FEASIBILITY STUDY

FEASIBILITY STUDY REPORT

WORK ASSIGNMENT D007622-21

TONAWANDA FORGE SITE — SITE NO. 915274
TONAWANDA (T) — ERIE COUNTY, NY

Prepared for:
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 Broadway, Albany, New York

Basil Seggos, Commissioner

DIVISION OF ENVIRONMENTAL REMEDIATION

URS Corporation
257 West Genesee Street
Buffalo, New York 14202

Final
September 2019

CERTIFICATION

I Donald A. McCall certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Feasibility Study Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

FEASIBILITY STUDY REPORT

TONAWANDA FORGE SITE
SITE NO. 915274
TOWN OF TONAWANDA, ERIE COUNTY, NEW YORK

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
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ALBANY, NEW YORK 12233

Prepared by:

URS CORPORATION
257 WEST GENESEE ST.
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September 2019

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ABBREVIATIONS

AAM	American Axle and Manufacturing
ACM	Asbestos Containing Material
AOC	Area of Concern
AST	Aboveground Storage Tank
BB&L	Blasland, Bouck, & Lee, Inc.
bgs	Below Ground Surface
C&D	Construction and Demolition
CB	Catch Basin
CFR	Code of Federal Regulations
CRA	Conestoga Rovers & Associates\
CY	Cubic Yards
ECM	Erosion Control Measures
ESA	Environmental Site Assessment
FS	Feasibility Study
ft/ft	Foot per Foot
FWRIA	Fish and Wildlife Resources Impact Analysis
GES	Groundwater Environmental Services
GM	General Motors
GM ER & IS	GM Environmental Remediation and International Environmental Support
HDPE	High Density Polyethylene
ICs	Institutional Controls
IRM	Interim Remedial Measure
ISCO	In Situ Chemical Oxidation
ISS	In Situ Solidification
IW	Industrial Waste
IWTP	Industrial Waste Treatment Plant
LNAPL	Light Non Aqueous Phase Liquid
mg/kg	Milligrams per Kilogram
MH	Manhole
µg/L	Micrograms per Liter
$\mu g/cm^2$	Micrograms per Square Centimeters
MS4	Municipal Separate Storm Sewer System
NAPL	Non Aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	Non Detect
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
OM&M	Operation, Maintenance, and Monitoring
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
POTW	Publically Owned Treatment Works
ppm	Parts Per Million
psi	Pounds Per Square Inch

QHHEA	Qualitative Human Health Exposure Assessment
RAO	Remedial Action Objective
RECs	Recognized Environmental Conditions
RI	Remedial Investigation
SCG	Standard, Criteria, and Guidance
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SPDES	State Pollution Discharge Elimination System
SSA	Storm Sewer Areas
SVOC	Semivolatile Organic Compound
TMV	Toxicity, Mobility, or Volume
TOGS	Technical and Operational Guidance Series
TSCA	Toxic Substance Control Act
TSS	Total Suspended Solids
URS	URS Corporation
USEPA	United State Environmental Protection Agency
VOCs	Volatile Organic Compounds
WA	Work Authorization

1.0 INTRODUCTION AND BACKGROUND

1.1 General

URS Corporation (URS) has prepared this *Feasibility Study* (FS) for the New York State Department of Environmental Conservation (NYSDEC) for the Tonawanda Forge Site (No. 915274). The work for this FS report is being performed for the NYSDEC under Work Assignment (WA) No. D007622-21.

1.2 Site History and Description

The Tonawanda Forge site (Site) consists of two properties and is located at 2390 and 2392 Kenmore Avenue, Tonawanda, New York (Figure 1-1). The 34.8 acre Site is zoned for industrial use and is approximately 2,300 feet southeast of the intersection of Kenmore Avenue and Sheridan Drive. The Site is relatively flat and primarily covered with asphalt, concrete and former building foundations and four buildings. The eastern portion of the Site, identified as AOC (Area of Concern) 1, is a grass covered landfill with an elevation approximately 6 feet above the surrounding grade.

The site has areas of standing water following precipitation and snow melt. The standing water is the result of previous plugging of the storm sewer system at downgradient locations to inhibit the flow of contamination offsite. A number of manholes, catch basins, and some sewer line sections have been plugged at several locations across the Site. As a result, water ponds in several areas following rain events or snow melt.

The property was originally part of the General Motors (GM) - Tonawanda Engine Plant (GM- Tonawanda) facility that borders the Site to the north, west, and south. The property originally consisted of four separate on-site buildings: Forge building, Heat Treating building, Maintenance/Die Shop building, and Office building. Over time, the Forge building, Heat Treating building, and Maintenance/Die Shop building were combined under a common roof into one building where the manufacturing operations were performed. Over the operational history of the facility, additional buildings were added at the Site, including an Oil Pump House (aka: Environmental Building), Cafeteria/Locker room, Air Compressor building, Maintenance Storage Facility, and Net Shape Gear Warehouse. A historical site plan is shown on Figure 1-2.

In 1994, GM sold the Site to American Axle and Manufacturing, Inc. (AAM) who performed the forging and manufacturing of automotive parts at the Site. In 2008, AAM sold the Site to the current owner, Lewis Brothers, LLC (Lewis), of Richmond, Virginia. Upon sale of the Site, Lewis began the demolition of the Site buildings that formerly housed the manufacturing operations, starting with the removal of the interior equipment and ending with the removal of the buildings' entire superstructure.

Upon the owner's refusal to address petroleum contamination on the site in violation of a stipulation agreement with NYSDEC, the NYSDEC proceeded with remediation of contamination under Spill Site number 0944809. During demolition there was a release of polychlorinated biphenyls (PCBs) from two transformers on December 19, 2011. Upon the Owner's refusal to address the spill the NYSDEC instituted clean-up procedures under Spill Site number 1112690.

Currently, the only structures remaining on the Site are the Office building, Cafeteria/Locker room, Environmental Building, and Net Shape Gear Warehouse. The majority of the western portion of the site consists of former building floor slabs, parking lots, and driveways. A large grassed area in the eastern part of the Site, bordered by Kenmore Avenue, is a former fill and disposal area that was re-graded and capped. This area, commonly known as the "Front Forty", was designated as AOC-1 during the Remedial Investigation.

Based upon a review of historical documents, drawings, and previous investigations, sixteen potential AOCs were identified at the Site (Figure 1-3). The AOCs were investigated to determine if historical activities at the Site and/or releases of PCBs during Site demolition activities by the property owner have adversely impacted the environment. A description and rationale for each AOC can be found in the Remedial Investigation report prepared by URS and dated January 2018.

1.3 Investigations Prior to the Remedial Investigation

The following section summarizes previous investigations that were performed at the Site by others. Figure 1-2 presents a historical site plan for Site locations referenced below. The locations of manholes, catch basins, and sewer lines referenced below are shown on Plate 1. The locations on Plate 1 are based upon drawings found in the reports summarized below. The sources were referenced on the plate.

1.3.1 Blasland, Bouck, & Lee, Inc. – December 1998

In December 1998, Blasland, Bouck, & Lee, Inc. (BB&L) submitted the Interim Corrective Measures Letter Report - Addendum I, American Axle & Manufacturing Tonawanda, NY Forge Plant (BB&L, December 1998) to the NYSDEC – Region 9 on behalf of GM Worldwide Facilities Group, Environmental Remediation and International Environmental Support, of Detroit, Michigan (GM ER & IES). The report summarized the results of an investigation and the corrective actions taken to address possible sources of PCBs in the AAM storm sewer system.

The following activities were performed at the Site as part of the investigations and corrective actions: historical records were reviewed in an attempt to determine potential sources of PCBs in the storm water; a soil investigation conducted in the vicinity of portions of the storm sewer system and manholes (MH); storm sewer cleaning was performed; portions of the sewer system were retrofitted; a storm sewer video inspection was performed; and storm sewer sampling events were conducted during the months of October, November, and December 1998. Results of these activities are discussed below.

An October 1998 storm sewer sampling indicated that PCB concentrations in storm water were not related to non-contact cooling water but were possibly the result of sediment and residue present in the piping.

A soil investigation was performed along the previously identified compromised storm sewer lines beneath the Forge area (i.e., manholes MH-51, MH-52, and MH-53) and beneath the southern access road (i.e., manholes MH-58, MH-59, and MH-60). The area in the vicinity of MH-52 had historically been used for the storage of swarf materials (i.e., metal turnings, cuttings, grindings, and chips, usually covered with cutting oil). The investigation indicted the presence of PCBs in subsurface soils.

A November 1998 sewer pre-cleaning sampling event was performed. Results indicated the primary areas of concern appeared to be at manhole locations MH-53-2, MH-53-3, MH-56, and MH-64. Storm sewer cleaning was performed between November 12 and 25, 1998 along 37 sewer intervals. A post-cleaning video inspection was made and several cracks and collapsed sections of piping were identified.

Between November 12 and 25, 1998, sewer lines deemed unnecessary were removed from the storm sewer system by installing bulkheads. The majority of the bulkheads installed were within the catch basins (CBs) located in the “Front Forty”, which is the term for the approximately 7.5 acres of undeveloped area that was located between Kenmore Avenue and the main parking lot. A post-cleaning sewer sampling event was performed in December 1998 and indicated that concentrations of PCBs in the AAM storm sewer system had been significantly decreased.

1.3.2 American Axle & Manufacturing – April, 15 1999

On April 15, 1999, AAM submitted a letter titled AAM Industrial Waste System (AAM, April 15, 1999) to the NYSDEC – Region 9. The letter indicated that AAM had performed cleaning and inspections of two industrial waste (IW) lines running the length of the Forge building. The cleaning included associated manholes, the hot former pits, and catch basins.

The results of a March 1999 sampling event indicated two sample locations from the IW lines, associated manholes, hot former pits, and catch basins with elevated PCBs (CB @ S-23 and IWP-HF#4).

1.3.3 Blasland, Bouck, & Lee, Inc. – June 1999

In June 1999, BB&L submitted the Interim Corrective Measures Letter Report - Addendum II, American Axle & Manufacturing Tonawanda, Tonawanda Forge Plant, Tonawanda, New York (BB&L, June 1999). The report summarized the storm sewer and industrial cleaning activities, storm sewer sampling, bulkhead installation, and inspection and repairs recommended and performed since the Addendum I report was submitted by BB&L in December 1998. The report covers the time period of December 1998 through March 1999.

In December 1998, storm sewer lines between manholes MH-58, MH-59, and MH-60 and MH-83 and MH-84 were cleaned and video inspected following the cleaning. Previous sampling events had detected PCBs in these manholes and video inspections had shown compromises to the storm sewer lines.

Additional bulkheads were installed in manholes and sewer lines within both the Forge area and the Front Forty between December 1998 and February 1999.

A storm sewer sampling event was performed in February 1999 to evaluate the results of the December 1998 cleaning event. Post-cleaning sampling indicated that PCBs were present in water from storm sewer lines between manholes MH-51 through MH-53 and MH 58 through MH-60. The source of the PCBs was suspected to be from damaged sewer lines being impacted by surrounding PCB-containing soils. In addition, a review of plant drawings by BB&L indicated that some manholes were connected to laterals from roof conductors used to convey rain water from the roof to the storm sewer system. PCB-containing transformers and electrical substations located on the roof in the vicinity of the roof conductors were identified as potential sources of PCBs.

The results of repeated cleaning, video inspection, and storm sewer sampling events identified six storm sewer areas (SSAs) as potential sources of PCBs. The identified SSAs and their associated manholes are as follows:

- SSA-1: MH-51, MH-52, and MH-53;
- SSA-2: MH-58, MH-59, and MH-60;
- SSA-3: MH-81, MH-82, MH-83, and MH-84;
- SSA-4: MH-82A, MH-201, MH-304, MH-305, and MH-306;
- SSA-5: MH-55, MH-65, and MH-66; and
- SSA-6: MH-64.

BB&L performed an engineering study to determine potential repair/replacement methods for the sewer lines in SSA-1, SSA-2, and SSA-3. Additional investigations were proposed for the sewer lines in SSA-4, SSA-5, and SSA-6.

In the report, BB&L also summarized the following remedial activities performed at the Site by AAM. During December 1998, AAM performed cleaning and inspections of two IW lines, the hot former pits, and catch basins which had been used to collect industrial waste generated during the forging process. The cleaning performed in December 1998 was in response to PCBs being detected in samples collected from the IW lines, hot former pits, and catch basins during sampling conducted by AAM in July of 1998. Although the IW lines, hot former pits, and catch basins were not suspected as potential sources of PCBs to the storm sewer, they were cleaned to eliminate possible PCB sources to AAM's Industrial Waste Treatment Plant (IWTP) because the IW lines were connected with overhead piping within the Forge to the IWTP. Three IW catch basins located in the truck repair area (formerly the Electrical Crib) were used to contain used motor oils and lubricants. The three IW catch basins were connected with overhead piping within the Forge to the AAM IWTP. It was concluded that previous maintenance activities performed in the Electrical Crib may have led to detections of PCBs in oils, sludges, and wastewater samples collected by AAM in July 1998. The cleaning activities performed on the IW lines, hot former pits, and catch basins reduced PCB-containing oils and sludges from the IW system.

1.3.4 Conestoga-Rovers & Associates – November 2000

In November 2000, Conestoga-Rovers & Associates (CRA) submitted a report titled the Historic and Active Railroad Drainage Line Subsurface Investigation, General Motors Powertrain Group, Tonawanda Engine Plant, Tonawanda, New York (CRA, November 2000). The report summarized an investigation of the railroad drainage lines at the GM-Tonawanda facility that was performed to determine if they were a contributing source of PCBs to the storm water discharge to State Pollution Discharge Elimination System (SPDES)-permitted Outfall 001. The railroad drainage lines are tied into the storm water sewer system. The report also provided a summary of the site background with regard to railroad drainage lines and past site activities which included the Site.

Between March 8, 1999, and April 6, 1999, 296 direct push soil borings were advanced along existing and historical railroad tracks. Soil samples were collected from the ground surface to 12 feet below ground surface (bgs) and screened for PCBs using SDI EnviroGard® Immunoassay PCB in Soil Test Kits. The PCB screening consisted of a comparison between the samples and the PCB standards at concentrations of 1 parts per million (ppm), 5 ppm, 10 ppm, and 50 ppm. Approximately 5 percent of the samples collected were sent off-site for confirmation analytical testing for PCBs by USEPA Method 8082.

Soil sample results indicated the presence of PCBs with concentrations greater than 50 ppm in soils at depths down to 12 feet bgs along the property line in the southwest corner of the Site. The maximum concentration of PCBs in samples sent off-site for confirmation analytical testing was 180 ppm.

Soil sample results also indicated the presence of PCBs with concentrations greater than 50 ppm in areas of compromised sewer system lines in the Forge area, southern access road, and along the former railroad spur located along the Site's southern property line.

1.3.5 Blasland, Bouck, & Lee, Inc. – October 2001

In October 2001, BB&L submitted a report titled Interim Corrective Measures Letter Report - Addendum III, American Axle & Manufacturing, Tonawanda Forge Plant, Tonawanda, New York (BB&L, October 2001) to the GM ER & IES. The report summarizes the results of an additional storm sewer assessment, an investigation of the Front Forty area, and the implementation of Erosion Control Measures (ECMs) in the Front Forty area.

Various investigations related to the presence of PCBs in the storm sewers were performed in 1999. PCB-containing transformers were known to be present on the roof of the AAM facility. Sampling was performed on the roof of the AAM facility to determine if the roof was a source of PCBs that were being carried by rainwater via roof conductors, to the storm sewer. Analytical results indicated the presence of PCB concentrations ranging from 0.14 μg/L to 1.09 μg/L. It was determined that the roof was a contributing source of PCBs to the storm sewers.

In February, August, and September 1999, sampling was conducted to determine if the Front Forty was a potential source of PCB-impacted sediment-laden runoff. Analytical results indicated a contribution of PCBs to the storm sewer system from runoff originating from the Front Forty.

In October 1999, a PCB/suspended solids study was performed to identify potential sources of the PCBs observed in storm water in relation to suspended solids, oil and grease, and changes in weather. BB&L concluded that PCB detections were associated with PCBs adsorbed to suspended solids and not dissolved PCBs in the water or in oil and grease. Also, BB&L

concluded that rainfall and wind conditions may have impacted the total suspended solids (TSS) and turbidity resulting in elevated PCBs detections in storm water.

An ECM was implemented in the Front Forty between March and October 2000 to reduce PCB storm water issues in SSA-3 and SSA-4, which are located along the northern Site boundary and in the main parking lot, respectively (Plate 1). In May 2000, six percolation test pits were excavated in the Front Forty to assess the potential for the subsurface soils to percolate or retain water. A 1- to 2-foot thick fill layer was encountered over a clay layer and no water was encountered. It was determined that the soils below the fill layer had minimal percolation capacity. In May and June 2000, 57 direct push soil borings were advanced. Soil samples were collected until native material was encountered. The fill was encountered down to 8 feet bgs. Soil samples of the fill material were field screened with EnviroGard® Immunoassay PCB in Soil Test Kits. Results indicated the presence of PCBs in the fill material at concentrations greater than 50 ppm at depths down to 6 feet bgs. Soil samples were not collected from the native material found below the fill material.

