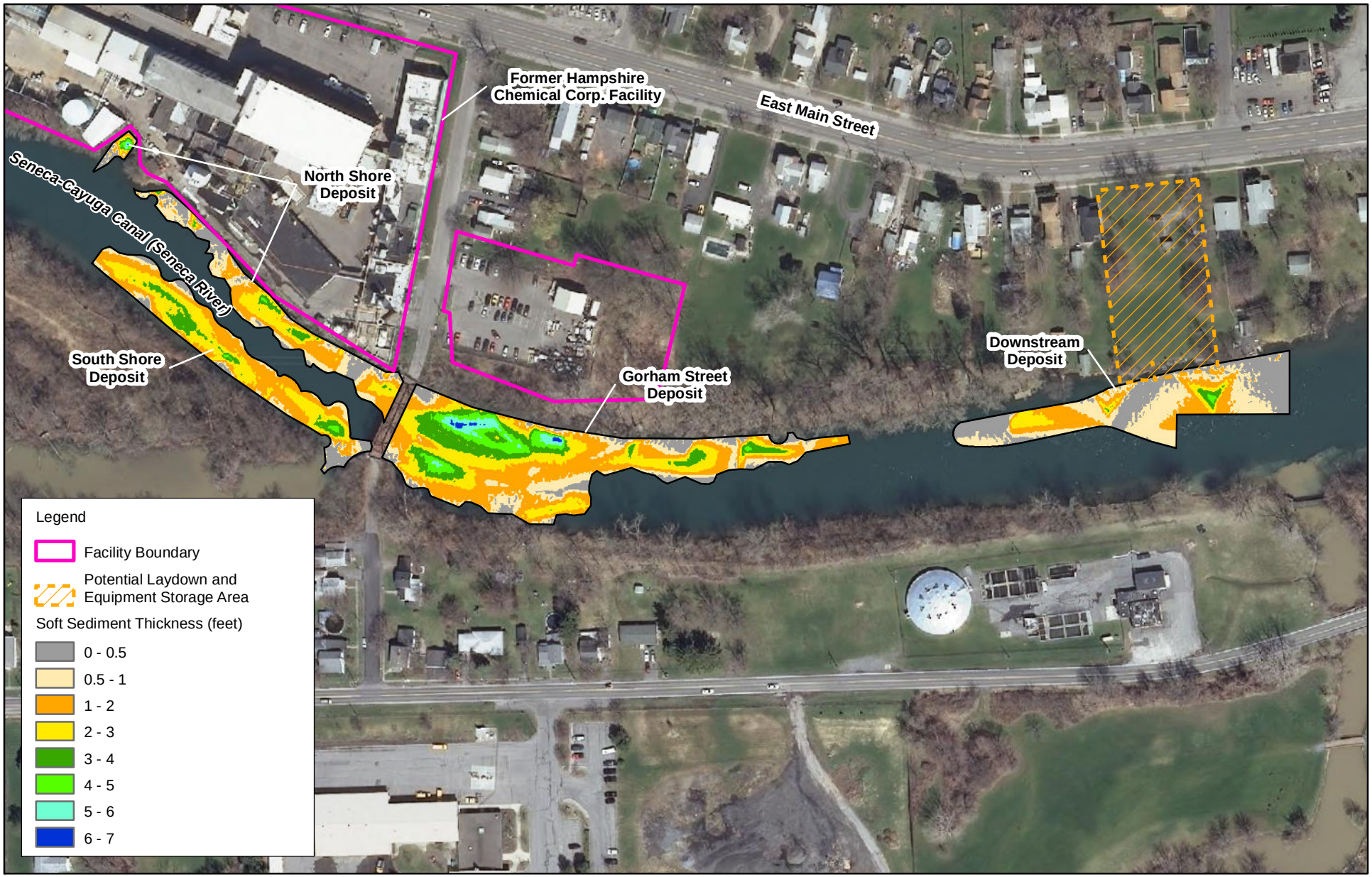

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Figure 4
North Shore, South Shore, Gorham Street, and Downstream Deposits
Corrective Measures Study for AOC A - Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2012\CORRECTIVEMEASURESSTUDY\MAPFILES\FIGURE 04 - ALL DEPOSITS.MXD JHANSEN1 6/17/2013 5:09:23 PM

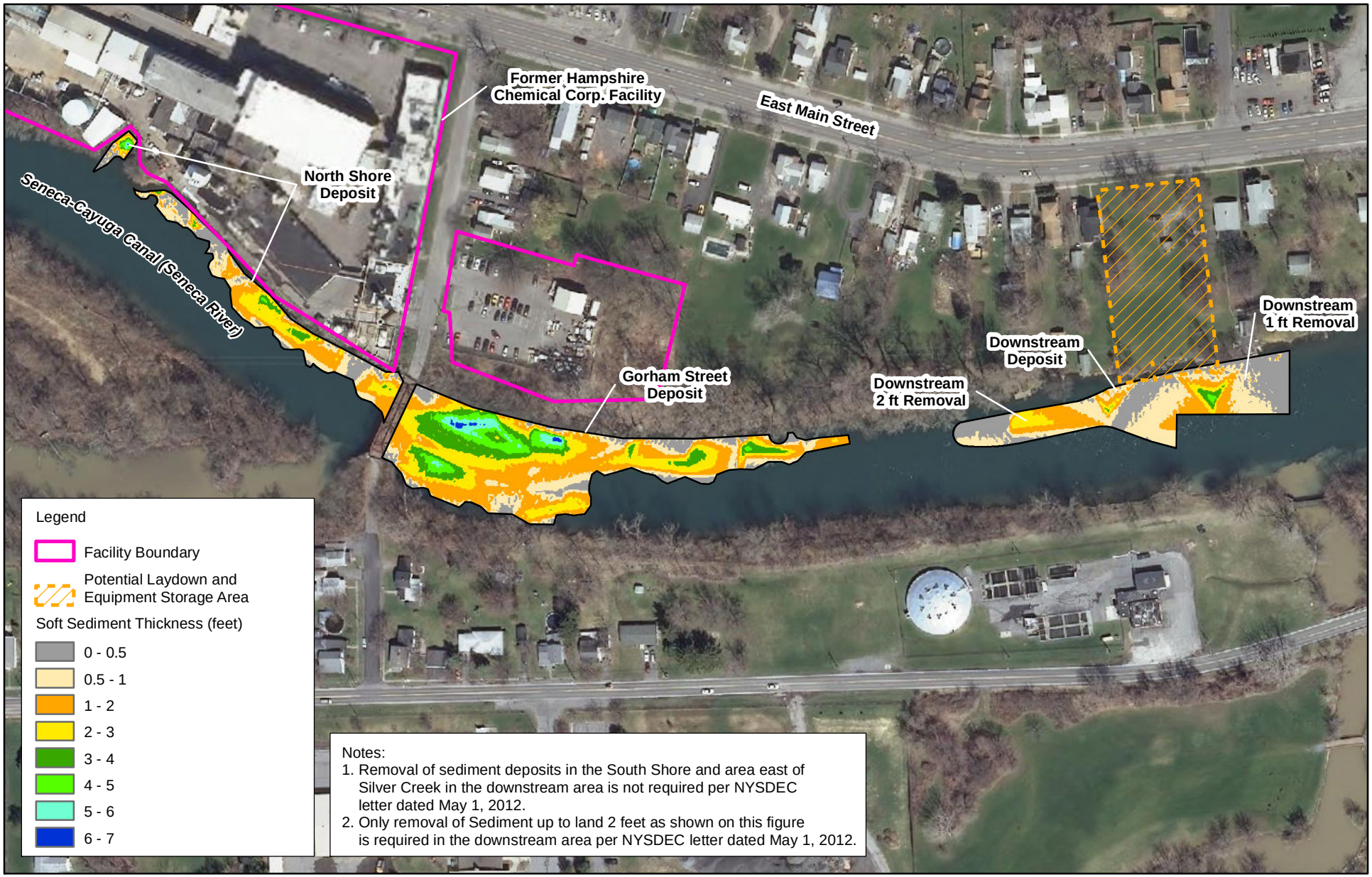

Figure 5
Sediment Remedial Target Areas
Corrective Measures Study for AOC A - Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility
Waterloo, New York

CH2MHILL

E:\GIS\DOW\WATERLOO\REPORTS\2012\CORRECTIVEMEASURESSTUDY\MAPFILES\FIGURE 05 - SEDIMENT REMEDIAL TARGET AREAS.MXD JHANSEN1 6/17/2013 4:41:33 PM

Source: Tax Maps 12,12A, 13, 16, and 17, Village of Waterloo, Seneca County, New York, McIntosh & McIntosh, Land Surveyors, Lockport, New York, 1972, updated October 2011
Parcel boundaries shown are approximate.

Figure 6
Land Based Staging and Working Areas and Existing Property Boundaries
Corrective Measures Study for AOC A - Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility
Waterloo, New York

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Appendix A
Remedial Alternative Technologies