The implementation of the Front Forty ECM was performed between March and October 2000. The ECM activities included:

- A pre-construction topographic survey and two subsequent construction surveys to establish grade control for earthwork activities.
- The leveling of existing on-site soil and construction and demolition (C&D) debris piles. The C&D piles were consolidated and buried below final grade.
- An area of slag was excavated, crushed and re-graded within the Front Forty.
- Approximately 3,413 cubic yards (CY) of Type S1 common fill was imported and placed to achieve necessary design elevations. The Type S1 consisted of a dark brown sandy silty clay soil. The fill was placed and compacted.
- A perimeter berm was constructed using a combination of on-site soil and imported Type S1 fill.

- A stone-lined low area was constructed. On-site excavated soils from the stone-lined low area were used to construct the eastern berm on the Front Forty.

- An earthen spillway was constructed along the northern berm to allow for drainage of storm water runoff from the Front Forty into manhole MH-85. The spillway invert and side slopes were lined with erosion control matting and the surfaces downstream of the invert were lined with riprap underlain with geotextile fabric.

- Approximately 5,650 CY of topsoil was imported and a 4-inch thick lift was placed over the Front Forty area.

- A maintenance access road and turn around were constructed in the northwest corner of the Front Forty.

- The topsoil was hydro seeded.

- Erosion control matting was installed on the side slopes of the perimeter berm and along the centerline of the drainage swales.

Between August and October 2000, storm sewer cleaning was performed in SSA-3 and SSA- 4 to address sediments and debris related to the Front Forty. In addition, select storm sewer lines and the inlet formerly associated with the Front Forty were abandoned in-place. Post-ECM storm sewer sampling indicated that the ECM implemented in the Front Forty was successful in reducing PCB impacts to the storm sewer.

1.3.6 Blasland, Bouck, & Lee, Inc. – November 2004

In November 2004, BB&L submitted a report titled 2002 Investigation and Response Activities Summary Report, American Axle & Manufacturing Tonawanda, NY Forge Plant (BB&L, November 2004) to the GM ER & IES. The report summarized the results of an additional storm sewer investigation and storm sewer response activities completed in 2002.

A storm water sampling program was conducted during May 2002. Between May 10 and May 17, 2002, 144 samples were collected from seven locations. Storm water sampling results indicated that the average concentration of PCBs was 0.040 μg/L, with a maximum PCB concentration of 0.32 μg/L at manhole MH-55.

As part of the storm sewer response activities, an 8-foot section of collapsed pipe located near manhole MH-52 was repaired. This repair was made to reduce the amount of PCB-impacted soil surrounding the pipe entering the storm sewer system. In addition, the manhole was raised by approximately 4 inches and a solid manhole cover installed to reduce any PCB-impacted soil from entering the manhole. Due to the observation of oil in manhole MH-58, in June 2002 manhole MH-58 was cleaned, select laterals were abandoned, and a sealant was applied to the inside of the manhole. The purpose of the sealant was to mitigate the seepage of oil into the manhole from surrounding soils.

Storm sewer cleaning and videotaping was performed in July 2003. The purpose was to remove potentially PCB-impacted sediments and debris from the storm sewer lines. During the video inspection the following observations were made:

- Some production-related material entered MH-57 from an extruder machine;
- Several cracks in pipe sections were noted between MH-51 to MH-52, MH-58 to MH-59, and MH-59 to MH-60;
- Moderate staining was noted between MH-59 and MH-60;
- Hardened debris was present in pipe sections from MH-56 to MH-55 and MH-55 to MH-54; and
- Black sludge/tar like material was observed throughout pipe sections from MH-54 to MH-78 and MH-78 to MH-77.

1.3.7 Conestoga-Rovers & Associates – August 2003

In August 2003, CRA submitted a report titled Re-Routing and Abandonment Certification Report, Storm Sewer Segment from Manholes MH-54 and MH-76, General Motors Powertrain Group, Tonawanda Engine Plant, Tonawanda, New York (CRA, August 2003) to GM ER & IES.

The report summarizes the sampling, investigations, replacement and abandonment of pipe sections from MH-54 to MH-78 and MH-78 to MH-77. In the pipe sections from MH-54 to MH-78 and MH-78 to MH-77, swarf material (material produced by machining operations) and a black sludge/tar like material were identified during a July 2003 storm sewer cleaning and videotaping. Analytical results of the swarf and black sludge/tar indicated both materials were impacted by PCBs ranging in concentrations from 1.47 ppm to 4,000 ppm. Subsequent cleanings were able to remove the swarf material by dry vacuuming, but the tar-like material could not be removed. Following the cleaning, GM experienced three consecutive water quality exceedances for PCBs at SPDES permitted Outfall 001. As a result of the exceedances, a bypass pumping system was set up at manhole locations (MH-54, MH-78, and MH-77) to eliminate flow through the pipe sections containing the tar-like materials. Based on an engineering evaluation, it was determined that the most effective solution was to re-route the sewer system upstream of the impacted areas by installing new sewer lines and abandoning in-place the impacted lines.

A direct-push investigation was performed in September 2002. The purpose of the investigation was to determine if PCB-impacted materials had migrated to the exterior of the existing sewer lines, and to pre-characterize soil in the areas where the new sewer lines would be installed for off-site disposal. Analytical results indicated that PCB-containing material located within the storm sewer pipes had not migrated to the exterior of the pipes.

An analysis was performed on the tar-like material and results did not exceed any of the leachable guidelines in 40 Code of Federal Regulation (CFR) Part 761 or 40 CFR Part 260. Based upon the results, the USEPA and NYSDEC concurred that abandonment of the PCB-containing material in-place using a non-erodible cement grout was an acceptable alternative to removal.

Between August 19, 2002, and September 7, 2002, the bypass at MH-54 was installed, connecting MH-54 to the GM Plant #4 mainline storm sewer. Between September 9, 2002, and September 23, 2002, the bypass at MH-78 was installed, connecting MH-78 to drop inlet DI-LH. Between September 11, 2002, and October 2, 2002, the bypass at MH-77 was installed, connecting MH-77 to MH-76.

On October 2, 2002, the storm sewer lines that ran from MH-54 to MH-76 were abandoned by backfilling with cement bentonite grout.

1.3.8 Groundwater & Environmental Services, Inc. – October 2012

In October 2012, Groundwater Environmental Services (GES) submitted a report titled Limited Environmental Site Assessment and Site Activities Summary Report, Tonawanda Forge, 2309 Kenmore Avenue, Tonawanda, New York 14207, NYSDEC Spill #0911809, NYSDEC Spill #1112690 (GES, October 2012) to the NYSDEC. The purpose of the limited Environmental Site Assessment (ESA) was to assess potential environmental conditions identified during numerous field visits, sampling events, and site investigations performed by GES at the Site. In addition to the ESA, GES was tasked by the NYSDEC with documenting various remedial activities being performed at the Site by Lewis' demolition contractor and other NYSDEC contractors performing remedial activities at the Site.

The GES ESA was performed from August 2011 through September 2012. The following activities were performed/documented during the ESA:

- GES performed a review of building schematics, blueprints, and documents left at various locations throughout the Site.
- In August 2011, GES started a field inspection to identify potential subsurface recognized environmental conditions (RECs). On September 2, 2011, GES sampled 23 of the RECs to assess the extent of contamination.
- GES conducted a subsurface investigation in October and November 2011 consisting of the advancement of 66 soil borings and the installation of six monitoring wells. On November 28, 2011, groundwater samples were collected from six new and one existing monitoring wells.
- In November 2011, GES collected samples to check the roof and two transformers located on the roof for PCBs.
- In November and December 2011, Op-Tech Environmental Services, Inc. of Buffalo, New York (Op-Tech), cleaned and decommissioned numerous vaults and drains for the NYSDEC. After the vaults and drains were cleaned, they were backfilled with clean clay brought on-site to minimize safety

hazards. GES, at the request of the NYSDEC, conducted periodic site visits to observe and document the remedial activities.

- On December 19, 2011, during the demolition of the Forge building, two roof-mounted transformers were damaged by Titan Wrecking and Environmental, LLC of Tonawanda, New York (Titan), resulting in the release of PCB-containing oil to the concrete floor of the Forge area below. As directed by the NYSDEC, GES collected samples and conducted periodic site visits to observe and document remedial efforts by Lewis' subcontractors at the spill location (NYSDEC Spill #1112690).

- In January 2012, the Site flooded due to the storm sewer lines being blocked where they flowed into the GM storm sewer. The flooding spilled over into the GM property.

- In March 2012, Lewis brought in equipment to store, treat, and discharge the PCB contaminated surface water.

- In March 2012, GES performed a supplemental subsurface investigation of the Front Forty, which was identified in the ESA as the "eastern berm area". The purpose of the investigation was to investigate potential impacts to soil and groundwater in the Front Forty. The supplemental investigation included the advancement of 21 soil borings, collection of soil samples, and the collection of a water sample from ponded surface water located within the Front Forty.

- In March 2012, GES also collected a series of PCB wipe samples to determine the extent of PCB contamination on the concrete floor of the Forge area where PCB-containing oil was spilled in December 2011.

- In March and April 2012, environmental remediation activities were conducted in the FormTech area (i.e., hot former area). The remedial activities were performed by Titan and Modern Corporation of Lewiston, New York (Modern). Remediation activities included demolition and vault and trench cleaning. After the vaults and trenches were cleaned, they were backfilled with clean clay brought on-site to minimize safety hazards. GES conducted periodic site visits to observe and document remedial activities.

- In April 2012, Empire Geo Services, Inc. of Hamburg, New York (Empire) was contracted by the NYSDEC to perform on-site treatment of the PCB-impacted surface water. The treated water was confirmed to be in compliance with the Town of Tonawanda Wastewater Treatment facility applicable guidelines and discharged to the storm sewer along UAW-GM Boulevard.

- On May 3, 2012, GES collected a series of PCB wipe and bulk samples to determine the extent and degree of PCB contamination associated with the PCB oil spill and to determine if PCBs had been tracked outside the spill area by vehicular and foot traffic. GES submitted a plan titled Workplan to Address PCB Surface Impacts to the NYSDEC on May 18, 2012.

- Between May and July 2012, Op-Tech cleaned and decommissioned numerous vaults and drains in the front Forge area for the NYSDEC. In addition, an oil/water separator located at the west side of the building was cleaned. After the vaults and drains were cleaned, they were backfilled with clean clay brought on-site to minimize safety hazards. After the oil/water separator was cleaned it was backfilled with concrete rubble. GES, at the request of the NYSDEC, conducted periodic site visits to observe and document the remedial activities.

- In July and August 2012, GES, under the direction of the NYSDEC, performed remediation of the PCB spill area. Remediation consisted of the demolition and disposal of the former transformer room and surrounding areas, and the milling of the impacted concrete and brick floor of the Forge area. GES contracted Todd Erection Corporation of Lockport, New York (Todd Corp.) to perform the concrete milling. Bulk samples were collected and analyzed for PCBs to confirm that the milling removed PCB-impacted concrete.

- In September 2012, GES coordinated the disposal of PCB-impacted materials generated during the remediation of the PCB spill area.

Based on the activities that were performed and documented during the ESA, the following observations and conclusions were made by GES:

Solid Samples

PCBs have impacted various solid materials at the Site which include: concrete/brick found on the floor of the Forge building and wooden brick portions of the floor of the Forge building. Wipe and bulk samples from concrete/brick found on the floor of the Forge building indicated the presence of PCBs at concentrations ranging from non-detect (ND) to 280 milligrams per kilogram (mg/kg). Bulk samples from the wooden brick flooring material, indicated the presence of PCBs at concentrations ranging from 0.56 to 29 mg/kg. Because of these detections, the wooden brick flooring was removed from the site. The bulk sample locations were later removed via milling of the concrete.

Subsurface Soils

PCBs were detected in subsurface soil beneath the former Forge building and in the Front Forty. PCBs in the subsurface soils beneath the former Forge building ranged from ND to 290 mg/kg at depths from 1 foot to 12 feet bgs, with the highest concentrations being detected in the fill material which was on average approximately 3 feet thick. PCB impacts were generally not detected in the native clay till underlying the fill material and if they were detected, were two to three orders of magnitude lower than the concentrations found in the fill material. The highest concentrations of PCBs in the subsurface soils beneath the former Forge building occurred in the vicinity of the 300 ton presses (i.e., Tie Rod Socket area).

PCB-impacted soils were detected in subsurface soil beneath the Front Forty. PCBs in the subsurface soils at depths from 2 feet to 8 feet bgs ranged from ND to 69 mg/kg detected in the fill material, which was on average approximately 6 feet thick. PCBs were not detected in the native clay till underlying the fill material.

Groundwater

Groundwater samples collected from six new and one existing monitoring well indicated the presence of only common laboratory contaminants [acetone and bis(2-ethylhexyl)phthalate] in three of the seven monitoring wells. Semivolatile organic compounds (SVOCs), metals, and PCBs were not detected in the groundwater samples collected.

Surface Water

Surface water samples were collected from the Front Forty ponded area and the flooded driveway/parking area. The surface water sample collected from the Front Forty ponded area indicated concentrations below applicable NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values for surface waters, with the exception of acetone. Surface water samples collected from the flooded driveway/parking area by both Titan and GES exceeded NYSDEC TOGS 1.1.1 values for PCBs and ranged from 3.9 to 350 µg/L.

Manhole Water

Water samples were collected from two manholes (MH-1 and MH-2) adjacent to the PCB oil spill area. Analytical data showed concentrations of PCBs that ranged from 7.99 to 1,254 µg/L.

PCB Oil Spill Cleanup

A total of 37 wipe and seven bulk samples were collected prior to remedial activities in the PCB spill area and surrounding areas. Wipe sample results from the concrete and brick surfaces indicated the presence of total PCBs ranging from 16.6 to 18,000 micrograms per 100 square centimeters (µg/100 cm^2). Bulk samples from the concrete and brick surfaces indicated the presence of total PCBs ranging from 2.7 to 280 mg/kg.

Following remedial activities in the PCB spill area, four bulk samples were collected from the milled concrete and brick. The results indicated the presence of total PCBs ranging from 0.48 to 28.1 mg/kg.

1.4 Remedial Investigation

The objective of the Remedial Investigation (RI) was to define the horizontal and vertical extent of contamination related to the Site in on-site sewers, manholes/catch basins, solid surfaces (i.e., brick, concrete, and asphalt), surface and subsurface soils, surface water, and overburden groundwater. The Remedial Investigation report prepared by URS and dated January 2018 is summarized below.

1.4.1 Site Conditions

Subsurface information indicates that the following textural units underlie the Site, from the surface downward: Fill, Silty Clay Till, Lacustrine Clay, and bedrock. Bedrock was not encountered in the on-site borings, which were advanced to a maximum depth of 30 feet. The unconsolidated units are described as follows:

- The Fill varies in thickness from 0 to approximately 14 feet thick and consists of a heterogeneous mixture of black, brown, and gray silt, sand, and gravel containing trace to some amounts of brick, crushed stone, foundry sand, wood, and slag. The thicker fill areas (i.e., greater than 8 feet) are associated with former basements, vaults, utility trenches, and remediated areas.

- The Silty Clay Till extends from 1 and 14 feet bgs down to 24 feet bgs. This unit consists of brown to reddish brown silty clay with traces of silt and fine, rounded gravel. The till was moist and stiff to hard in consistency. Laboratory permeabilities for the unit are on the order of 1×10^{-8} cm/sec. Discontinuous brown to gray sand lenses observed within the Silty Clay Till Unit vary in thickness from a few inches up to 4 feet.

- The Lacustrine Clay occurs beneath the Silty Clay Till at depths ranging from 24 to 30 feet bgs. The Lacustrine Clay was observed to be a reddish brown to gray brown, moist, and soft to medium stiff in consistency. The laboratory permeability of the Lacustrine Clay was measured at 2.0×10^{-8} cm/sec.

The primary hydrogeologic units at the Site are a discontinuous perched water table in the Fill and the water table in the Silty Clay Till. The depth to the fill unit groundwater ranged from about 1 to 6 feet bgs and groundwater in the Silty Clay Till was encountered from about 2 to 15 feet bgs.

Overall groundwater flow in the fill unit groundwater is toward the west with a horizontal hydraulic gradient that ranges from 0.0001 to 0.0336 foot per foot (ft/ft). Horizontal hydraulic conductivity obtained from field testing indicates values ranging from 3.73×10^{-5} cm/sec to 8.07×10^{-3} cm/sec.

A relative high in the groundwater surface occurs in the eastern portion of the site and is likely due to groundwater recharge through the fill in AOC-1. Groundwater flow in the Silty Clay Till across the western portion of the site is generally toward the west. The horizontal hydraulic gradients in the Silty Clay Till range from 0.0037 to 0.0226 ft/ft. Horizontal hydraulic conductivity values for the Silty Clay Till range from 7.11×10^{-8} cm/sec to 5.47×10^{-3} cm/sec with the higher hydraulic conductivity associated with sand lenses within the unit.