Appendix A
Remedial Alternative Technologies
Corrective Measures Study for AOC A – Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Option	Alternative 1 No Action	Alternative 2 Mechanical Dredging with Select Landside Removal	Alternative 3 Hydraulic Dredging with Select Landside Removal	Alternative 4 Mechanical Excavation Following Isolation Using Portadams or Similar Water Divertment Structure Under Watered Conditions	Alternative 5 Mechanical Excavation In Dry Conditions Following Isolation with Sheet Piles	Alternative 6 Mechanical Excavation With Upstream and Downstream Dam with Bypassing Pumping
Description	• Does not include any treatment, engineering controls, or institutional controls, but may include non-intrusive, visual monitoring program.	• Conventional mechanical dredging from a floating barge with an excavator. The dredged material will be placed in a scow and offloaded for processing. The offloaded sediment will be dewatered w/Portland cement or equalivent material. Debris in sediment removal areas will be removed as necessary prior to mechanical dredging. Some landside removal to be completed along upper extent of North Shore deposit using long-reach excavator allowing for visual verification of sediment removal.	• Conventional hydraulic dredging from a floating barge with 8 inch cutter head hydraulic dredge and 1,500 feet of 8 inch HDPE pipeline for slurry transport (1,000-1,500 gpm). Geotextile tubes with polymer added would be used for sediment dewatering. Debris in sediment removal areas will be removed as necessary prior to mechanical dredging. Some landside removal to be completed along upper extent of North Shore deposit using long-reach excavator allowing for visual verification of sediment removal.	• Portadams are a temporary, portable cofferdam structure used for water diversion. Portadams will be installed down the center of the canal. Portadams consist of tubular steel sections that are connected to one another to create a wall or enclosure and bolted to the floor of the canal. Flexible, water-tight fabric is then installed over steel sections. Once installed, the water is pumped from the cells or work areas to create dry zones. Outfalls from Evans Chemetics are extended through the work areas to the flowing side of the canal. Under low-flow water conditions, Portadams can accommodate 6-8 feet of water. Deeper depths may be possible with non-flowing water and no allowances for precipitation events. Uneven and rocky canal bottoms pose significant challenges to a water-tight seal; sandy sediment is some areas of the canal could also potentially create a challenge to a water-tight seal due to water seepage and washouts under the Portadam.	• Steel sheet piles to be installed parallel and along the length of canal (~3,000 LF). Sheets would be 30 feet in length and require 4-5 foot depth anchoring into the canal bottom. Vertical steel piling supports would also be installed at regular intervals for added support and the flowing water would be routed around sheet piles to create dewatered removal areas or dry cells.	• Involves creation of a dry canal environment by building an upstream and downstream dam and pumping the water around the canal. Requires removal of sediment from the RTAs by mechanical excavation.
Advantages	• No technology is used. • No additional risk because impacted material will not require management by humans, and ecological habitat. • No short term disturbance of ecological habitat. • Does not require monitoring of air quality and noise levels. • Does not rely on the operation schedule of the canal.	• Effective technology. • Mechanical dredging is a common technology for sediment removal. • Work to only take one season. • Can be completed in both navigational and non-navigational seasons. • Lower water volumes for management (treatment or offsite disposal).	• Effective technology. • Hydraulic dredging is a common technology for sediment removal. • Work to only take one season. • Can be completed in both navigational and non-navigational seasons.	• Very effective in sediment removal. • Verification of sediment removal is done visually. • Sediment removal in dry conditions is easier to manage/coordinate.	• Very effective in sediment removal. • Sediment removal in dry conditions are easier to manage/coordinate. • Limited or no need for Seneca Falls Power Company involvement.	• Effective technology. • Removal of impacted sediment will protect the environment and prevent downstream migration of COCs to environmental receptors. • Improves flexibility regarding future use of the water body.
Disadvantages	• Not regulatory acceptable. • Not effective.	• Requires an offloading area built at Village of Waterloo property. • If volumes of water make offsite water disposal not cost-effective, a temporary, onsite water treatment system will be constructed and SPDES permitting may be needed for treated water unless water is disposed of offsite. • Debris removal necessary prior to sediment dredging. • Silt curtains needed to reduce transport downstream. • Some material may settle out during dredging.	• Requires larger footprint for setup/processing area for dewatering using geotextile tubes. • High water flows for water treatment after dewatering of up to 1,500 gpm. • SPDES permit needed for water discharge. • Debris removal can be extensive. • Some material may settle out during dredging. • Silt curtains needed to reduce transport downstream.	• Not able to remove all sediments under current conditions (15 feet of water lowered to 10 feet) with Portadams • Minimal safety factor with water levels at 6-8 feet • An uneven and rocky canal bottom make installation and dam sealing challenging • Commitment required from Seneca Falls Power Company to limit water flows. • Sudden rise in water level within the canal due to heavy precipitation and warmer than normal weather could result in collapse of the Portadam. • South side Gorham Street sediment removal requires Portadam remobilization to reset dams for water rerouting. • Due to the generally flat bottom, moving Portadams closer to the shoreline only reduces water levels by 1-3 feet. • Ice build-up on Portadams requires daily maintenance and can affect dam seals	• Very high cost and high complexity of design and installation. • Detailed design needed for complicated sheet pile installation to ensure adequate installation. • Work requires 9+ months (installation of sheet piles alone is 6+ months) and will include work during navigation and non-navigation season. Barge and boat traffic in the canal would be significatly affected which is not permitted by Canal Corporation. • Sheeting into bedrock in watered conditions is very complicated and few subcontractors are familiar with work scope. • Ice build-up on sheet piles would require regular maintenance.	• Very high cost and high complexity of design and installation. • Potential safety risks associated with creation of temporary dams. • Requires intensive water management. • Increased potential human exposure to impacted material during remediation. • Negative public perception. • Short term increase in chemicals of concern bioavailability. • May require monitoring of air quality and noise levels.
Overall protection of human health and the environment	• Not protective.	• Protective.	• Protective.	• Protective.	• Protective.	• 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.	• Complies with SCGs.
Reduction of toxicity, mobility, or volume (TMV) through treatment	• Does not reduce toxicity, mobility or volume through no action.	• Does not reduces toxicity or volume, but the mobility is reduced by placing material in controlled landfill.	• Does not reduces toxicity or volume, but the mobility is reduced by placing material in controlled landfill.	• Does not reduces toxicity or volume, but the mobility is reduced by placing material in controlled landfill.	• Does not reduces toxicity or volume, but the mobility is reduced by placing material in controlled landfill.	• Does not reduces toxicity or volume, but the mobility is reduced by placing material in controlled landfill.