The surface of the Site is almost entirely covered by buildings, concrete, brick, wood blocks and/or pavement, with the exception of AOC-1 which is covered with grass. The sewers previously flowed into the GM-Tonawanda facility storm water system and ultimately discharged through GM's SPDES permitted Outfall 001. Several sewers, manholes and catch basins were re-routed, abandoned and plugged by GM during remedial activities. After Lewis took ownership of the property and began demolition, GM installed bulkheads in their manholes to keep storm water which contained PCBs from entering their storm water system. As a result, surface water does not drain from the Site and ponds on the surface across the Site. The ponded surface water slowly disappears by either evaporation and\or downward percolation through cracks in the surface material and into the Fill water-bearing zone. Also, runoff water has been observed flowing from the ponded area on the east side of AOC-1 across the sidewalk onto Kenmore Avenue.

1.4.2 Summary of Analytical Results

No background samples were collected. Therefore, the analytical results were only compared to promulgated and un-promulgated standards, criteria, and guidance values.

The groundwater analytical results are compared to Class GA groundwater standards, criteria, and guidance values (SCGs) presented in TOGS 1.1.1 and the surface water analytical results are compared to Class A surface water SCGs also presented in TOGS 1.1.1.

Soil and sediment analytical results were compared to three 6 New York Code of Rules and Regulations (6 NYCRR) Part 375 Soil Cleanup Objective (SCO) categories:

- Unrestricted Use
- Protection of Groundwater
- Industrial Use

The Unrestricted Use category is required by DER-10 Section 4.4 (b) 3 ii. The level and extent of contamination found at the Site makes it unsuitable for unrestricted use without remediation.

The Protection of Groundwater category is used to address the potential for residual soil contamination to leach and act as a long-term source of groundwater contamination. For organics, the Protection of Groundwater criteria are based on the ability of organic matter in soil to adsorb organic chemicals and prevent them from leaching out of the soil. The criteria are calculated using a default fraction of organic carbon value and published soil-water partition coefficients. For inorganics, published soil-water distribution coefficients are used. As such, the Protection of Groundwater criteria were developed using generic site conditions and may not accurately reflect actual Site conditions. As a result, it is prudent to evaluate exceedances of Protection of Groundwater criteria in comparison to actual contaminant concentrations in groundwater. The following presents a broad summary of contaminant conditions at the Site. Because contaminant concentrations exceed Unrestricted Use criteria across most of the Site, the Unrestricted Use category is not included in this summary.

1.4.2.1 Asbestos Containing Materials Impacts

Asbestos containing material (ACM) is present on the ground surface in every AOC except for AOC-1. These materials are primarily roofing material left over from the demolition, and sealant used between concrete sections.

1.4.2.2 Surface Cover Impacts

The site is primarily covered by concrete and asphalt. Areas formerly inside the buildings exposed after demolition also include surface cover with brick, and tile. All except one wipe samples collected exceeded the 40CFR 761.79 decontamination standard of 10 μg/100 cm^2 for PCBs. However, only one brick chip sample exceeded the threshold of 50 mg/kg that requires disposal as a hazardous waste.

1.4.2.3 Soil Impacts

No volatile organic compounds (VOCs) were detected in the soils at concentrations exceeding Industrial Use criteria. Acetone exceeded Unrestricted Use and Protection of Groundwater criteria in AOC-01, AOC-02, AOC-06, AOC-09, AOC-10, AOC-13, AOC-14, AOC-16 and North of AOC-14; and methylene chloride exceeded Unrestricted Use and Protection of Groundwater criteria in AOC-13 and the parking lot.

SVOCs, primarily polycyclic aromatic hydrocarbons (PAHs), were detected in aboveground storage tank (AST)/manhole/catch basin sediments, surface soils, and subsurface soils at concentrations exceeding Unrestricted Use, Protection of Groundwater and Industrial Use criteria. In general, SVOC concentrations were relatively low, within one order of magnitude of the SCOs. The Site is located in an industrial area and it is possible that PAHs detected at the Site may reflect, in part, background conditions.

PCBs were detected in AST/manhole/catch basin sediments, surface soils, and subsurface soils at concentrations exceeding Unrestricted Use, Protection of Groundwater, and Industrial Use criteria. The highest PCB levels in soils were found in AOC-8, AOC-12, AOC-13, and AOC-15. PCBs were also in stained concrete.

The presence of arsenic in soils at concentrations exceeding its Industrial Use criterion was found at several locations in AOC-1 and AOC-5 and at one location in AOC-8 and AOC-12. Mercury was detected in one location in AOC-1 at a concentration exceeding the Industrial Use criterion.

Table 1-1 summarizes which AOCs and surface soil samples (taken outside AOC boundaries) exceed the Unrestricted Use, Protection of Groundwater, and Industrial Use criteria for SVOCs, PCBs, and arsenic.

1.4.2.4 Groundwater Impacts

Two groundwater sampling events were conducted during the RI (January 2014 and November 2106). With the exception of acetone and methylene chloride in the first event only, no VOCs were detected in groundwater at concentrations exceeding NYSDEC TOGS (1.1.1) Class GA groundwater standards. Acetone and methylene chloride are common laboratory contaminants and the sporadic detections of these two VOCs suggests that they are not Site contaminants.

With few exceptions, SVOCs were not detected in groundwater at concentrations exceeding criteria. Exceptions included six detections of phenolic isomers (i.e., phenol, cresols), one detection of bis(2-ethylhexyl)phthalate (in the first event only), and one detection of PAHs. These isolated detections do not suggest the presence of an SVOC plume beneath the Site.

PCBs were detected in groundwater at concentrations exceeding criteria at numerous locations across the Site. In general, PCB impacts are relatively low. However, PCB impacts in AOC-13 are considerably higher than at other locations across the Site. As noted above, some of the highest PCB in soil impacts were detected in AOC-13, and adjacent AOC-12 and AOC-15.

Arsenic, chromium, lead, selenium and/or thallium were detected above groundwater criteria in only AOC-1, AOC-5, AOC-12, AOC-13, and AOC-16. Iron, magnesium, manganese, and sodium were also detected above their relevant criteria at numerous locations across the Site. However, the ubiquitous presence of these metals in groundwater suggests that these detections may represent background groundwater conditions.

1.4.2.5 LNAPL Impacts

Eight light non aqueous phase liquid (LNAPL) samples were collected: two from ASTs, one from a standpipe, four from manholes and one from a monitoring well. LNAPL thicknesses in seven of the eight samples ranged from 1/8-inch to 1-inch. The LNAPL present in the monitoring well (AOC-14-MW-21I) was measured at 96 inches. Three LNAPL samples were identified as motor oil, one sample (AOC-14-MW-21I) as diesel fuel, and the remaining four samples were unknown petroleum hydrocarbons. Four of the samples (AOC-14-MW-21I, MH-59, MH-108 and MH-120) contained PCBs at concentrations greater than 50 mg/kg and are considered hazardous wastes. The location of all manholes can be found on Plate 1. Periodic removal of the LNAPL in AOC-14-MW-21I is ongoing as an Interim Remedial Measure (IRM). The source of this LNAPL and its removal is currently the subject of further investigation and further removal through a more extensive IRM. This FS assumes that this material, and its source, is removed via this IRM and is not addressed further.

1.4.2.6 Sewer System Impacts

A complex network of utilities underlies the Site. Available information indicates the presence of electrical lines, storm sewers, sanitary sewers, non-contact cooling water, perforated pipe, industrial waste lines, fire protection, and mill water lines. Surface expressions of these systems consist of manholes, catch basins, and current and former roof drains. The available information indicates that storm and sanitary sewers ran from the eastern, upgradient portion of the Site to the former industrial waste treatment plant on the western side of the Site. Discharge from the treatment plant would have been to the west via a storm sewer. As previously stated, sewers leading off Site have been plugged.

Accessible manholes and catch basins were opened and inspected. Sediment samples were collected from those manholes that contained a recoverable volume of sediment. Also, LNAPL samples were collected from four manholes; sediment sampling at these four locations was not attempted.

The catch basins and the majority of manholes sampled were associated with the storm sewer system; manholes MH-119 and MH-120 appear to be associated with the IW line, and manholes MH-117, MH-126, and MH-137 were associated with the sanitary sewer.

LNAPL

LNAPL was present in manholes MH-59, MH-108, MH-119, and MH-120. As mentioned above, manholes MH-119 and MH-120 appear to be associated with the IW line. Manhole MH-108 might be associated with the IW line. The sample from MH-108 was identified as motor oil, the sample from MH-119 as an unknown petroleum hydrocarbon, and the sample from MH-120 as motor oil.

Manhole MH-59, located on the southern side of the Site, is associated with the storm sewer system. The analytical results were inconclusive, identifying the sample as an unknown hydrocarbon.

It is noted that LNAPL, identified as No. 2 fuel oil, was found in monitoring well AOC-14-MW-21I. It is suspected that during drilling, the drill rig might have punctured a fuel pipeline, resulting in a release of the product into the formation.

Sewer Sediments

Sewer sediment samples were collected from 34 catch basins and 11 manholes. There are no cleanup standards specific to sewer sediments. Because the sediments are located at depth and could be encountered by a construction worker during future development, the analytical results were compared to Part 375 Industrial Use SCGs for soil. The results were also compared to Unrestricted Use and Protection of Groundwater SCGs, however, because Industrial Use is the most applicable category for the sewers, the following discussion focuses on the evaluation of the sediment results with respect to the Industrial Use SCGs.

Sediment samples from 10 manholes and 28 catch basins contained at least one PAH, PCB, or metal at a concentration exceeding the Industrial Use SCGs. Benzo(a)pyrene, which has a very low Industrial Use SCO, was the predominant PAH exceeding criteria. In general, PAH concentrations were relatively low, within one order of magnitude of the Industrial Use criteria. However, the highest PAH concentrations detected in AOC-12 manhole MH-51 had PAH levels more than two orders on magnitude above the Industrial Use criteria.

PCBs were detected at concentrations above the Industrial Use criteria at 15 locations. The predominance of PCBs in manholes and catch basins on the west side of the Site suggests possible impacts along the sewer lines in that area (i.e., not just in the manholes and catch basins). PCB concentrations in the western manholes/catch basins ranged from 32 to 880 mg/kg.

In the southern portion of the Site, PCBs were detected above the Industrial Use SCG in manholes MH-128, and MH-132. These manholes appear to be associated with the industrial waste sewer line.

Also in the southern portion of the Site, PCBs were detected above the Industrial Use SCG in catch basin CB-33, which appears to be an isolated location of PCB impacts in the southern side catch basins.

Sewer system drawings are incomplete; the exact pipeline sizes and routing are unknown. As a result, the volume of impacted sediments in the sewers cannot be determined.

1.4.2.7 Surface Water Impacts

One surface water sample was collected from the drainage swale adjacent to Kenmore Avenue (AOC-1-LF-SW-01) during the RI Phase I sampling event. A second surface water sample was collected from the parking lot during the RI Phase II sampling event (Parking Lot Water).

No VOCs or PCBs were detected above Class A surface water SCGs in either sample. PAHs were detected above Class A surface water SCGs in the AOC-1-LF-SW-01 sample. No SVOCs were detected in the parking lot standing water sample.

Metals exceeding Class A SCGs in the AOC-1-LF-SW-01 surface water sample were: aluminum, iron, lead, and zinc. No metals exceeded Class A criteria in the parking lot standing water sample.

1.4.3 Contaminant Fate and Transport

The Site and vicinity is mostly covered with asphalt and concrete. Also, the majority of contaminants detected in soil and groundwater are not readily volatile. As a result, the migration of contaminants in the gas phase is likely minimal, if any.

Contaminants of concern in groundwater are primarily limited to PCBs, arsenic and some phenolic isomers. Overall groundwater flow is to the west for both the Fill and Silty Clay Till water-bearing zones.

In the surface water sample collected from the Site parking lot, no compounds were detected at concentrations exceeding surface water criteria. The surface water sample collected from the east side of AOC-1, was collected from a drainage swale. The sample contained several PAHs and metals at concentrations above the surface water criteria. However, as no background or upgradient samples were collected, it is unknown whether the results reflect Site impacts or background conditions. It is likely that the PAHs and metals will sorb to sediments and are unlikely to degrade or otherwise be transformed. Consequently, contaminant transport may occur through physical transport of the surface water and sediment particles.

Many of the contaminants detected above SCGs in the sewer sediment samples were not detected above SCGs in either the soil or groundwater. This absence of groundwater impacts, along with the observed surface water ponding at the Site, suggests that the contaminants in the sewer systems are contained and not migrating.

1.4.4 Qualitative Human Health Exposure Assessment (QHHEA)

A Qualitative Human Health Exposure Assessment (QHHEA) determined that under current and future use conditions, there are completed exposure pathways from soil, surface water, sewer sediment, and groundwater.

It is unlikely that indoor air would present an exposure issue if buildings were constructed. However, without further remediation, a soil vapor intrusion evaluation would need to be completed if the on-site buildings became reoccupied or if buildings were constructed in the future.

1.4.5 Fish and Wildlife Resources Impact Analysis (FWRIA)

The Site is located in a highly urbanized and industrial area. Plant communities in the project area are limited. The results of the Fish and Wildlife Resources Impact Analysis (FWRIA) Step I analysis indicate that there is limited potential for wildlife at the Site due to lack of suitable habitat. The Site does not provide any current or potential value to humans as a nature recreation area. It is unlikely that the Site is impacting habitats or species in the upper Niagara River, including Beaver Island, Strawberry Island and Motor Island.

1.5 Interim Remedial Measure

During the Phase I Remedial Investigation carried out at the Tonawanda Forge Site, the presence of three large C&D debris piles hampered investigation activities. These piles were sampled for Site contaminants of concern, and an asbestos survey of the surficial debris piles was conducted. The piles were found to contain asbestos, as well as PCBs in excess of Toxic Substances Control Act (TSCA) criteria. The objective of this IRM was to characterize, remove, and dispose of these debris piles in accordance with all regulatory requirements to enable completion of remedial investigation activities hampered by the piles.

Between October 12, 2015 and February 9, 2016, a total of 2,321.84 tons of Non-TSCA Waste and 3,680.08 tons of TSCA Waste were removed from the Site and disposed of in accordance with all applicable New York State and Federal regulations. The C&D debris piles were completely removed, with the underlying areas returned to the same elevations as the surrounding grade. However, other ACM and PCB contamination remains at the Site. ACM is present on the ground surface across the Site in floor tiles and grout, except for in AOC-1; PCB contamination is present in sediments in numerous catch basins and manholes at the western end of the Site.

1.6 Standards, Criteria and Guidance Values

For each medium, detected concentrations of individual contaminants were compared to applicable SCGs. The site-specific SCGs were determined for the individual media as follows:

1.6.1 Soil

Part 375 SCOs are considered as SCGs for soil samples in conjunction with CP-51 criteria. CP-51 supplements Part 375 by providing criteria for contaminants where values were not included in Part 375. Hereafter, mention of Part 375 SCOs includes incorporation of CP-51 criteria values. Part 375 Unrestricted Use criteria are considered to assist in the development of a remedial alternative capable of achieving unrestricted future use, as required by DER-10 Section 4.4 (b) 3 ii. In addition, criteria for the Protection of Groundwater are considered as SCGs for contaminants which exceed groundwater SCGs.

The property from which the soil samples were collected is zoned General Industrial District. The zoning classification for the property is a consideration in the determination of the appropriate soil SCGs. Industrial Use criteria have been applied to the soil samples.

1.6.2 Groundwater

The SCGs for groundwater are the Class GA standards and guidance values presented in NYSDEC TOGS 1.1.1.

1.6.3 Surface Water

The SCGs for surface water are the Class A standards and guidance values presented in NYSDEC TOGS 1.1.1. The most stringent of the following protection types were applied: Source of Drinking Water [H(WS)], Human Consumption of Fish [H(FC)], Fish Propagation [A(C)], Fish Survival [A(A)], Wildlife Protection [W] or Aesthetic [E]. The Niagara River is the nearest body of water to the site. The Niagara River is identified as a “Class A-Special” body of water, as per 6 NYCRR Part 837.4, Table I.

1.6.4 Sewer Sediment

Sediment samples were collected from sewer manholes and catch basins on Site. The manholes and catch basins are not connected to public owned treatment works sewers or outfalls. These samples were collected for the purpose of evaluating levels of contamination and for the determination of disposal requirements. The analytical results are compared to Part 375 Unrestricted Use, Protection of Groundwater and Industrial Use criteria since the sewers have been determined to be leaking to adjacent soil and groundwater.

1.6.5 Concrete, Asphalt, and Brick

Samples were collected from concrete, asphalt, and brick. These samples were collected for the purpose of evaluating the presence of PCB contamination. The applicable standards are found in 6 NYCRR Part 371.4 (e) and 40 CFR Part 761.

1.6.6 Wipes

Wipe samples were collected from various non-porous surfaces at the site. These samples were collected for the purpose of evaluating levels of PCB contamination. There are action-specific, but no location-specific (e.g. cleanup objectives) applicable standards in 40 CFR Part 761. This section defines “contaminated” as greater than 10 μg/100 cm^2, but less than 100 µg/100 cm^2 of total PCBs. Surface concentrations <100 µg/100 cm^2 shall be disposed of in accordance with paragraph (a)(5)(i)(B)(2)(ii) of 40CFR Part 761.61.

2.0 REMEDIAL GOAL AND OBJECTIVES

2.1 Goal and Objectives

The remedial goal for the site is to restore the site to pre-disposal conditions, to the extent feasible. At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by contaminants disposed at the site through the proper application of scientific and engineering principles. To meet this goal, remedial action objectives (RAOs) have been established. These RAOs provide the basis for selecting appropriate remediation technologies and developing remedial alternatives for the site. RAOs were established based on contaminated media, identified contaminants of concern, SCGs, and results of the QHHEA and FWRIA as presented in the RI.

Media	RAO for	Remedial Action Objectives
Asbestos	Public Health Protection	o Prevent direct contact with contaminated media.
Concrete, Asphalt, and Brick	Public Health Protection	o Prevent ingestion or direct contact with contaminated media.
Soil	Public Health Protection	o Prevent ingestion or direct contact with contaminated soil.
Soil	Environmental Protection	o Prevent migration of contaminants that would result in groundwater, surface water or sediment contamination.
Groundwater	Public Health Protection	o Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards. o Prevent contact with contaminated groundwater.
Groundwater	Environmental Protection	o Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable. o Prevent the discharge of contaminants to surface water or sediments. o Remove the source of groundwater contamination.

Media	RAO for	Remedial Action Objectives
Sewer Sediments	Public Health Protection	o Prevent ingestion or direct contact with contaminated sediments.
Sewer Sediments	Environmental Protection	o Prevent migration of contamination from the sewers to the groundwater.
Soil Vapor	Public Health Protection	o Prevent migration of contaminated soil vapor from underground sources into the indoor air of buildings via soil vapor intrusion.
Surface Water	Public Health Protection	o Prevent ingestion or direct contact with contaminated surface water.

2.2 Remediation Areas and Volumes

The extent of contamination in the media of concern is discussed below. These areas and volumes have been developed based on the characterization information provided in the RI report and will serve as the basis for development and evaluation of alternatives in this FS.

2.2.1 Asbestos

An asbestos survey was performed during the RI. The survey showed ACM throughout the site except AOC-1. However, the material is primarily some roofing material not collected following demolition, and sealant between concrete floor sections. This material does not require removal; however, if excavation is performed in areas where asbestos is present, it would have to be disposed of properly in accordance with the appropriate New York State Department of Labor regulations.

2.2.2 Concrete, Asphalt and Brick

No contaminants were found in asphalt samples. Brick sample results exceeded 50 ppm total PCBs at one location, AOC-02-CC-01 (92 ppm). PCBs had previously been detected in chip samples collected from concrete, but the areas where they were detected have been milled and removed in 2012. Only one sample collected from this area during the RI (which was performed after the area had been milled) exceeded 50 µg/kg. All but one wipe samples exceeded the 40CFR Part 761 criterion for PCBs to be considered "contaminated" (10 µg/100 cm^2). However, only 2 samples exceeded 100 µg/100 cm^2 which would require disposal in a hazardous waste landfill or comparable approved facility. The area of concrete contamination is assumed to be 100 square feet per sample and assuming an average thickness of 1 foot of contamination, corresponds to 200 cubic feet of concrete requiring disposal in a hazardous landfill or comparable approved facility. The area of brick contamination is assumed to be 400 square feet to a depth of one foot for a total of 400 cubic feet of brick requiring disposal in a hazardous landfill or comparable approved facility. Only these materials are addressed in this FS.

2.2.3 Surface Soil

For the purpose of this FS and discussion of the remediation areas, surface soil is considered to be soil that extends from the surface to one foot bgs. The surface soil samples, including soil boring samples that were collected within the first one foot of depth, are shown on Figure 2-1, and results are provided for detections above Part 375 Industrial Use SCOs.

The zones of surface soil contamination can be broken into two sections. In the eastern portion of the site, the parking lot and AOC-1, the majority of samples showed the presence of benzo(a)pyrene or arsenic slightly above their Industrial Use SCOs of 1.1 mg/kg and 16 mg/kg, respectively. It is likely that such concentrations exist throughout this entire area. It is anticipated that the entire eastern half of the site exceeds these criteria. However, a volume estimate is not calculated as it would be difficult to excavate these areas to a clean endpoint. Protection of public health and the environment would be better afforded by covering.

Within the area of the former forge building, the western half of the site, surface samples were collected in AOCs 7, 8, 9, 10, 11, and 12. The other AOCs were covered with the former building floors. These results show no exceedances in AOCs 8, 10 and 11. One of the three samples from AOC-7 had benzo(a)pyrene at 1.3 mg/kg, just barely over its SCO of 1.1 mg/kg. AOC-9's eight samples were below Industrial Use SCOs, with the notable exception of AOC-09-SS-05 where multiple PAHs were detected, with total PAH concentrations over 500 mg/kg. All but two of the surface soils from AOC-12 exceeded Industrial Use SCOs for PAHs, with two detections of total PCBs and one detection of arsenic above its SCO. Based on these results, all of AOC-12, and a portion of AOC-9 (see Figure 4-1) are considered above Industrial Use SCOs, with an estimated area of 44,000 square feet and an estimated volume of 1,630 cubic yards based on a depth of 1 foot.

2.2.4 <u>Subsurface Soil</u>

For this FS, subsurface soil is considered to be soil that is deeper than one foot bgs. The subsurface soil sample results are shown on Figure 2-2, and results are provided for detections above Part 375 Industrial Use SCOs. As with the surface soils, the zones of subsurface soil contamination can be broken into two sections.

In the eastern portion of the site, the parking lot and AOC-1, the majority of samples showed the presence of benzo(a)pyrene or arsenic slightly above their Industrial Use SCOs of 1.1 mg/kg and 16 mg/kg, respectively although there are also two exceedances of PCBs at 33.4 mg/kg and 37 mg/kg. It is likely that such concentrations exist throughout this entire area. It is anticipated that the entire eastern half of the site exceeds these criteria. However, a volume estimate is not calculated as it would be difficult to excavate these areas to a clean endpoint. Protection of public health and the environment would be better afforded by covering.

Within the area of the former forge building, the western half of the site, subsurface samples were taken from all AOCs. The majority of the samples did not exceed Industrial Use SCOs, and those that did primarily were for benzo(a)pyrene, arsenic, or PCBs. CP-51 Section V.H allows for the use of a PAH cleanup value of 500 mg/kg total PAHs. None of the subsurface soil samples exceeded this threshold. The samples exceeding SCOs for arsenic and PCBs are found in AOC-5 (exclusively arsenic), an isolated arsenic detection in AOC-8, and isolated (single) PCB detections in AOCs 8, 10, 13, and 15. The depths of contamination range from just below surface (i.e. to 3 feet bgs or less) except for the four samples in AOC-5 which are as deep as 10.7 feet bgs and AOC-8, which are as deep as 5 feet bgs. Groundwater is present in the fill zone at depths of 1 to 6 feet bgs and in the till zone between 2 to 15 feet bgs, so the majority of the subsurface soils are present in the saturated zone. Anticipating an area of 400 square feet for each of the five isolated detections and an area of 2,000 square feet for the 4 samples in AOC-5, approximately 4,000 square feet of subsurface contamination exceeds Industrial Use SCOs, and corresponds to about 1,020 CY of material based on excavation depths ranging from 2 feet to 10 feet.

2.2.5 Groundwater

Figures 2-3 and 2-4 show the locations from the November 2016 sampling event where contaminants exceeded groundwater criteria in the fill unit and glacial till unit, respectively. Criteria were exceeded for SVOCs, PCBs, and metals. For the FS, it is anticipated that the groundwater is contaminated throughout the site.

2.2.6 Sewer Sediments

There are no specific criteria for sewer sediment contaminant concentrations, but for this evaluation, they are compared to both the Part 375 Industrial Use SCOs, and, because of the potential for water to flow through the sewers and leak to the subsurface, the SCOs for protection of groundwater. The contaminated sewer sediment analytical results exceeding these criteria are shown in Figure 2-5. Data is insufficient to determine the quantity of contaminated sediments in the sewer. PCBs are present in the vast majority of the sediment samples collected, and thus it is anticipated that the entire sewer system on the site is contaminated.

2.2.7 Surface Water

Surface water does not drain from the Site and ponds on the surface across the Site. Also, runoff water has been observed flowing from the ponded area on the east side of AOC-1 across the sidewalk onto Kenmore Avenue. PAHs and metals (i.e., aluminum, iron, lead, and zinc) exceeding Class A SCGs were found in the surface water sample from the drainage swale adjacent to Kenmore Avenue. Remedial actions for both soil and groundwater will reduce the concentrations of contaminants in the surface water. However, surface water control will also be considered to prevent the migration of contaminated surface water and to reduce the impact that blocking the storm sewers has had on site drainage.

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Remedial technology identification and screening presented in this section consists of: identification of general response actions to satisfy the site-specific RAOs; identification of potentially applicable remedial technologies that fall within the general response categories; and screening of those technologies with respect to their relative effectiveness, technical implementability and cost in meeting the site RAOs. Technologies identified for this site have been selected from the host of technologies considered potentially effective, and primarily include those technologies that have been previously implemented successfully at other similar sites. The most promising technologies are retained and carried forward into the development of alternatives.

3.1 General Response Actions

General response actions are broad categories of remediation approaches capable of satisfying the RAOs for a site. Some response actions may be sufficiently broad to be able to satisfy all RAOs for the site as a whole. Other response actions must be combined to satisfy RAOs for impacted media. Remedial technologies have been identified which correspond to the general response actions of no action, containment, source removal, and treatment. A brief description of each of the general response actions follows:

No Action - The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that a no action alternative be evaluated as part of the Feasibility Study process. This alternative will be used as the baseline for comparison of remedial alternatives.

Institutional Controls - Institutional Controls are non-physical means of enforcing a restriction on the use of the property that limit human or environmental exposure, restrict the use of groundwater, provide notice to potential owners, operators, or members of the public, or prevent actions that would interfere with the effectiveness of a remedial program or with the effectiveness and/or integrity of site management activities at or pertaining to a site.

Containment - Containment measures are those remedial actions for which the purpose is to contain and/or isolate contaminants. These measures provide protection to human health and the environment by reducing exposure or migration of contaminants, but they do not treat or remove the contamination.

Removal - Excavation of soil or removal of contaminated media are remedial actions for which the purpose is to remove contaminants from the site and vicinity. Combined with on-site treatment or off-site treatment and/or disposal, source or contaminated media removal provides protection to human health and the environment by reducing exposure to or migration of contaminants.

Treatment – Treatment measures include technologies for which the purpose is to reduce the toxicity, mobility, or volume of contaminants by directly altering, isolating, or destroying those contaminants. Soil that is not excavated and groundwater may be treated in place (in-situ). In-situ treatment could potentially utilize biological, chemical/physical, solidification, or thermal processes.

3.2 Identification and Screening of Technologies for Soil

This section identifies and provides an initial screening of remedial technologies for contaminated soil at the site. Contaminated soil includes contaminated surface soil and contaminated subsurface soil. Potentially applicable remedial technologies within each general response action which could meet the remedial action objectives are identified and, identified technologies are screened with respect to their effectiveness, technical implementability and relative cost. This evaluation is based on the site characterization, which includes the types and concentrations of contaminants, and the geology and hydrogeology of the area.

3.2.1 Institutional Controls

Implementing institutional controls (ICs) would achieve the following:

- Manage potential exposure to residual contaminated soil, including procedures for soil characterization, soil excavation and handling, and the health and safety of workers and the community,
- Provide for disposal/reuse of excavated soil in accordance with applicable NYSDEC regulations and procedures;
- Restrict the use of the property to specified categories (the site is currently zoned industrial); and

Effectiveness: ICs would be effective in identifying residuals and controls required for those residuals at the site. This would assist in preventing direct contact with the contaminated media.

Implementability: ICs for the site would not be difficult to implement.

Cost: The cost for ICs would be relatively low.

Conclusion: ICs are retained for use at the site.

3.2.2 Containment

Soil covers, a low permeability cap, and vertical subsurface barriers are potential containment technologies for the site.

3.2.2.1 Soil Covers

A soil cover is a permeable cover that serves to provide a barrier against direct contact with contaminated soil. It would consist of 6 inches of imported soil, topped by 6 inches of topsoil to enable vegetative growth.

Effectiveness: A soil cover would be effective in preventing direct contact with contaminated soil and in preventing migration of contaminants to surface water. It is not effective in reducing surface water infiltration to the soil below.

Implementability: This technology is readily implementable.

Cost: The cost of soil covers is relatively low.

Conclusion: Soil cover is retained as a technology to prevent direct contact exposure.

3.2.2.2 Capping

A low permeability cap with geomembrane could be constructed over areas of the site not already covered by concrete or asphalt to limit infiltration, i.e. AOC-1 located on the northeastern portion of the site near Kenmore Avenue. The geomembrane would be placed on 6 inches of sand overlying the cleared and grubbed ground surface. A drainage layer, 12 inches of clean soil, and topsoil would be placed over the geomembrane to promote drainage and provide geomembrane protection.

Effectiveness: A geomembrane cap would prevent direct contact and reduce infiltration and contaminant leaching from this portion of the site. The cap would not stop groundwater continuing to flow through the site. Contamination from other portions of the site would continue to migrate in groundwater.

Implementability: Regrading would be required prior to cap installation and drainage features would have to be installed.

Cost: The cost of a geomembrane cap is considered to be moderate.

Conclusion: A geomembrane cap is not retained for the development of alternatives for the site.

3.2.2.3 Vertical Barriers

Vertical barriers considered potentially applicable for the site are sheet piling, soil cement walls, and jet grouting.

- Sheet piling – Sheet pile cutoff walls are constructed by driving interlocking steel or high density polyethylene (HDPE) into the ground. The joints between individual sheets are typically plugged with grout (when using steel sheets) or an expanding gasket (when using HDPE). Sheet piling may be used for structural support and soil and groundwater containment applications.

- Soil Cement Wall – A soil cement wall consists of a mixture of cement and native materials. The cement is introduced into the subsurface by an excavator or by augering through the overburden to the top of bedrock or low permeability clay layer. A soil cement wall may be designed for structural excavation support and soil and groundwater containment applications.

- Jet (pressure) Grouting – Jet grouting injects cementitious reagents under pressure into the ground. Under high pressure, the injected grout is blended with the soil and solidifies, reducing the hydraulic conductivity of the formation.

Effectiveness: Vertical barriers require the barrier to be keyed into an impervious layer to effectively cut off flow. Although lacustrine clay is present a depth at the site, it is not a continuous impervious layer as determined by the boring program. If there is no impermeable layer, groundwater can flow underneath the barrier limiting the effectiveness of the barrier in meeting RAOs.

Implementability: The vertical barriers would be difficult to construct because the site consists of fill that is very heterogeneous and contains significant amounts of below ground structures and C&D debris.

Cost: The relative cost of vertical cutoff walls is considered to be high and would depend on the depth and location.

Conclusion: Vertical barriers are not retained for the development of alternatives.

3.2.3 Excavation and Off-Site Disposal

Effectiveness: Excavation of contaminated soil and off-site disposal would be effective in removing the source of contamination and meeting the RAOs for soil.

Implementability: This technology is practical and implementable. PCBs are regulated by USEPA under Title 40 of the Code of Federal Regulations (40 CFR) Part 761, the regulatory implementation of TSCA. 40 CFR Part 761.61(a)(5)(i)(B)(2)(iii) requires PCB remediation waste at concentrations greater than or equal to 50 ppm to be disposed of in a permitted hazardous waste landfill, or an approved PCB disposal facility.

Cost: The cost for excavation and disposal of soil contaminated with PCB concentrations below 50 ppm would be moderate, but the cost of excavation and disposal of contaminated soil with concentrations of PCBs of 50 ppm or more would be high.

Conclusion: Excavation and off-site disposal of contaminated soil is retained for the development of alternatives.

3.2.4 Excavation and On-Site Treatment

Utilizing this method, contaminated soil is excavated by conventional equipment, treated on-site above ground, and then replaced on the site.

Effectiveness: Contaminants in soil include PAHs, PCBs, and metals. There is not one effective technology, other than possibly solidification, that would treat all these contaminants. Multiple technologies might be required to treat all the contaminants.

Implementability: There would be significant health and safety concerns for on-site workers and workers in nearby facilities if contaminated soil were treated on site resulting from potential air emissions and direct exposure. There would be significant administrative complications from handling and/or treating soil with PCBs above 50 ppm.

Cost: The cost of excavating and processing contaminated soil using proper health and safety measures and the use of multiple technologies for treatment would render this technology relatively high in cost.

Conclusion: Excavation and on-site treatment of contaminated soil with replacement on-site is considered to be difficult to implement and relatively higher in cost than other technologies. Excavation and on-site treatment will not be retained for the development of alternatives.

3.2.5 In-Situ Treatment

In-situ soil treatment technologies include: chemical and thermal processes designed to destroy or increase the mobility of contaminants prior to removal, in-situ solidification processes that reduce the mobility of the contaminants, or biological processes designed to destroy the contaminants.

3.2.5.1 Biological Treatment

Naturally occurring microorganisms in the soil promote the breakdown and detoxification of organic contaminants. In-situ biological treatment such as bioremediation may enhance that process in soil and groundwater. Water enhanced with nutrients, oxygen, and other amendments is delivered to contaminated soil to enhance biological degradation of target contaminants. An infiltration gallery could be used for the unsaturated zone and injection wells for the saturated zone.