Appendix A
Remedial Alternative Technologies
Corrective Measures Study for AOC A – Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Option	Alternative 1 No Action	Alternative 2 Mechanical Dredging with Select Landside Removal	Alternative 3 Hydraulic Dredging with Select Landside Removal	Alternative 4 Mechanical Excavation Following Isolation Using Portadams or Similar Water Divertment Structure Under Watered Conditions	Alternative 5 Mechanical Excavation In Dry Conditions Following Isolation with Sheet Piles	Alternative 6 Mechanical Excavation With Upstream and Downstream Dam with Bypassing Pumping
Short-term effectiveness	• Not effective because it does not remove impacted media • Effective because no technology needs to be implemented.	• Effective because it removes the impacted media. • Risks associated with migration of contamination to the currently unaffected media would be reduced as the RTAs are removed through active removal.	• Effective because it removes the impacted media. • Risks associated with migration of contamination to the currently unaffected media would be reduced as the RTAs are removed through active removal.	• Effective because it removes the impacted media. • Risks associated with migration of contamination to the currently unaffected media would be reduced as the RTAs are removed through active removal and verified by visual confirmation. • Challenging because of the safety issue with having to manage a high water column on the other side of the Portadam and need for extensive site preparation.	• Effective because it removes the impacted media. • Risks associated with migration of contamination to the currently unaffected media would be reduced as the RTAs are removed through active removal and verified by visual confirmation. • Challenging because extensive site preparation is required	• Very effective because it removes the impacted media. • Risks associated with migration of contamination to the currently unaffected media would be reduced as the RTAs are removed by mechanical excavation and verified by visual confirmation. • Challenging because extensive site preparation is needed and required continuous management of natural volume of canal water by bypass pumping safely.
Long-Term Risks	• Same as currently present.	• Very limited. Minimal quantities of sediment may enter in resuspension and may not be removed by the mechanical bucket.	• Very limited. Minimal quantities of sediment may enter in resuspension and may not be removed by the hydraulic dredge.	• Very limited.	• Very limited.	• Very limited.
Uncertainties	• Sediment migration will not be determined.	• Extent of debris for removal prior to dredging. • Resuspension and settlement during dredging • Water volumes for management.	• Extent of debris for removal prior to dredging. • Resuspension and settlement during dredging. • Water volumes for management.	• Water volumes for management infiltrating into the dewatered area. • SFPC involvement and commitment. • Weather.	• Large water volumes for management. • Design criteria for sheet piles and installation methods into bedrock • Weather.	• Removal of impacted sediment will reduce the uncertainty associated and the potential for future exposure and transport of impacted material. • Water volume requiring bypass. • SFPC involvement and commitment.
Sustainability	• Not applicable.	• Medium sustainability. Medium to low quantities of water will be generated for treatment and disposal.	• Low sustainability. Since settling or dewatering system is required, and large volume of water generated from dewatering activities will need to be managed and treated. The number of pumps required will be high. In addition, the large water treatment system would need to be constructed on a large footprint.	• Low sustainability. Since large volumes of water will need to be managed and treated, the number of pumps and energy consumption will be high.	• Medium sustainability. Since sheet piles can be reused, but requires intensive water management; enclosed area needs to be dewatered, and additional water management may be required due to stormwater run off, snow melt, rain, groundwater infiltration, etc	• Low sustainability. The amount of water to be managed and treated is uncertain.
Land use	• Not protective of future or current land use.	• Requires relatively smaller area/footprint to disturb for processing sediments. Protective of future and current land use.	• Requires larger area/footprint to accommodate the geotextile tubes and water treatment system. However, protective of current and future land use.	• Requires relatively smaller area/footprint to disturb for processing sediments. Protective of current and future land use.	• Requires relatively smaller area/footprint to disturb for processing sediments. Protective of current and future land use.	• Requires relatively smaller area/footprint to disturb for processing sediments. Protective of current and future land use.
Community acceptance	• Likely not acceptable.	• Medium to High acceptance	• Medium to High acceptance.	• Medium to High acceptance.	• Low to Medium – Noisy installation and extended time in the field may not be acceptable to local property owners or local ordinances. Also, NYS Canal Corporation will not accept sheet pilings obstructing traffic in the canal during the navigation season.	• Uncertain due to noise from pumps.
Design Component Assumptions	• None.	• Need to enclose work area with silt curtain to prevent transport of sediment that may enter canal as resuspension and be transported downstream. Depending on production rates, a temporary onsite water treatment system may be needed for treatment of suspended solids in water derived from the sediment dewatering and decontamination activities.	• A temporary onsite water treatment system will be needed for treatment of solids in water derived from the sediment dewatering and decontamination activities. Need to enclose work area with silt curtain to prevent transport of sediment that may enter in resuspension and be transported downstream.	• Need to enclose work area with Portadam, to perform excavation, and rerouting of facility outfalls discharge points is required. Excavators, access roads, laydown and storage areas, and dewatering pads are needed. Onsite water treatment may be needed for removal of suspended solids in effluent unless collected water is hauled offsite for disposal. In addition, Seneca Falls Power Company needs to reduce flow into the canal.	• Need to determine how deep the sheet pile should be driven to withstand the water column pressure, wind, etc. Rerouting of facility outfalls discharge points is required. Excavators, access roads, laydown and storage areas, and dewatering pads are needed. Water treatment system for treatment of solids is required.	• Upstream and downstream dam sizing depend on theoretical volumes of water. Excavators, access roads, laydown and storage areas, and dewatering pads are needed. Rerouting of facility outfalls discharge points is required. Water treatment system for treatment of solids is required.
Cost (PW) **ROM Level – AACE Class 4**	• None.	• Medium to High costs.	• Medium to High costs. Costs may increase due to the need for the treatment of large quantities of water.	• Medium to High costs.	• Very high costs associated with installation of sheet piles and dewatering of excavation areas.	• Very high costs associated with installation of upstream and downstream dams, management of canal water by bypass pumping and dewatering of the dam area.

Appendix B

Evaluation of Proposed Remedial Alternatives

Appendix B
Evaluation of Proposed Remedial Alternatives
Corrective Measures Study for AOC A – Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Option	Alternative 2 Mechanical Dredging with Select Landside Removal	Alternative 3 Hydraulic Dredging with Select Landside Removal
Design Component Assumptions	• Approximately 4500-7200 cubic yards of impacted sediment to be removed (North Shore Deposit : 530 - 1000 cubic yards, Gorham Street Deposit : 3300 - 5000 cubic yards and Downstream Deposit : 670 - 1200 cubic yards). • Need to enclose work area with silt curtain to prevent transport of sediment that may enter in resuspension and be transported downstream. • Depending on production volumes, a temporary onsite water treatment system may be needed for treatment of suspended solids in water derived from the sediment dewatering and decontamination activities.	• Approximately 4500-7200 cubic yards of impacted sediment to be removed (North Shore Deposit : 530 - 1000 cubic yards, Gorham Street Deposit : 3300 - 5000 cubic yards and Downstream Deposit : 670 - 1200 cubic yards). • Need to enclose work area with a silt curtain to prevent transport of sediment that may enter in resuspension and be transported downstream. • A temporary onsite water treatment system would likely be needed for treatment of solids in water derived from the sediment dewatering and decontamination activities.
Overall protection of human health and the environment	• Protective because remedial action objective (RAO) will be achieved by complete removal of remedial target areas (RTAs).	• Protective because RAO will be achieved by complete removal of RTAs.
Compliance with standards, criteria and guidance (SCGs)	• Complies with SCGs by removing impacted sediment from RTAs.	• Complies with SCGs by removing impacted sediment from RTAs.
Effectiveness	• High because impacted sediment from RTAs will be removed.	• High because impacted sediment from RTAs will be removed.
Reduction of toxicity, mobility, or volume (TMV) through treatment	• Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.	• Implementation of this remedy will not reduce its toxicity or volume, but will decrease mobility by being placed in a controlled landfill.
Short-term effectiveness	• Effective as it removes impacted sediment and does not have rebound potential.	• Effective as it removes impacted sediment and does not have rebound potential.
Implementability	• Highly implementable. Requires lesser land area for processing. Water generated from processing can be disposed offsite without treatment. In general, removal process will be slightly more effective in getting out sediment with the bottom conditions. • Permits and agreements are required.	• Highly implementable. Requires larger land area/footprint to accommodate dewatering tubes and water treatment system. • Permits and agreements are required.
Long-Term Risks	• Limited. All of the impacted sediment may not be removed due to resuspension and transport of sediment in the water column.	• Limited. All of the impacted sediment may not be removed due to resuspension and transport of sediment in the water column.
Uncertainties	• Volume of unremoved impacted sediment due to resuspension. • Extent of turbidity due to re-suspension of sediment.	• Volume of unremoved impacted sediment due to resuspension. Extent of turbidity due to re-suspension of sediment.
Time frame	• Least timeframe; to set up the staging area and offloading platform.	• Medium timeframe; to set up sediment dewatering and water treatment system; longer timeframe than Alternative 2.
Schedule	• Implementation schedule can be sequenced in navigation and non-navigation seasons pending NYS Canal Corporation giving final approval to work in the canal. • Depends on permit approvals and regulatory approval of the CMS.	• Implementation schedule can be sequenced in navigation and non-navigation seasons pending NYS Canal Corporation giving final approval to work in the canal. • Depends on permit approvals and regulatory approval of the CMS.
Sustainability	• Medium sustainability. Medium to low quantities of water will be generated and smaller treatment footprint.	• Low sustainability. Since settling or dewatering system is required, and large volume of water generated from dewatering activities will need to be managed and treated. The number of pumps required will be high. Therefore, larger treatment footprint.
Land use	• Requires relatively smaller area/footprint to disturb for processing sediments. Protective of future, current and historical land use.	• Requires larger area/footprint to accommodate the geotextile tubes and water treatment system. However, protective of future, current and historical land use.
Community acceptance	• Medium to High acceptance.	• Medium to High acceptance.