Establishing a healthy microbial community able to actively degrade contaminant species at this site (PAHs and PCBs) will likely require biostimulation and/or bioaugmentation. Biostimulation is the addition of an amendment (i.e., a food source) and/or nutrients needed to create an environment supporting microbial growth. Bioaugmentation is the introduction of laboratory-grown microbes to introduce specific bacteria with the ability to degrade target contaminants or to strengthen an existing microbial community to speed up biodegradation. Contaminants present can be degraded via multiple pathways, aerobically (in the presence of oxygen), anaerobically (in the absence of oxygen), or co-metabolically (combination of aerobic in anaerobic conditions).

As with other in-situ applications, subsurface distribution is a key component in the potential success of bioremediation. In general, microbial communities are fixed to the soil matrix. Once suitable aquifer conditions are established, microbes can spread in all directions, which can increase subsurface distribution where surface access is limited or unavailable (i.e., below structures, utilities, etc.).

Effectiveness: This technology has had limited success on PAHs and PCBs and would be ineffective for metals and thus would have difficulty meeting RAOs for preventing exposure to these compounds. Given the concentrations of contaminants present, bioremediation would require a long time period and significant amendment materials to remediate site soil. This technology would have limited effectiveness in remediating contaminated soil in the unsaturated zone.

Implementability: An infiltration gallery and/or injection wells for delivery of materials to establish aquifer conditions conducive to biodegradation would have to be located on the upgradient edge of the site. Adequate subsurface distribution is required for contaminant treatment. Effective delivery of materials in the overburden may be difficult to implement due to the presence of fill creating heterogeneous conditions. Unsaturated conditions are present throughout the site and the majority of impacted soil is found at depth which would complicate the delivery system. Bench-scale laboratory analysis can be used to evaluate aquifer conditions and the amendments and/or additional microbial culture are needed.

Cost: The cost is considered to be moderate to high depending on the operating period and quantities of amendment materials required.

Conclusion: Biological treatment is not retained for the development of alternatives at the site.

3.2.5.2 Chemical Treatment

Treatment using in-situ chemical oxidation (ISCO) involves the delivery of a chemical oxidant to contaminated media to destroy target contaminants and convert them to non-toxic compounds. The rate and extent of degradation of organics using chemical oxidation are dictated by the properties of the contaminants and their susceptibility to oxidation. In addition, soil and groundwater matrix conditions (e.g., pH, temperature), and the concentration of other oxidant-consuming substances, such as natural organic matter and reduced minerals, affect the transport and reactions of both the oxidant and the target contaminants. Chemical oxidation reactions occur only with dissolved-phase contaminant materials and require contact between the oxidant and the contaminant. It is not effective on NAPL. ISCO is heavily dependent upon subsurface distribution and contact with target contaminant mass. For the unsaturated zone, an infiltration gallery would be used.

Effectiveness: This technology has had limited success on PAHs and PCBs and would be ineffective for metals. This technology would have limited effectiveness in remediating contaminated soil in the unsaturated zone. Thus this technology would have difficulty meeting RAOs for preventing exposure to these compounds

Implementability: ISCO reactions are aqueous in nature and adequate subsurface distribution is required for contaminant treatment. Access to the subsurface is required to allow adequate delivery of materials. Access to the subsurface is limited by onsite building slabs and underground utilities. Based upon this limited access to the subsurface and heterogeneity of the subsurface, this technology would be limited in effectiveness.

Cost: The relative costs of all ISCO processes are assumed to be moderate to high due to large quantities of oxidant materials required and the potential large number of injections required.

Conclusion: ISCO will not be retained for the development of alternatives.

3.2.5.3 Solidification

In-situ solidification (ISS) is the process of mechanical injection of a solidification mixture into contaminated subsurface soil in order to immobilize and contain the contaminants in a low permeability monolith. The solidification mixture is typically a combination of Portland cement and ground-granulated blast furnace slag with other additives to enhance chemical binding, improve mixture distribution, auger lubrication, or cohesive soil shearing as needed. Contaminants are immobilized primarily by incorporating contaminated soil into a low permeability mass, reducing groundwater flow through the soil, and binding the contaminants in a soil-cement matrix. While the overall mass of contaminants is not reduced, the mobility and the dissolution of contaminants to groundwater are largely eliminated. ISS also eliminates the LNAPL phase by binding the LNAPL with surrounding soil.

On relatively deep sites (i.e., greater than 20 feet), solidification reagents would be introduced through a drilling auger. A batch plant is constructed on-site where the grout is formulated from dry reagents and water. Permeabilities of treated soils are typically less than 10^{-6} cm/sec, thereby achieving several orders of magnitude reduction in permeability as compared to surrounding soil. Solidified soil strengths are typically between 50 and 250 pounds per square inch (psi) unconfined compressive strength, which is capable of supporting a wide variety of post-remediation development construction, yet such soil can be excavated or drilled into for the purpose of utility installation or support pile installation.

Effectiveness: This technology would be effective in reducing source and exposure pathways and the mobility of all site-related contaminants in soil in a relatively short time frame. ISS improves the soil bearing capacity. This technology has been applied to numerous sites nationwide. Bench-scale testing and pilot-scale testing are necessary to develop a site-specific mix design.

Implementability: Dewatering and/or groundwater control would not be required. An increase in the volume of the soil mixture may occur requiring appropriate site grading and off-site disposal of swell material. Air monitoring would be required to protect the public and on-site workers from fugitive emissions. Augering through fill such as found at the site would be extremely difficult and could significantly reduce the effectiveness of the technology.

Underground utilities and structures would also interfere with the implementation of this technology

Cost: The cost is considered to be high.

Conclusion: Solidification will not be retained for the development of alternatives since its implementability would be limited by fill material at the site and below grade utilities and structures.

3.2.5.4 In-Situ Thermal Treatment

In-situ thermal treatment methods employ heat to increase the mobilization of contaminants via volatilization for recovery or for thermal destruction of contaminants. Heat added to the subsurface, through steam injection, electrical resistance heating, radiofrequency heating, or thermal desorption, induces remedial processes that, depending on the level of heating, soil and groundwater conditions, and the nature of the wastes, can partially or fully remediate the wastes. Among other processes, it can break down or volatilize the organic compounds, and reduce the viscosity of remaining source material to allow it to be more easily captured. Vacuum extraction wells would be installed within the heating wells to collect steam or contaminant vapors generated during heating. For optimal effectiveness, groundwater inflow should be minimized within the treatment area.

Effectiveness: Under favorable conditions, thermal treatment can remediate sites to cleanup criteria. The presence of groundwater at this site; however, will limit the effectiveness of the technology at and below the water table without groundwater containment since heat will be carried away by the groundwater. In addition, thermal treatment may not be as effective in treating less volatile organic compounds such as PCBs, PAHs and metals.

Implementability: Groundwater containment would be required to increase the effectiveness of thermal treatment. During thermal treatment, VOCs would have to be captured through an aboveground vacuum extraction system. Air emissions would be a major concern to nearby workers and facilities. The treatment is likely to be uneven because of the varying soil permeabilities throughout the site subsurface and the presence of numerous utilities.

Cost: The cost is estimated to be high due to power requirements and system construction costs.

Conclusion: In-situ thermal treatment is not retained for the development of alternatives for the site.

3.3 Identification and Screening of Technologies for Groundwater

This section identifies and provides a screening of remedial technologies for groundwater.

3.3.1 Institutional Controls

Institutional controls, including restrictions on access and long-term monitoring limit potential exposures and would assess the degree to which natural processes were reducing contaminant concentrations in groundwater.

Natural processes which would be expected to occur include physical processes such as hydrodynamic dispersion and dilution by infiltration, and microbial degradation, which transforms the contaminants into typically less toxic daughter products and, ultimately, to carbon dioxide and water. Given sufficient time, a plume will stabilize after reaching a size where all of the mass delivered by the source is either diluted to very low concentration or destroyed. Further, if the source is removed or isolated from the aquifer through remediation, natural processes will cause the remaining plume to collapse with time, as the contaminant mass residing within the plume is diluted and destroyed, assuming no new mass is introduced.

Groundwater on-site and in the vicinity of the site is not utilized for potable purposes. A Site Management Plan (SMP), which maintains use restrictions regarding groundwater and a monitoring plan to assess future groundwater conditions, would be in line with current practices and be protective of human health. Monitoring would consist of periodic sampling of select existing monitoring wells, and analysis for VOCs, SVOCs, PCBs and metals.

Effectiveness: Institutional controls would be effective in controlling exposure to residuals at the site and thus meets the RAO of preventing exposure. Monitoring will indicate whether contaminant levels are being reduced over time.

Implementability: Institutional controls would not be difficult to implement.

Cost: The annual cost for Institutional controls and sampling, analysis, and reporting would be relatively low.

Conclusion: Institutional controls are retained for use at the site.

3.3.2 <u>Interceptor Trench</u>

An interceptor trench would consist of the following components:

- Permeable trenches penetrating the fill layer installed downgradient near the property lines to reduce off-site migration of contamination; and
- Sumps or recovery wells to collect groundwater.

Effectiveness: An interceptor trench would reduce off-site migration of groundwater contamination.

Implementability: An interceptor trench is an established technology; however, constructing a trench would be somewhat difficult because of the heterogeneity and unknown nature of the subsurface fill.

Cost: The cost of an interceptor trench would be moderate. However, associated costs for treatment of the water collected would be high.

Conclusion: An interceptor trench will be retained for the development of alternatives.

3.3.3 <u>Vertical Barriers</u>

Vertical barriers are considered potentially applicable for groundwater to produce hydraulic control, are similar to those considered for soil, and include sheet piling, soil cement walls, and jet grouting as discussed in Section 3.2.2.3. Since these vertical barriers cannot be keyed into an impermeable layer, would be difficult to construct through fill, and would have a high relative cost, they are not retained for use in the development of alternatives.

3.3.4 Capping

Capping was discussed in Section 3.2.2.2, and for the reasons previously presented, capping is not retained for the development of alternatives.

3.3.5 Groundwater Extraction Wells

Groundwater extraction wells would remove groundwater through pumping. The wells would be installed with screens within the water bearing zones where contamination has been observed. Due to the low permeability of the fill and till zones, extraction wells would have to be placed close together to effectively recover areas of contamination.

Effectiveness: Groundwater extraction wells could provide hydraulic control that would curtail off-site migration of contamination. However, the effectiveness of extraction wells would be limited by the heterogeneity of the soil at the site and the below grade utilities and structures at the site that would interfere with groundwater capture by the wells.

Implementability: Well installation would be limited by underground structures and utilities.

Cost: The cost for groundwater extraction wells is estimated to be low to moderate.

Conclusion: Groundwater extraction wells are not retained for the development of alternatives because of their limited potential effectiveness.

3.3.6 Groundwater Treatment

Groundwater collected by extraction wells or interceptor trenches would be treated in an above-ground facility with subsequent discharge to either groundwater, surface water, or a publicly owned treatment works (POTW).

- Groundwater Treatment On-site; Discharge to Groundwater – An on-site water treatment facility could be constructed to treat collected groundwater. A site-specific process train would have to be developed to remove contaminants to appropriate standards and meet discharge permit requirements for effluent to be re-injected into the groundwater system (Class GA).

- Groundwater Treatment On-site; Discharge to Surface Water – An on-site water treatment facility could be constructed to treat collected groundwater. A site-specific process train would have to be developed to remove contaminants to appropriate standards and meet permit requirements for effluent to be discharged to the Niagara River, a Class A water body.
- Groundwater Pretreatment On-site; Discharge to POTW – Collected groundwater could be separated from the collected LNAPL and pre-treated on-site to meet influent standards and either conveyed via tanker trucks or pumping to existing sanitary sewer lines to the POTW.

Effectiveness: Groundwater treatment could be provided to meet the appropriate requirements for re-injection, discharge to the Niagara River or discharge to the POTW.

Implementability: Groundwater treatment is a conventional technology that can easily be implemented. However, groundwater treatment systems require significant operation, maintenance and monitoring activities that require greater attention over time; thereby, reducing the reliability of the treatment system.

Cost: On-site treatment to meet NYSDEC groundwater (GA) standards for re-injection to the aquifer would be the most expensive. On-site treatment to meet NYSDEC Class A standards and discharge to the adjacent Niagara River would likely be somewhat less expensive, and discharging pretreated water to a POTW would likely be the least costly.

Conclusion: On-site pretreatment and discharge to the POTW will be retained for the development of alternatives.

3.4 Sewer Sediments

3.4.1 Institutional Controls

Institutional Controls could be put in place to manage potential exposure to residual sewer sediments, including procedures for future sediment characterization, sediment removal and handling, and the health and safety of workers and the community should site redevelopment occur.

Effectiveness: Institutional controls would be effective in controlling exposure to residual sewer contamination.

Implementability: Institutional controls would not be difficult to implement.

Cost: The annual cost for Institutional controls and sampling, analysis, and reporting would be relatively low.

Conclusion: Institutional controls are retained for use at the site.

3.4.2 Removal and Off-Site Disposal

Effectiveness: Removal of contaminated sediment and off-site disposal may or may not be effective in meeting the RAOs for sewer sediments. Sewer cleaning has been performed at the site in 1998, 2000, and 2003 and yet contamination remains. Excavation and removal of the entire sewer system would be effective in removing the contaminated sediments located within the pipes.

Implementability: The technologies employed for sewer cleaning are conventional although the handling of PCBs will require more stringent health and safety measures.

Cost: Removal and disposal for contaminated sediment with PCB concentrations below 50 ppm would be moderate, but the cost of excavation and disposal of contaminated sediment with concentrations of PCBs of 50 ppm or more would be high.

Conclusion: Removal and off-site disposal of contaminated sediment is retained for the development of alternatives.

3.4.3 Grouting

Sewers can be sealed through grouting with flowable fill. This material would be pumped into the sewers from existing access points such as manholes and drop inlets. The grout would fill the sewers, solidifying any residual contamination present, and sealing locations where leaks exist.

Effectiveness: Grouting of subsurface structures with contaminated sediment and off-site disposal would be effective in meeting the RAOs for sewer sediments.

Implementability: The technologies employed for sewer grouting are conventional.

Cost: The cost of sewer grouting would be moderate.

Conclusion: Sewer grouting is retained for the development of alternatives.

3.5 Surface Water

3.5.1 Institutional Controls

Institutional controls, including restrictions on access and long-term monitoring, would limit potential exposures to contaminated surface water and would allow assessing the degree to which natural processes were reducing contaminant concentrations in the surface water.

Effectiveness: Institutional controls would be somewhat effective in controlling exposure to ponded surface water on the site, but would not be effective in controlling exposure to runoff flowing off site.

Implementability: Institutional controls would not be difficult to implement.

Cost: The annual cost for Institutional controls and sampling, analysis, and reporting would be relatively low.

Conclusion: Due to the potential for uncontrolled runoff leaving the site, institutional controls are not retained for use at the site.

3.5.2 Surface Water Management

Surface water at this site is not a permanent feature and only occurs periodically due to the precipitation and snow melt that cannot easily drain from the site as a result of plugged sewers. Options considered for the management of the surface water were percolation to groundwater and discharge to a municipal storm sewer system.

3.5.2.1 Percolation to Groundwater

Surface water at the site would be captured by grading of the site following the excavation of soil and/or implementation of other remedial components. Drainage structures, permeable pavement, or perforation of existing slabs and asphalt would be implemented to allow collected water to drain to the underlying aquifer.

Effectiveness: Capture and percolation of storm water to groundwater would be effective in reducing both the ponding and offsite runoff of surface water.

Implementability: Percolation of surface water to groundwater is considered to have limited implementability at this site. This is due to the amount of impervious area on the site and the characteristics of the soil below. Management of stormwater from the site would require numerous inlet structures. It would be difficult to install these structures in areas where they would not be passing through contaminated materials. The subsurface conditions at the site would also limit the implementability of this technology due to the low permeability of the fill and till zones.

Cost: The cost of this technology would be relatively low.

Conclusion: Percolation to groundwater is not retained as a technology.

3.5.2.2 Discharge to a Municipal Storm Sewer

A series of new, clean catch basins and storm water collection systems would be constructed to connect to the existing Town of Tonawanda municipal separate storm sewer system (MS4). The new catch basins and collection system would drain ponded water from the Parking Lot area, the ponded area between AOC-1 and Kenmore Avenue, along with other areas of ponding on-site. Detention of the storm water collected, if necessary to meet peak flow criteria established by the Town of Tonawanda, can be achieved within the collection system.

Effectiveness: Capture and discharge of surface water to storm sewers would be effective in controlling both the ponding and offsite runoff of surface water. This technology would require that the water discharged to the MS4 meet the requirements for discharge.

Implementability: The Town of Tonawanda has a storm sewer system running along Kenmore Avenue and along the southwest side of the site in the UAW-GM Boulevard. The collection system discharges to the Niagara River. The town has indicated that the sewers have adequate capacity to accept stormwater runoff from the site.

Cost: The cost of this technology would be relatively low to moderate, depending on the quantity of catch basins and lengths of collection system required.

Conclusion: Discharge to a municipal storm sewer is retained for use at this site.