Appendix B
Evaluation of Proposed Remedial Alternatives
Corrective Measures Study for AOC A – Seneca-Cayuga Canal
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Option	Alternative 2 Mechanical Dredging with Select Landside Removal	Alternative 3 Hydraulic Dredging with Select Landside Removal
Advantages	• Removal of impacted sediment will protect the environment and prevent downstream migration to environmental receptors. • Phased approach with limited landside removal allows for some visual verification. • Sediment removal is not dependent on water levels or water flow rates in the canal. • Lower water management: less water generation due to dewatering and limited canal outfall rerouting (outfalls can remain • Relatively smalled land area needed for staging, storage and sediment processing.	• Removal of impacted sediment will protect the environment and prevent downstream migration to environmental receptors. • Phased approach with limited landside removal allows for some visual verification.
Disadvantages	• Some vegetation removal would be required at the canal bank for access to remediation areas. • Significant large debris removal is needed prior to mechanical sediment removal. • Silt curtains are needed to limit resuspension and downstream transport. • Daily canal traffic will need to be managed to ensure no impediment to boat traffic.	• Some vegetation removal would be required at the canal bank for access to remediation areas. • High water management and treatment costs due to large quantity of water generated during hydraulic removal. • Relatively larger setup/processing area for sediment processing and dewatering. • Significant large debris removal is needed prior to mechanical sediment removal. • Silt curtains are needed to limit resuspension and downstream transport. • Daily canal traffic will need to be managed to ensure no impediment to boat traffic.
Cost **Costs are -30/+50 (30 year net worth not applicable due to no O&M)**	• Medium to High • Capital Costs: $ 5,808,000 (includes waste disposal) • Present Worth Cost - $5,808,000 • **Total - $5,808,000**	• Medium to High • Capital Costs: $ 6,189,000 (includes waste disposal) • Present Worth Cost - $6,189,000 • **Total - $6,189,000**

Appendix B. Evaluation of Proposed Remedial Alternatives

Corrective Measures Study for AOC A – Seneca-Cayuga Canal

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Alternative 2 - Mechanical Dredging with Select Landside Removal

Assumptions

1 Assumptions are based on known conditions and may need to be adjusted as details of sediment dewatering and removal are refined

2 Fieldwork can be completed within a four to eight months period if started in March 2014.

3 All applicable permits will be obtained prior to performing the field work.

4 Only the sediment demarcated in the North Shore, Gorham Street and the western portion of the Downstream deposits will be removed and is estimated to be between 4500 and 7200 cubic yards (6,750 - 10,800 tons). One cubic yard of sediment is assumed to weigh 1.5 tons.

5 The remedial action objective (RAO) for the North Shore and Gorham Street deposits is removal of soft sediment deposits to the maximum capabilities of the technology selected.

6 The RAO in the downstream deposit is two feet sediment removal on western edge of downstream deposit (SD-71 to SD-73), and removal of 1 foot of sediment along the northern bank of the Downstream Deposit from SD-73 to Silver Creek, in the portion of the deposit from SD-74 to the northern edge of soft sediment accumulation.

7 Conventional mechanical dredging from a floating barge with an excavator.

8 Sediment removal to be done under full watered conditions with some limited exceptions during landside removal.

9 Debris removal will be effective to allow for mechanical dredging.

10 Initial removal near North Shore bank could be completed from the shore in water depths of up to 5 feet or water lowered allowing for potential of visual verification of sediment removal. Remaining sediment removal would be done under watered conditions. Limited dry removal from the shoreline could remove up to 20% of volume of the North Shore Deposit only.

11 Current canal depth is approximately 15 feet (channel center line). NYSCC will lower water level during non-navigation season up to 5 feet to accommodate the initial landbased sediemnt removal.

12 Need to enclose work area with silt curtain to prevent transport of sediment that may enter canal as resuspension and be transported

13 A rescue boat and pilot will be available during all sediment removal activities.

14 Post dredging confirmation sampling will not be performed.

15 Post excavation long-term monitoring will not be performed

16 Water generated from sediment removal activities will be treated for suspended solids by an onsite water treatment system and

17 Water generated from sediment removal is non-hazardous.

18 A drying agent may be added to sediments prior to offsite disposal.

19 Sediment material is non-hazardous and will be handled and disposed of appropriately.

20 A five person management team will be onsite and includes a project specific health and safety (H&S) coordinator who will perform daily

21 State and local taxes are not included and will be added where applicable.

22 Pollution Liability and Comprehensive Liability Insurances are included.

23 Primary site access will be Village of Waterloo property (northern bank) adjacent to Downstream Deposit area.

24 Some undetermined sediment may settle out in suspension and will remain post-removal.

25 Rerouting of the facility outfall discharge points will be conducted as needed.

26 Field work will be performed up to 12 hours per day, up to six days a week.

27 All work will be conducted in Modified Level D personal protective equipment.

28 Barge traffic would not be affected; scows and barges will be small enough and can move to accommodate other traffic.

29 There will be no delays caused by facility operations, the surrounding neighbors, or any outside party of interest.

30 Seneca Falls Power Corporation is not limited in the amount of water can be discharged upstream (no agreement will be established with SFPC).