3.6 Summary of Retained Technologies

Technologies retained for consideration in the development of alternatives include the following:

Soil

- Institutional Controls
- Soil Cover
- Excavation of Contaminated Soil and Off-Site Disposal

Groundwater

- Institutional Controls
- Groundwater Interceptor Trench
- Groundwater Pre-Treatment and Discharge to POTW

Sewer Sediments

- Institutional Controls
- Sediment Removal and Off-Site Disposal
- Grouting

Surface Water

- Surface Water Discharge to a Storm Sewer

4.0 DEVELOPMENT OF ALTERNATIVES

This section combines the remedial technologies considered feasible for each media into a list of remedial alternatives that best meet the remedial goal and RAOs for the site as a whole. The alternatives are described in this section with regards to: size and configuration, time for remediation, spatial requirements, options for disposal, permitting requirements, limitations, and ecological impacts.

4.1 Development of Alternatives

Alternatives have been developed to address the general response actions identified for the site including: no action, containment, removal and treatment. The No Action alternative (listed as Alternative 1 below) serves as a baseline of comparison for the other alternatives. Alternative 2 is the Site Management alternative and includes only institutional controls for the site. Remedial alternatives other than No Action and Site Management include combinations of remedial technologies for concrete, soil, groundwater, sewer sediments and surface water.

DER-10 guidance requires that the FS include an alternative that restores the site to pre-disposal or Unrestricted Use conditions. This alternative would require the demolition of onsite structures and removal of all contaminated soil exceeding Unrestricted Use criteria. This alternative is listed as Alternative 6 below.

Institutional Controls are included for all alternatives except for the Alternative 6 - Remediation to Unrestricted Use Conditions since this alternative anticipates that no residual contamination will remain at the site.

Three other alternatives were developed for the site. Removal of contaminated sewer sediments and sewer grouting and management of surface water runoff are common remedial components for each of these three other alternatives.

Other components of the three alternatives offer progressively greater levels of protection for human health and the environment. Alternative 3 includes removal of contaminated surface soil which represents the greatest risk. Under this alternative, institutional controls would provide protection from remaining soil and groundwater contamination. Alternative 4 includes removal of all contaminated soil and relies on institutional controls to address groundwater contamination. Alternative 5 includes collection and treatment of groundwater which is more protective of the environment, but still would rely on institutional controls to prevent groundwater use and would require monitoring to insure the site was not negatively impacting the environment.

Based on the technologies considered feasible for remediation listed in Section 3.6 and the discussion above, six alternatives have been developed for the site as follows:

- Alternative 1 – No Action
- Alternative 2 – Site Management
- Alternative 3 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls
- Alternative 4 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls
- Alternative 5 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls
- Alternative 6 – Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines

A summary of the remedial alternatives including their components is presented in Table 4-1.

4.2 <u>Description of Alternatives</u>

4.2.1 <u>Alternative 1 – No Action</u>

Alternative 1 is the No Action alternative that includes no active remediation and leaves the site in its present condition. There would be no additional protection to public health and the environment.

<u>Size and Configuration</u>

- There would be no remedial action under this alternative.

Time for Remediation

- For the purpose of this report, a 30-year period is anticipated.

Spatial Requirements

- There are no spatial requirements for this alternative.

Options for Disposal

- No off-site disposal will be required for this alternative.

Permit Requirements

- No permits will be required for this alternative other than NYSDEC approval.

Limitations

- This alternative would not meet RAOs for at least 30 years.

Ecological Impacts

- There would be no change from existing conditions.

4.2.2 Alternative 2 – Site Management

Alternative 2 is the Site Management alternative that requires only institutional controls for the site and includes no active remediation. Institutional Controls in the form of an environmental easement and a site management plan protect public health and the environment from any contamination identified at the site.

Size and Configuration

- Institutional controls, in the form of an environmental easement would be specified in the SMP to manage residual contaminated media and potential on-site worker or community exposures to contaminated media and maintain use restrictions regarding site development and groundwater use.
- Annual sampling and analysis for VOCs, SVOCs, PCBs and metals, as well as routine water quality indicator parameters, (e.g., oxidation-reduction potential, pH, temperature and conductivity) would be performed in approximately 20 select existing groundwater monitoring wells. The list of parameters, number of

monitoring wells, and sampling frequency could be modified following data review of monitoring results.

- The potential for soil vapor intrusion will be evaluated for any new on-site construction or any building re-development with actions taken to prevent exposures, if necessary.

- An annual report and periodic review (frequency to be determined by NYSDEC) would evaluate site conditions and monitoring activities and recommend any changes necessary to the SMP.

Time for Remediation

- For the purpose of this report, a 30-year period is anticipated for monitoring.

Spatial Requirements

- There are no spatial requirements for this alternative.

Options for Disposal

- No off-site disposal will be required for this alternative.

Permit Requirements

- No permits will be required for this alternative other than NYSDEC approval.

Limitations

- This alternative would not meet RAOs for at least 30 years.

Ecological Impacts

- There would be no change from existing conditions.

4.2.3 Alternative 3 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls

Alternative 3 includes removal of sewer sediments (to the extent practicable), sealing of the sewers with flowable fill, management of surface water runoff, and removal of most surface soil with contamination above the Part 375 Industrial Use criteria. Some areas where surface soil exceeds these criteria are primarily from low (less than 10 mg/kg) levels of benzo(a)pyrene (Industrial Use SCO of 1.1 mg/kg) and arsenic detections in the tens of mg/kg (Industrial Use SCO of 16 mg/kg), that are common in heavily industrial areas. These areas would be addressed by placement of a 1-foot clean soil cover in accordance with Section V.I of CP-51 to reduce direct contact exposures. Contaminated concrete and brick would be demolished, removed, and disposed as PCB contaminated waste. Alternative 3 also includes Institutional Controls. A conceptual layout of this alternative is presented on Figure 4-1.

Size and Configuration

- Institutional controls, in the form of an environmental easement, would be implemented to manage residual contaminated media and potential on-site worker or community exposures to contaminated media and maintain use restrictions regarding site development and groundwater use.

- Jet cleaning of an estimated 19,000 linear feet of contaminated sewer, followed by sealing of sewers with flowable fill. This would include the removal and off-site disposal of approximately 109,000 gallons of sludge (a mix of sediment and waste water generated from jet cleaning).

- Removal and off-site disposal of approximately 1,500 cubic yards of contaminated soil and concrete. The soil will be replaced by approximately 1,100 cubic yards of clean backfill and 400 cubic yards of topsoil that will be imported to the site.

- Approximately 600 cubic feet of contaminated concrete and brick would be demolished, removed, and disposed as PCB contaminated waste.

- Placement of clean soil cover over an area of 46,200 square yards in the eastern portion of the site. This will require the removal and off-site disposal of approximately 900 cubic yards of soil and concrete. Approximately 12,300 cubic yards of clean backfill and approximately 6,200 cubic yards of topsoil will be imported to the site.

- Management of storm water after construction via a series of new, clean catch basins and storm water pipes that will connect to the existing MS4 at several locations. The new catch basins and pipes will drain ponded water from the Parking Lot area, the ponded area between AOC-1 and Kenmore Avenue, and any other areas of ponding on-site. Detention of the storm water, if necessary to meet peak flow criteria established by the Town, can be achieved in-pipe. This will include the removal and off-site disposal of approximately 280 cubic yards of pipe trench and catch basin concrete; and 2,400 cubic yards of soil. This will also include the importing and placement of approximately 1,900 cubic yards of clean fill; 4,700 linear feet of piping, and 26 catch basins. In addition, approximately 1,200 square yards of asphalt pavement will be replaced.

- An environmental easement will control access to groundwater, but no remedial action for groundwater will be conducted. On-going attenuation processes will continue to reduce contaminant concentrations over time.
- Annual sampling and analysis for VOCs, SVOCs, PCBs and metals as well as routine water quality indicator parameters would be performed in approximately 20 selected existing groundwater monitoring wells.
- The potential for soil vapor intrusion will be evaluated for any new on-site construction or any building re-development with actions taken to prevent exposures, if necessary.
- An annual report and periodic review (frequency to be determined by NYSDEC) would evaluate site conditions and monitoring activities and recommend any changes necessary to the SMP.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for monitoring.
- Construction would require less than one year.

Spatial Requirements

- Adequate on-site space is available for stockpiling excavated soil and sewer sediments and for storing materials brought on to the site during construction.

Options for Disposal

- Contaminated concrete, sewer sediments and contaminated soil would be disposed of off-site.

- Sewer sediments and soil with a PCB concentration equal to or above 50 mg/kg would be shipped off-site for disposal at a hazardous waste landfill or other comparable approved facility.

Permit Requirements

- A permit would be required for the offsite discharge of the surface water to the municipal storm sewer.

Limitations

- On-site buildings and structures and below grade utilities and structures could limit access to and removal of contaminated materials and the installation of catch basins and piping.

Ecological Impacts

- Remediation activities would have no ecological impacts.

4.2.4 Alternative 4 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls

Alternative 4 includes removal of sewer sediments (to the extent practicable), sealing of the sewers with flowable fill, management of surface water runoff, and removal of most surface and subsurface soil with contamination above the Part 375 Industrial Use criteria. Contaminated concrete and brick would be demolished, removed, and disposed as PCB contaminated waste. Alternative 4 also includes Institutional Controls. A conceptual layout of this alternative is presented on Figure 4-2.

As with Alternative 3, the areas of low level benzo(a)pyrene and arsenic contamination in the eastern portion of the site would receive a one-foot soil cover.

<u>Size and Configuration</u>

- Institutional controls, in the form of an environmental easement, would be implemented to manage residual contaminated media and potential on-site worker or community exposures to contaminated media and maintain use restrictions regarding site development and groundwater use.

- Jet cleaning of an estimated 19,000 linear feet of contaminated sewer, followed by sealing of sewers with flowable fill. This would include the removal, transport and disposal of approximately 109,000 gallons of sludge (a mix of sediment and waste water generated from jet cleaning).

- Removal and off-site disposal of 2,520 cubic yards of contaminated soil and concrete. The soil will be replaced by approximately 2,070 cubic yards of clean backfill and 450 cubic yards of topsoil that will be imported to the site.

- Approximately 600 cubic feet of contaminated concrete and brick would be demolished, removed, and disposed as PCB contaminated waste.

- Placement of clean soil cover over an area of 46,200 square yards in the eastern portion of the site. This will require the removal and off-site disposal of approximately 900 cubic yards of soil and concrete. Approximately 12,300 cubic yards of clean backfill and approximately 6,200 cubic yards of topsoil will be imported to the site.

- Management of storm water after construction via a series of new, clean catch basins and storm water pipes that will connect to the existing MS4 at several locations. The new catch basins and pipes will drain ponded water from the Parking Lot area, the ponded area between AOC-1 and Kenmore Avenue, and any other areas of ponding on-site. Detention of the storm water, if necessary to meet peak flow criteria established by the Town, can be achieved in-pipe. This will include the removal and off-site disposal of approximately 280 cubic yards of pipe trench and catch basin concrete; and 2,400 cubic yards of soil. This will also include the importing and placement of approximately 1,900 cubic yards of clean fill; 4,700 linear feet of piping, and 26 catch basins. In addition, approximately 1,200 square yards of asphalt pavement will be replaced.

- An environmental easement will control access to groundwater, but no remedial action for groundwater will be conducted. On-going attenuation processes will continue to reduce contaminant concentrations over time.

- Annual sampling and analysis for VOCs, SVOCs, PCBs and metals as well as routine water quality indicator parameters would be performed in approximately 20 selected existing groundwater monitoring wells.

- The potential for soil vapor intrusion will be evaluated for any new on-site construction or any building re-development with actions taken to prevent exposures, if necessary.

- An annual report and periodic review (frequency to be determined by NYSDEC) would evaluate site conditions and monitoring activities and recommend any changes necessary to the SMP.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for monitoring.

- Construction would require less than one year.

Spatial Requirements

- Adequate on-site space is available for stockpiling excavated soil and for storing materials brought on to the site during construction.

Options for Disposal

- Contaminated sewer sediments and contaminated soil would be disposed of off-site.

- Concrete, sewer sediments and soil with PCB concentrations equal to or above 50 mg/kg would be shipped off-site for disposal at a hazardous waste landfill or other comparable approved facility.

Permit Requirements

- A permit would be required for the offsite discharge of the surface water to the municipal storm sewer.

Limitations

- On-site buildings and structures and below grade utilities and structures could limit access to and removal of contaminated materials and the installation of catch basins and piping.

Ecological Impacts

- Remediation activities would have no ecological impacts.

4.2.5 Alternative 5 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls

Alternative 5 is identical to Alternative 4 with the addition of a trench constructed to intercept groundwater before it migrates off-site; the collected groundwater will be treated and discharged to the POTW. A conceptual layout of this alternative is presented on Figure 4-3.

Size and Configuration

- Institutional controls, in the form of an environmental easement would be specified in the SMP to manage residual contaminated media and potential on-site worker or community exposures to contaminated media and maintain use restrictions regarding site development and groundwater use.

- Jet cleaning of an estimated 19,000 linear feet of contaminated sewer, followed by sealing of sewers with flowable fill. This would include the removal, transport and disposal of approximately 109,000 gallons of sludge (a mix of sediment and waste water generated from jet cleaning).

- Removal and off-site disposal of 2,520 cubic yards of contaminated soil and concrete. The soil will be replaced by approximately 2,070 cubic yards of clean backfill and 450 cubic yards of topsoil that will be imported to the site.

- Approximately 600 cubic feet of contaminated concrete and brick would be demolished, removed, and disposed as PCB contaminated waste.

- Placement of clean soil cover over an area of 46,200 square yards in the eastern portion of the site. This will require the removal and off-site disposal of approximately 900 cubic yards of soil and concrete. Approximately 12,300 cubic yards of clean backfill and approximately 6,200 cubic yards of topsoil will be imported to the site.

- Management of storm water after construction via a series of new, clean catch basins and storm water pipes that will connect to the existing MS4 at several locations. The new catch basins and pipes will drain ponded water from the Parking Lot area, the ponded area between AOC-1 and Kenmore Avenue, and any other areas of ponding on-site. Detention of the storm water, if necessary to meet peak flow criteria established by the Town, can be achieved in-pipe. This will include the removal and off-site disposal of approximately 280 cubic yards of pipe trench and catch basin concrete; and 2,400 cubic yards of soil. This will also include the importing and placement of approximately 1,900 cubic yards of clean fill; 4,700 linear feet of piping, and 26 catch basins. In addition, approximately 1,200 square yards of asphalt pavement will be replaced.

- Trenches would be constructed near the east (Kenmore Ave.) and west property lines to intercept groundwater and prevent groundwater migration. The east collection trench is assumed to be 655 feet long and the west collection trench is assumed to be 747 feet long. This will include the installation of approximately 2,600 linear feet of drain pipe. Approximately 8,000 cubic yards of soil and concrete will be removed.

This will also include the importing and placement of approximately 7,800 cubic yards of bedding stone for backfilling the trench.

- Groundwater collected in the trenches would be treated and discharged to the sanitary sewer. A collection rate of 50 gpm is assumed for cost estimating purposes.

- Annual sampling and analysis for VOCs, SVOCs, PCBs and metals as well as routine water quality indicator parameters would be performed in approximately 20 selected existing groundwater monitoring wells.

- The potential for soil vapor intrusion will be evaluated for any new on-site construction or any building re-development with actions taken to prevent exposures, if necessary.

- An annual report and periodic review (frequency to be determined by NYSDEC) would evaluate site conditions and monitoring and treatment system activities and recommend any changes necessary to the SMP.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for groundwater treatment operation and for monitoring.

- Construction, including excavation and disposal of contaminated soil, would require less than one year.

Spatial Requirements

- Adequate on-site space is available for construction of a treatment system, and for stockpiling excavated soil and for storing materials brought on to the site during construction.

Options for Disposal

- Contaminated sewer sediments and contaminated soil would be disposed of off-site.

- Concrete, sewer sediments and soil with PCB concentration equal to or above 50 mg/kg would be shipped off-site for disposal at a hazardous waste landfill or other comparable approved facility.

Permit Requirements

- A permit would be required for the offsite discharge of the surface water to the municipal storm sewer.

- A permit for treated groundwater discharge would be required.

Limitations

- On-site buildings and structures and below grade utilities and structures could limit access to and removal of contaminated materials and limit the installation of catch basins and piping.

Ecological Impacts

- Remediation activities would have no ecological impacts.

4.2.6 Alternative 6 – Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines

This alternative includes removal of all former building floors, utilities and other above grade or below grade structures. Because the former building slabs contain asbestos materials, all ACM will be removed prior to demolition. In addition it includes the excavation all soil to a depth of 8 feet bgs and off-site disposal of all soil and debris. It includes excavation of all sewer lines on the site. A conceptual layout of this alternative is presented on Figure 4-4.

Size and Configuration

- All building floors and utilities would be demolished and all other structures, other than the existing buildings, would be removed. Approximately 400,000 CY of soil and 27,500 CY of concrete and other floor material would be excavated and disposed of off-site. The excavation areas would be backfilled with approximately 430,000 cubic yards of clean imported material.