31 Bayard Street culvert will not be affected by the sediment removal work.

32 The New York State Canal Corporation is responsible for maintaining the pool elevation in a manner that protects its infrastructure.

Appendix B. Evaluation of Proposed Remedial Alternatives

Corrective Measures Study for AOC A – Seneca-Cayuga Canal

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Alternative 3 - Hydraulic Dredging with Select Landside Removal

Assumptions

1 Assumptions are based on known conditions and may need to be adjusted as details of sediment dewatering and removal are refined during design.

2 Fieldwork can be completed within a four to eight month s period if started in March 2014.

3 All applicable permits will be obtained prior to performing the field work.

4 Only the sediment demarcated in the North Shore, Gorham Street and the western portion of the Downstream deposits will be removed and is estimated to be between 4500 and 7200 cubic yards (6,750 - 10,800 tons). One cubic yard of sediment is assumed to weigh 1.5 tons.

5 The remedial action objective (RAO) for the North Shore and Gorham Street deposits is removal of soft sediment deposits to the maximum capabilities of the technology selected.

6 The RAO in the downstream deposit is two feet sediment removal on western edge of downstream deposit (SD-71 to SD-73), and removal of 1 foot of sediment along the northern bank of the Downstream Deposit from SD-73 to Silver Creek, in the portion of the deposit from SD-74 to the northern edge of soft

7 Conventional hydraulic dredging from a floating barge with 8-inch cutter head hydraulic dredge and 1,500 feet of 8-inch HDPE pipeline for slurry transport (1,000-1,500 gpm).

8 Sediment removal to be done under full watered conditions with some limited exceptions during landside removal.

9 Extensive debris removal will be effective to allow for hydraulic dredging.

10 Current canal depth is approximately 15 feet (channel center line). NYSCC will lower water level during non-navigation season up to 5 feet to accommodate the initial landbased sediemnt removal.

11 Initial removal near North Shore bank could be completed in water depths of up to 5 feet or water lowered allowing for potential of visual verification of sediment removal. Remaining sediment removal would be done under watered conditions. Limited dry removal from the shoreline could remove up to 20% of volume of the North Shore Deposit only.

12 Need to enclose work area with silt curtain to prevent transport of sediment that may enter canal as resuspension and be transported downstream.

13 A rescue boat and pilot will be available during all sediment removal activities.

14 Post dredging confirmation sampling is not planned.

15 Post excavation long-term monitoring is not planned.

16 Water generated from sediment removal activities will be treated for suspended solids by an onsite water treatment system and discharged back to the canal

17 Water generated from sediment removal is non-hazardous.

18 A drying agent may be added to sediments prior to offsite disposal.

19 Sediment material is non-hazardous and will be handled and disposed of appropriately.

20 A five person management team will be onsite and includes a project specific health and safety (H&S) coordinator who will perform daily H&S monitoring.

21 State and local taxes are not included and will be added where applicable.

22 Polution Liability and Comprehensive Liability Insurances are included.

23 Primary site access will be Village of Waterloo property (northern bank) adjacent to Downstream Deposit area.

24 Canal Corporation property south of Village of Waterloo Sewage Treatment Plant would be available for staging and dewatering.

25 Some undetermined sediment may settle out in suspension and will remain post-removal.

26 Rerouting of the facility outfall discharge points will be conducted as needed.

27 Field work will be performed up to 12 hours per day, up to six days a week.

28 All work will be conducted in Modified Level D personal protective equipment.

29 Barge traffic would not be affected; scows and barges will be small enough and can move to accommodate other traffic.

30 There will be no delays caused by facility operations, the surrounding neighbors, or any outside party of interest.

31 Seneca Falls Power Corporation is not limited in the amount of water can be discharged upstream (no agreement will be established with SFPC).

32 Bayard Street culvert will not be affected by the sediment removal work.

33 The New York State Canal Corporation is responsible for maintaining the pool elevation in a manner that protects its infrastructure.