- No remedial action for groundwater will be conducted. On-going attenuation processes will continue to reduce any contaminants remaining following excavation the soil.

Time for Remediation

- Construction is estimated to be completed in 2 years.

Spatial Requirements

- Adequate on-site space is available for stockpiling excavated soil and demolition debris and for storing materials brought on to the site during construction.

Options for Disposal

- ACM, contaminated sewer sediments, demolition debris and contaminated soil would be disposed of off-site.

- Concrete, sewer sediments and soil with PCB concentration equal to or above 50 mg/kg would be shipped off-site for disposal at a hazardous waste landfill or other comparable approved facility.

Permit Requirements

- A permit would be required for asbestos work performed on the site.

Limitations

- The excavation, handling and transportation of this large quantity of material would produce significant air emissions which would be difficult to manage and would represent a potential threat to human health and the environment.

Ecological Impacts

- Remediation activities would have no ecological impacts.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

5.1 Description of Evaluation Criteria

Each of the alternatives is subjected to a detailed evaluation with respect to the criteria outlined in 6 NYCRR Part 375. A description of each of the evaluation criteria is provided below. This evaluation aids in the selection process for remedial actions in New York State.

5.1.1 Overall Protection of Public Health and the Environment

This criterion is an assessment of whether the alternative meets requirements that are protective of human health and the environment. The overall assessment is based on a composite of factors assessed under other evaluation criteria, particularly long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs. This evaluation focuses on how a specific alternative achieves protection over time and how potential site risks are reduced. The analysis includes how the contamination is to be eliminated, reduced, or controlled.

5.1.2 Compliance with Standards, Criteria, and Guidance

This criterion determines whether or not each alternative and the proposed remedial technologies comply with applicable environmental laws and SCGs pertaining to the contaminants detected and the location of the site.

5.1.3 Long-term Effectiveness and Permanence

This criterion addresses the performance of a remedial action in terms of its permanence and the quantity/nature of waste or residuals remaining at the site after implementation. An evaluation is made on the extent and effectiveness of controls required to manage residuals remaining at the site and the operation and maintenance systems necessary for the remedy to remain effective. The factors that are evaluated include permanence of the remedial alternative, magnitude of the remaining risk, adequacy of controls used to manage residual contamination, and the reliability of controls used to manage residual contamination.

5.1.4 Reduction of Toxicity, Mobility or Volume with Treatment

This criterion assesses the remedial alternative's use of technologies that permanently and significantly reduce toxicity, mobility, or volume (TMV) of the contamination as their principal element. Preference is given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of contamination at the site.

5.1.5 Short-term Effectiveness

This criterion assesses the effects of the alternative during the construction and implementation phase with respect to the effect on human health and the environment. The factors that are assessed include protection of the workers and the community during remedial action, environmental impacts that result from the remedial action, and the time required until the remedial action objectives are achieved.

5.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing the alternative and the availability of various services and materials required during implementation. The evaluation includes the feasibility of construction and operation, the reliability of the technology, the ease of undertaking additional remedial action, monitoring considerations, activities needed to coordinate with regulatory agencies, availability of adequate equipment, services and materials, off-site treatment, and storage and disposal services.

5.1.7 Cost

Capital costs and operation, maintenance, and monitoring costs (OM&M) are provided for each alternative and presented as present worth using a 5% discount rate.

5.1.8 Community and State Acceptance

Concerns of the State and the Community will be addressed separately in accordance with the public participation program developed for this site.

5.1.9 Land Use

This criterion addresses the current, intended, and reasonably anticipated future land use in the area as impacted by the remediation.

5.2 Alternative 1 – No Action

5.2.1 Overall Protection of Public Health and the Environment

This alternative does not meet the RAOs for the site and is not effective in the long-term because the contaminated media are not remediated. No additional protection to human health and the environment would be provided.

5.2.2 Compliance with SCGs

Since no remediation is proposed, contamination would remain in-place at the site. This alternative would not meet the SCGs for media at the site.

5.2.3 Long-term Effectiveness and Permanence

Contaminant migration and potential exposure to contaminants would continue due to residual contamination. The potential risks to human health caused by contaminated subsurface soil and groundwater would continue. This alternative is not effective or permanent in reducing long-term risks.

5.2.4 Reduction of Toxicity, Mobility and Volume with Treatment

Reduction of the toxicity, mobility and volume would occur very slowly through natural processes. No treatment is included to reduce TMV.

5.2.5 Short-term Effectiveness

There is no construction associated with this alternative, so there are no potential impacts to workers or residents. RAOs would not be met.

5.2.6 Implementability

Because of the uncontrolled risks that would remain at that site, it would likely be administratively difficult to implement this alternative.

5.2.7 Cost

Estimated OM&M costs for Alternative 1 are presented on Table 5-1. The present worth of OM&M costs is $0.

5.2.8 Land Use

The site is expected to remain an industrial area for the foreseeable future. Risks to human health and the environment would remain.

5.3 Alternative 2 – Site Management

5.3.1 Overall Protection of Public Health and the Environment

This alternative does not meet the RAOs for the site and is not effective in the long-term because the contaminated media are not remediated. Implementing institutional controls would provide limited protection to human health and the environment as compared to current conditions. If necessary, measures will be taken to prevent migration of contaminated soil vapor from underground sources into the indoor air of buildings via soil vapor intrusion.

5.3.2 Compliance with SCGs

Since no remediation is proposed, contamination would remain in-place at the site. This alternative would not meet the SCGs for media at the site.

5.3.3 Long-term Effectiveness and Permanence

Contaminant migration and potential exposure to contaminants would continue due to residual contamination. The potential risks to human health caused by contaminated subsurface soil and groundwater could be addressed by an SMP with use restrictions, soil excavation protocols and groundwater use restrictions. This alternative is not effective or permanent in reducing long-term risks.

5.3.4 <u>Reduction of Toxicity, Mobility and Volume with Treatment</u>

Reduction of the toxicity, mobility and volume would occur very slowly through natural processes. No treatment is included to reduce TMV.

5.3.5 <u>Short-term Effectiveness</u>

There is no construction associated with this alternative, so there are no potential impacts to workers or residents. RAOs would not be met.

5.3.6 <u>Implementability</u>

Environmental easements are routinely implemented at contaminated sites.

5.3.7 <u>Cost</u>

Estimated OM&M costs for Alternative 2 are presented on Table 5-1. The present worth of OM&M costs is $222,000.

5.3.8 <u>Land Use</u>

The site is expected to remain an industrial area for the foreseeable future and will be restricted to industrial use. Alternative 2 will restrict land use through an environmental easement.

5.4 <u>Alternative 3 - Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls</u>

5.4.1 <u>Overall Protection of Public Health and the Environment</u>

A combination of an environmental easement and the other active remedial measures in this alternative are protective of human health and would meet the RAOs for public health protection. However, this alternative would not meet the RAOs for environmental protection. This alternative would leave residual soil contamination in the subsurface that may impact groundwater quality. Groundwater is not used as a potable supply source and monitoring would protect the environment because additional remedial measures could be implemented if monitoring showed that groundwater contamination was a significant threat to the environment. If necessary, measures will be taken to prevent migration of contaminated soil vapor from underground sources into the indoor air of buildings via soil vapor intrusion.

5.4.2 Compliance with SCGs

SCGs for surface soil and sewer contamination would be met, either through excavation or placement of a cover. Surface water SCGs would be met through management of surface water runoff. Subsurface soil SCGs would not be met. Sewer decontamination and sealing would reduce the amount of contamination and potential exposure of contamination to the groundwater. On-going attenuation processes will continue to reduce contaminant concentrations in groundwater, but SCGs for groundwater would not be achieved for more than 30 years.

5.4.3 Long-term Effectiveness and Permanence

This alternative addresses the significant paths of human exposure but contaminated subsurface soil and groundwater would remain on site. The soil cover would limit exposure and environmental easements would limit the usage of and access to the site. These controls would be effective and require little to no operation and maintenance to remain effective. Periodic monitoring would ensure that any potential threats are identified and addressed.

5.4.4 Reduction of Toxicity, Mobility and Volume with Treatment

Excavation of surface soil and cleaning the sewers will reduce the volume of contaminated soil and sewer sediments at the site. The mobility of any sewer sediments that are not effectively removed by the cleaning will be reduced through the sealing with flowable fill.

5.4.5 Short-term Effectiveness

Construction would produce noise, disrupt daily traffic patterns, and present short-term risks to on-site and off-site workers that would need to be addressed through engineering controls and air monitoring. Dust control would be required. The time of construction would be less than one year. Air emissions would also be a concern during removal operations. Engineering controls would also be required to address these concerns.

5.4.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Implementation of monitoring and site controls after construction would not be difficult.

5.4.7 Cost

Estimated capital and OM&M costs for Alternative 3 are presented on Table 5-1. The capital cost is $5,790,000, present worth of OM&M costs is $222,000, and the total present worth of Alternative 3 is $6,012,000.

5.4.8 Land Use

The site is expected to remain an industrial area for the foreseeable future and will be restricted to industrial use. Alternative 3 will restrict land use through an environmental easement.

5.5 Alternative 4 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls

5.5.1 Overall Protection of Public Health and the Environment

A combination of an environmental easement and the other active remedial measures in this alternative are protective of human health and would meet the RAOs for public health protection. This alternative would remove the source of groundwater contamination although some groundwater contamination would remain. Groundwater is not used as a potable supply source and monitoring would protect the environment because additional remedial measures could be implemented if monitoring showed that groundwater contamination was a significant threat to the environment. If necessary, measures will be taken to prevent migration of contaminated soil vapor from underground sources into the indoor air of buildings via soil vapor intrusion.

5.5.2 Compliance with SCGs

SCGs for surface and subsurface soil and sewer contamination would be met. Surface water SCGs would be met through management of surface water runoff. Sewer decontamination and sealing and removal of source material (i.e., excavation) would reduce the amount of contamination and potential exposure of contamination to the groundwater. On-going attenuation processes will continue to reduce contaminant concentrations in groundwater, but SCGs for groundwater would not be achieved for more than 30 years.

5.5.3 Long-term Effectiveness and Permanence

This alternative addresses the significant paths of human exposure but contaminated subsurface soil and groundwater would remain on site. The soil cover would limit exposure and environmental easements would limit the usage of and access to the site. These controls would be effective and require little to no operation and maintenance to remain effective. Periodic monitoring would ensure that any potential threats are identified and addressed.

5.5.4 Reduction of Toxicity, Mobility and Volume with Treatment

Excavation of surface and subsurface soil and cleaning the sewers will reduce the volume of contaminated soil and sewer sediments at the site. The mobility of any sewer sediments that are not effectively removed by the cleaning will be reduced through the sealing with flowable fill.

5.5.5 Short-term Effectiveness

Construction would produce noise, disrupt daily traffic patterns, and present short-term risks to on-site and off-site workers that would need to be addressed through engineering controls and air monitoring. Dust control would be required. The time of construction would be less than one year. Air emissions would also be a concern during removal operations. Engineering controls would also be required to address these concerns.

5.5.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Implementation of monitoring and site controls after construction would not be difficult.

5.5.7 Cost

Estimated capital and OM&M costs for Alternative 4 are presented on Table 5-1. The capital cost is $6,999,000 present worth of OM&M costs is $222,000 and the total present worth of Alternative 4 is $7,222,000.

5.5.8 Land Use

The site is expected to remain an industrial area for the foreseeable future and will be restricted to industrial use. Alternative 4 will restrict land use through an environmental easement.

5.6 Alternative 5 – Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls

5.6.1 Overall Protection of Public Health and the Environment

A combination of an environmental easement and active remedial measures in this alternative are protective of human health and would meet the RAOs for public health protection and environmental protection. This alternative would remove the source of groundwater contamination although some groundwater contamination would remain. Groundwater contaminant migration off-site would be reduced by the groundwater collection and treatment system. Groundwater is not used as a potable supply source and monitoring would protect the environment because additional remedial measures could be implemented if monitoring showed that groundwater contamination was a significant threat to the environment. If necessary, measures will be taken to prevent migration of contaminated soil vapor from underground sources into the indoor air of buildings via soil vapor intrusion.

5.6.2 Compliance with SCGs

SCGs for surface and subsurface soil and sewer contamination would be met. Surface water SCGs would be met through management of surface water runoff. Collection and treatment of groundwater would reduce contamination, but due to limitations in effectively capturing the entirety of the zone of groundwater contamination, SCGs for these media would not be achieved for at least 30 years by natural attenuation.

5.6.3 Long-term Effectiveness and Permanence

This alternative addresses the significant paths of human exposure but contaminated subsurface soil and groundwater would remain on site. The soil cover would limit exposure and environmental easements would limit the usage of and access to the site. These controls would be effective and require little to no operation and maintenance to remain effective. Periodic monitoring would ensure that any potential threats are identified and addressed.

5.6.4 Reduction of Toxicity, Mobility and Volume with Treatment

Excavation of surface and subsurface soil and cleaning the sewers will reduce the volume of contaminated soil and sewer sediments at the site. Groundwater contamination would be treated with carbon adsorption to remove PCBs and other organics from the water, reducing the volume of contamination of this medium. When the carbon is removed and sent for regeneration, the adsorbed organics would be desorbed and incinerated, reducing the toxicity of these contaminants. The mobility of any sewer sediments that are not effectively removed by the cleaning will be reduced through the sealing with flowable fill.

5.6.5 Short-term Effectiveness

Construction would produce noise, disrupt daily traffic patterns, and present short-term risks to on-site and off-site workers that would need to be addressed through engineering controls and air monitoring. Dust control would be required. The time of construction would be less than one year. Air emissions would also be a concern during removal operations. Engineering controls would also be required to address these concerns.

5.6.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Construction of the groundwater collection trenches at each end of the site would pose implementability problems with active roads and utilities in this area.

However, those challenges could be overcome. Implementation of monitoring and site controls after construction would not be difficult.

5.6.7 Cost

Estimated capital and OM&M costs for Alternative 5 are presented on Table 5-1. The capital cost is $11,051,000 present worth of OM&M costs is $667,000, and the total present worth of Alternative 5 is $11,718,000.

5.6.8 Land Use

The site is expected to remain an industrial area for the foreseeable future and will be restricted to industrial use. Alternative 5 will restrict land use through an environmental easement.

5.7 Alternative 6 – Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines

5.7.1 Overall Protection of Public Health and the Environment

A combination of an environmental easement and active remedial measures in this alternative are protective of human health and would meet the RAOs for public health protection and environmental protection. Excavation to unrestricted use criteria (estimated to require excavation to 8 feet below ground surface) would provide for the greatest protection to human health. This alternative would remove the source of groundwater contamination although some groundwater contamination would remain; however, groundwater contamination migration off-site would be reduced. Complete removal of the sewers would eliminate the possibility of contaminated sediments providing recurring groundwater contamination.

5.7.2 Compliance with SCGs

SCGs for surface and subsurface soil and sewer contamination would be met. Groundwater and surface water quality would be improved through the removal of much if not all of the contamination source and dewatering during excavation.

5.7.3 Long-term Effectiveness and Permanence

This alternative addresses the significant paths of human exposure. The vast majority of contamination would be removed from the site.

5.7.4 Reduction of Toxicity, Mobility and Volume with Treatment

Excavation of all contaminated surface and subsurface soil and removing the sewers will reduce the volume of contaminated soil and sewer sediments at the site.

5.7.5 Short-term Effectiveness

Construction would produce noise, disrupt daily traffic patterns, and present short-term risks to on-site and off-site workers that would need to be addressed through engineering controls and air monitoring. Dust control would be required. The time of construction would be approximately two years. Air emissions would also be a concern during removal operations. Engineering controls would also be required to address these concerns.

5.7.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Extensive subsurface structures present from the former plant operations would require demolition prior to excavation which may pose some implementability challenges. Implementation of monitoring and site controls after construction would not be difficult.

5.7.7 Cost

Estimated capital and OM&M costs for Alternative 6 are presented on Table 5-1. The capital cost is $149,556,000 present worth of OM&M costs is $0, and the total present worth of Alternative 6 is $149,556,000.

5.7.8 Land Use

The site is expected to remain an industrial area for the foreseeable future. However, the site would be remediated to unrestricted use.

5.8 Comparative Analysis of Alternatives

A comparison of the alternatives in light of the evaluation criteria follows.

5.8.1 Overall Protection of Public Health and the Environment

Alternatives 1 and 2 are not protective of public health and the environment. Alternatives 3 and 4 meet RAOs for human health, but do not meet the environmental RAOs. Alternative 5 provides better compliance with environmental RAOs than Alternatives 3 and 4 through treatment of groundwater. Alternative 6 meets all the RAOs and is protective of human health and the environment.

5.8.2 Compliance with SCGs

Alternatives 1 and 2 do not comply with the SCGs. Alternatives 3 and 4 use a combination of excavation and a soil cover that would meet the SCGs for surface soil. SCGs for most subsurface soil would be met with Alternatives 4, 5, and 6. Alternatives 5 and 6 provide accelerated compliance with groundwater SCGs. Alternatives 3 through 6 would meet the SCGs for surface water.