Appendix C
Permits Under Consideration

AGENCY	AUTHORITY	PERMITTING AGENCY and POINT OF CONTACT	ACTIVITY COVERED
1. Nationwide Permit 38			
USACE	CWA Section 404, 10	Maggie Crawford, Auburn Field Office (315-704-0256), and Mark Scalabrino, Regulatory Chief, Buffalo District, New York Section (716-879-4327)	Mechanical excavation and restoration
NYSDEC	Article 15, 6NYCRR Part 608, Protection of Waters **(NYSDEC Exemption)**	Tom Haley, NYSDEC, (585-226-5393)	Mechanical excavation and restoration
NYSDEC	Article 24, 6NYCRR Part 663, Freshwater Wetlands **(Not Applicable)**	Tom Haley, NYSDEC (585-226-5393)	Mechanical excavation and restoration
NYSDEC	CWA Section 401 **(NYSDEC Exemption for Sediment Removal)**	Tom Haley, NYSDEC (585-226-5393)	Mechanical excavation and restoration
USFWS	Federal T&E Species, Endangered Species Act **(NYSDEC Exemption)**	Robyn Niver or Sandy Duran, USFWS T&E Species Coordinator, New York Ecological Field Office (607-753-9334)	All activities
NYSDEC	State T&E Species Consultation, 6NYCRR Part 182 **(NYSDEC Exemption)**	Jean Pietrusiak, NYSDEC, Natural Heritage Program (518-402-8935)	All activities
NYS Historic Preservation Office (SHPO)	Cultural Resources Section 106 **(NYSDEC Exemption)**	Nancy Herter, NYS Historic Preservation Office, (518-237-8643 ext 3280)	On-shore activities
2. Canal Work Permit			
Canal Work Permit	Rules and Regulations of the NYS Canal Corporation	Neil Vellone, NYS Canal Corporation (315-438-2403)	Mechanical excavation and restoration
3. State Lands Permit/ Authorization (NYSDEC Exemption)			
NYS Education Department	NYS Education Department	Christina Rieth (518-402-5975)	State land activities
4. Floodplain Permit (NYSDEC Exemption)			
Floodplain Permit	Village of Waterloo per NYSDEC approval	Karis Manning, Environmental Engineer, NYSDEC, Region 8 (585-226-5445) and Dan Driscoll, Village of Waterloo (315-539-9131)	On-shore activities
5. Soil Erosion and Sediment Control Plan			
NYSDEC	NYSDEC Division of Environmental Remediation (DER)	Gail Dieter Project Manager, NYSDEC	Soil disturbance
6. Stormwater Discharge due to Construction Activities Permit No. GP-O-IO-00 I			
NYSDEC	NYSDEC Division of Environmental Remediation (DER)	Gail Dieter Project Manager, NYSDEC	Construction activities that disturb one or more acre of soils. Requires the preparation of a Stormwater Pollution Prevention Plan.
7. Relocation of Facility Outfalls			
NYSDEC	State Pollutant Discharge Elimination System (SPDES)	Tom Haley NYSDEC (585-226-5393)	Creation of "Dry Zones" in the vicinity of the facility by relocating facilty outfall discharge points downgradient of the work area and across the canal.
8. Permission to Dredge/ Discharge Treated Canal Water Back into the Canal			
NYSDEC	Article 15, 6 NYCRR Part 608, Protection of Waters	Tom Haley NYSDEC (585-226-5393)	Mechanical excavation activity. Discharge of treated canal water back into the canal; treatment for solids may be required.
9. Permission to Discharge to the local POTW (Not Applicable)			
Waterloo Sewage Treatment Plant	*NYSDEC Division of Water Engineers and Waterloo Sewage Treatment Plant. No permit application to be submitted.*	*Dixon Rollins, NYSDEC Division of Water Engineers (585-226-5468)*	*Discharge of treated canal water.*
10. Part 364 Waste Hauler Permit			
NYDEC Division of Materials Management	Article 15, 6 NYCRR Part 364, Waste Transporter Permit	Patti Leonardo New York State Department of Transportation - Division of Materials Management (518) 402-8792	Anyone that transports regulated waste on the roads of New York State. For access routes around the work area and for transport to the Seneca Meadows Landfill, Waterloo, NY.
11. Letter to the Village of Waterloo for permission to use their property. Amendment of existing access agreement for potential construction activities (e.g. access road construction).			
Village of Waterloo	Village of Waterloo	Steve Ward Village of Waterloo Public Works (315) 539-9393	General access for construction equipment.
12. Waste dewatering via mixing of drying or fixation agents.			
NYSDEC	NYSDEC Division of Environmental Remediation (DER)	Gail Dieter Project Manager, NYSDEC	Waste Disposal
13. Amendment to Revocable Permit No. C3W120008 Granting Access to NYS Canal Corporation property until December, 2012			
New York State Canal Corporation (NYSCC)	NYSCC	Neil Vellone New York State Canal Corporation P.O. Box 308 East Syracuse, NY 13057- 0308	Access to canal lands from Lock C/S 4 to Lock C/S 2/3 to complete a visual outfall survey. sediment sampling and site walks with potential subcontractors.

Notes:

A NYSDEC Division of Water Engineer representative (Mr. Dixon Rollins) and the POTW Plant Manager (Mr. Robert Loach “Bob”) verbally indicated in December, 2011, that the POTW is currently operating at full capacity and is unable to accept additional volume per an order from the NYSDEC. Therefore, there it is not necessary to obtain permission to discharge to the POTW.