5.8.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence is directly related to the quantity of residuals remaining on the site. Alternative 6 would result in little to no residual contamination. Alternatives 4 and 5 remove both surface and subsurface soil and are thus more effective long term than Alternative 3, which just addresses surface soil. Alternatives 3, 4, and 5 all leave some low level soil beneath a soil cover in the eastern portion of the site. Alternatives 1 and 2 do not address the source of contamination and are the least effective.

For Alternatives 2 through 5, monitoring and institutional controls in the form of environmental easements and an SMP would be an effective means of managing residual contamination.

5.8.4 Reduction of Toxicity, Mobility and Volume with Treatment

Alternatives 1 and 2 would not provide any reduction in TMV. Alternatives 3 through 6 use excavation to reduce the volume of soil contaminants, with increased quantities of excavation for each alternative. The mobility of any sewer sediments that are not effectively removed by the cleaning will be reduced through the sealing with flowable fill in Alternatives 3 through 6. Alternative 5 includes treatment of extracted groundwater.

5.8.5 Short-term Effectiveness

Alternatives 1 and 2 do not include any active remediation, and therefore, pose no risk to human health or the environment during construction. However, these alternatives would not achieve the remedial action objectives for public health or the environment. Alternative 3 has the least intrusive activities during remediation, and therefore, would pose the smallest short-term risks. Alternatives 4 and 5 include excavation of subsurface soil in addition to surface soil and thus include significantly more intrusive activities that would require significant air monitoring to protect residents, dust monitoring and control, and would represent more of a short-term risk to local residents. Alternative 6, with the greatest amount of excavation would present the greatest short-term impacts to the surrounding vicinity. Alternatives 3, 4, and 5 could all be constructed in less than a year, but Alternative 5 would include 30 years of groundwater system operation. Alternative 6 would require 2 years to complete.

5.8.6 Implementability

Since there is no construction, there are no technical implementation issues associated with Alternatives 1 and 2. The technologies employed for Alternative 3, 4, and 5 are conventional and reliable technologies for remediation. However, Alternative 5 includes the construction of groundwater collection trenches at each end of the site, which would pose implementability problems with active roads and utilities in this area. However, those challenges could be overcome. Alternative 6 would be the most difficult alternative to implement due to the extensive subsurface structures present from the former plant operations, which would require demolition prior to excavation. The extensive excavation would be very disruptive to nearby residences and businesses, and the transportation of the great volume of waste would impact a much larger community.

5.8.7 Cost

Capital costs and operation, maintenance, and monitoring costs (OM&M) are provided for each alternative and presented as present worth using a 5% discount rate. Cost estimates for each alternative are provided in Appendix A and are summarized on Table 5-1.

5.8.8 Land Use

The site is expected to remain an industrial area for the foreseeable future. Environmental easements would be required under Alternatives 2, 3, 4 and 5 that would restrict activities at the site. Environmental easements would not be required for Alternative 6 and the site would not be restricted with regard to its use.

6.0 RECOMMENDED REMEDIAL ALTERNATIVE

Six alternatives were developed, screened, and evaluated for the remediation of the Tonawanda Forge site. The evaluation of alternatives focused on remedial action objectives that were designed to eliminate or mitigate all significant threats to the public health and the environment presented by contaminants previously disposed of at the site. As described in Section 5.0, the alternatives were evaluated based on the following criteria:

- Overall Protection of Public Health and the Environment
- Compliance with SCGs
- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility and Volume with Treatment
- Short-term Effectiveness
- Implementability
- Cost
- Land Use

Based on the results of the evaluation, it is recommended that Alternative 4: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls be implemented to remediate the site. The basis for this recommendation is provided in Section 6.1 below.

6.1 Basis for Recommendations

Alternative 4: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls is the recommended remedial alternative for this site based on the following:

- Alternative 1: No Action and Alternative 2: Site Management are not protective of human health and the environment and are rejected as viable alternatives for remediation.

- Alternative 6: Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines meets all of the RAOs, but is not considered to be cost effective. The estimated cost to implement Alternative 6 is nearly 13 times the estimated cost of Alternative 5: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls, the next most expensive alternative. Alternative 6 remediates the site to meet Unrestricted Use criteria. Alternatives 3: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls, 4, and 5 remediate the site to meet Industrial Use criteria, which is not unreasonable given that the site is expected to remain an industrial area for the foreseeable future. Therefore, Alternative 6 was rejected as a viable alternative for remediation based on cost and future anticipated land use.

- The difference between Alternatives 4 and 5 is that Alternative 5 includes an active groundwater remediation component. Both alternatives remove the source of groundwater contamination, but some groundwater contamination will remain.

  As part of Alternative 5, the contaminated groundwater would be collected and treated to further reduce the potential of off-site migration. Groundwater quality would be improved, but due to limitations in effectively capturing all of the contaminated groundwater, SCGs for groundwater would not be achieved for at least 30 years. Both alternatives include monitoring, and additional remedial measures that could be implemented if monitoring showed that groundwater contamination was a significant threat to the environment.

  Because groundwater is not used as a potable supply source, and since monitoring would protect the environment under both alternatives, the additional cost to include an active groundwater remedial component in Alternative 5 provides little additional protection to human health or the environment. As a result, Alternative 4 is preferred over Alternative 5.

- The difference between Alternatives 3 and 4 is that Alternative 4 includes the excavation and removal of subsurface soil with contamination above the Part 375 Industrial Use criteria. Alternative 3 would not achieve the subsurface soil SCGs and the contaminants present in the subsurface soil above the criteria (arsenic and PCBs) would not be significantly reduced in the future through natural attenuation or other means. Because excavation and removal of the subsurface soil provides additional protection to human health and the environment, Alternative 4 is preferred over Alternative 3.

6.2 Components of Remediation

A conceptual layout for Alternative 4 is shown on Figure 4-2. The major components of the alternative are described below.

6.2.1 Sewer Decontamination and Sealing

Sewer sediments would be removed to the extent practicable via jet cleaning of an estimated 19,000 linear feet of contaminated sewer. Liquid and solid spoils from the cleaning will be collected, sampled and either treated on-site or transported and disposed of off-site as appropriate. Following cleaning, the sewers would be sealed with flowable fill material and abandoned in place.

6.2.2 Excavation or Covering of Contaminated Soil

The remedial action for soil includes the excavation and off-site disposal of approximately 2,520 cubic yards of contaminated surface and subsurface soil exceeding Industrial Use criteria and 600 cubic yards of concrete and brick as shown on Figure 4-2. The surface soil exceeds Industrial Use SCOs primarily for PAHs and arsenic. All of AOC-12 and a portion of AOC-9, shown on Figure 4-2, are considered to be above Industrial Use SCOs. The subsurface soil exceeds Industrial Use SCOs primarily for benzo(a)pyrene, arsenic, or PCBs and is found in isolated samples in various AOCs in the western half of the site. Additionally, approximately 200 cubic feet of contaminated concrete and 600 cubic feet of brick will be demolished, removed, and disposed as PCB contaminated waste.

Groundwater is present in the fill zone at depths of 1 to 6 feet bgs and in the till zone between 2 to 15 feet bgs. A portion of the subsurface soils to be excavated are present in the saturated zone.

Following excavation and removal of the contaminated material, the excavated volume will be replaced with clean backfill. Any fill material brought to the site will meet the SCOs for cover material for the use of the site as set forth in 6 NYCRR Part 375-6.7(d) and any other additional guidance or regulations in regard to emerging contaminants in clean backfill.

The majority of the surface soils samples collected in the eastern portion of the site, the parking lot and AOC-1, indicate the presence of benzo(a)pyrene or arsenic slightly above the Industrial Use SCOs of 1.1 mg/kg and 16 mg/kg, respectively. The addition of a soil cover will allow for industrial use of the site in these areas where the existing upper one foot of exposed surface soil exceeds the Industrial Use SCOs. A soil cover will be constructed over an area of approximately 46,200 square yards in the eastern portion of the site as shown on Figure 4-2. The soil cover will be a minimum of one foot of soil placed over a demarcation layer, with the upper six inches of the cover being topsoil of sufficient quality to maintain a vegetative layer. Soil cover material, including any fill material brought to the site, will meet the SCOs for cover material for the use of the site as set forth in 6 NYCRR Part 375-6.7(d).

6.2.3 Surface Water Controls

After excavation of the contaminated soil and prior to the installation of the soil cover, a storm water management system will be constructed. The general conceptual design for the system is presented on Figure 4-2. Details regarding the design must be approved by the NYSDEC. The system will consist of a series of new catch basins and storm water collection lines that will connect to the existing Town of Tonawanda MS4 system at a number of locations along the UAW/GM Boulevard located adjacent to the site. In addition to the stormwater collection system in the UAW/GM Boulevard, the town has a storm sewer on Kenmore Ave, also adjacent to the site. These sewers are 24-inch and 30-inch in diameter respectively, and flow to the Niagara River. The Town of Tonawanda has confirmed that the system has adequate capacity to accept runoff from the site.

The new stormwater collection system will drain ponded water from the Parking Lot area, AOC-1, and other on-site areas that have experienced ponding and discharge the water to the Town of Tonawanda system. Detention of the storm water, if necessary to comply with peak flow criteria established by the Town, will be achieved within the collection system.

6.2.4 Institutional Controls

Alternative 4 includes institutional controls to manage residual contaminated media and potential on-site worker or community exposures to contaminated media, and maintain use restrictions regarding site development and groundwater use. Institutional control in the form of an environmental easement for the controlled property will:

- Require the periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allow the use and development of the property for industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment; and
- Require compliance with an approved SMP.

The SMP will include:

- Identification of all restrictions and engineering controls for the site and the requirements to ensure that the controls remain in place and effective;
- An operations and maintenance manual outlining the procedures if disturbances to the cover occur;
- Monitoring to assess the performance and effectiveness of the remedy. Monitoring would consist of periodic sampling and analysis of groundwater for VOCs, SVOCs, PCBs and metals as well as routine water quality indicator parameters. Monitoring

would be performed in approximately 20 selected existing groundwater monitoring wells on an annual basis; and

- Preparation of an annual report and periodic review (frequency to be determined by NYSDEC) to evaluate site conditions and monitoring activities and recommend any changes necessary to the SMP.

TABLES

Table 1-1

AOCs and Surface Soils Exceeding Criteria for SVOCs, PCBs, and Arsenic

	Unrestricted Use			Protection of Groundwater			Industrial Use		
	SVOCs	PCBs	Arsenic	SVOCs	PCBs	Arsenic	SVOCs	PCBs	Arsenic
AOC 1	X	X	X	X	X	X	X	X	X
AOC 2		X			X				
AOC 3	X	X		X	X				
AOC 4	X								
AOC 5		X	X			X			X
AOC 6		X							
AOC 7	X	X		X	X		X		
AOC 8	X	X	X	X	X	X	X	X	X
AOC 9	X	X		X	X		X		
AOC 10	X	X	X	X	X		X	X	
AOC 11	X	X		X	X				
AOC 12	X	X	X	X	X	X	X	X	X
AOC 13	X	X		X	X		X	X	
AOC 14		X							
AOC 15		X	X		X			X	
AOC 16	X	X			X				
SS-03	X	X							
SS-04	X	X		X	X		X		
SS-05	X	X	X		X	X			X
SS-06	X	X							
SS-07		X	X			X			X
SS-08	X	X	X						
SS-09	X	X		X			X		
SS-10	X	X		X			X		
SS-11	X	X		X			X		
SS-12	X	X		X	X		X		
SS-13		X							

Unrestricted Use criteria: 6 NYCRR PART 375, Table 375-6.8(a)

Protection of Groundwater and Industrial Use criteria: 6 NYCRR PART 375, Table 375-6.8(b)

X - At least one compound exceeds criteria in surface soil and/or subsurface soil.

TABLE 4-1

SUMMARY OF REMEDIAL ALTERNATIVE COMPONENTS

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Description	No Action	Site Management	Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls	Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls	Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls	Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines
Source Control	None	None	Remove contaminated sewer sediments and surface soil (Industrial Use SCOs)	Remove contaminated sewer sediments and all contaminated soil (Industrial Use SCOs)	Remove contaminated sewer sediments and all contaminated soil (Industrial Use SCOs)	Removal of all sources of contamination
Remedial Actions for Surface Soil	None	None	Removal of contaminated surface soil	Removal of contaminated surface soil	Removal of contaminated surface soil	Removal of contaminated surface soil
Remedial Actions for Subsurface Soil	None	Environmental easement to prevent exposure	Environmental easement to prevent exposure	Removal of contaminated subsurface soil	Removal of contaminated subsurface soil	Removal of contaminated subsurface soil
Remedial Actions for Groundwater	None	Environmental easement to prevent exposure	Environmental easement to prevent exposure	Environmental easement to prevent exposure	Groundwater collection and treatment and environmental easement to prevent exposure	Removal of all contaminated soil impacting groundwater
Remedial Actions for Surface Water	None	None	Discharge to a storm water system	Discharge to a storm water system	Discharge to a storm water system	Removal of all sources of contamination

Tonawanda Forge
Feasibility Study

TABLE 5-1
COST ESTIMATE SUMMARY

Client NYSDEC
Project Tonawanda Forge FS
Title Feasibility Study Cost Estimate

Project Number 60416128
Calculated By: DNM Date: 04/23/2019
Checked By: KRJ Date: 05/03/2019

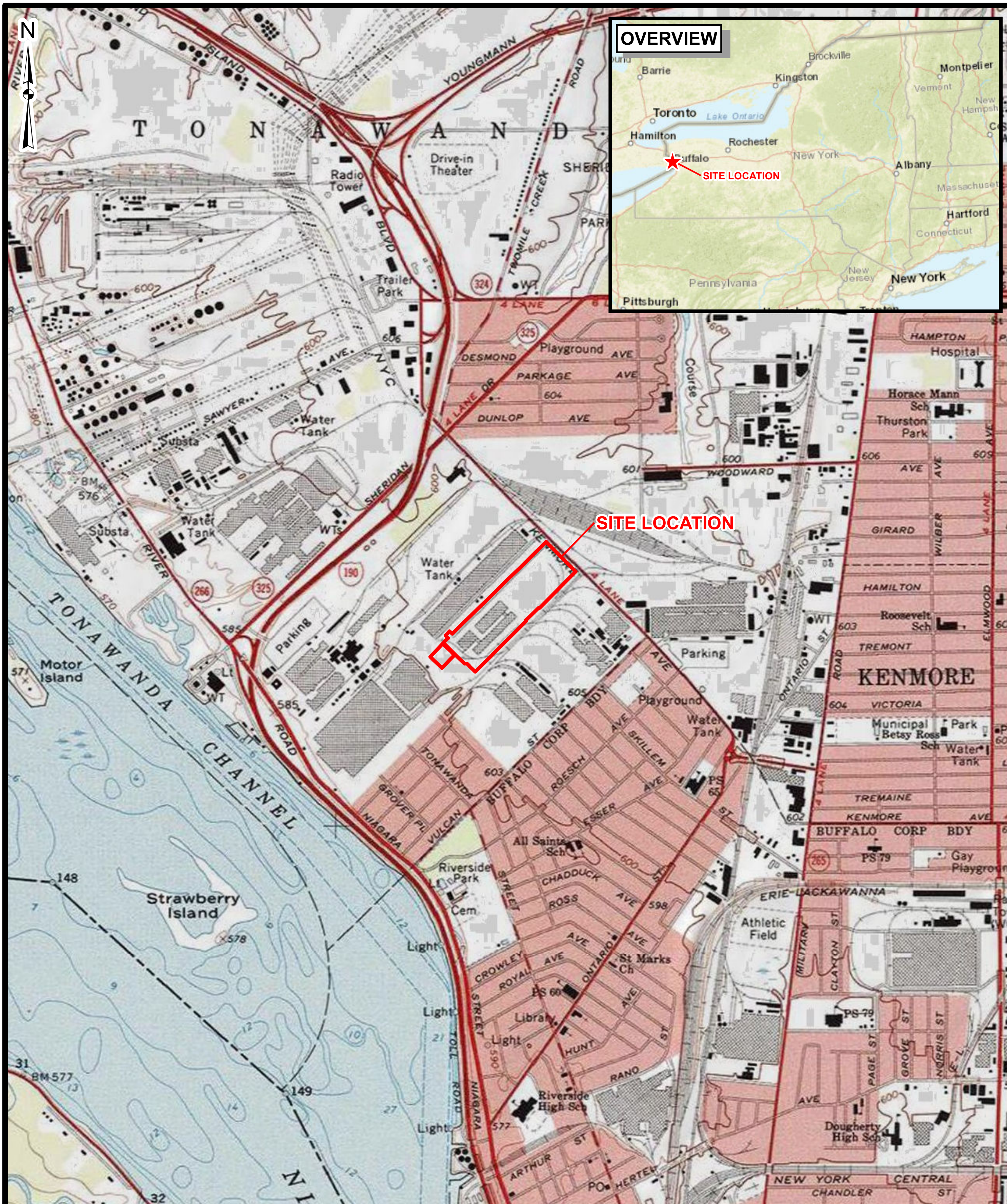
CAPITAL COSTS			ALTERNATIVE 1: No Action	ALTERNATIVE 2: Site Management	ALTERNATIVE 3: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls	ALTERNATIVE 4: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls	ALTERNATIVE 5: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls	ALTERNATIVE 6: Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines
Item	Description	Units	COST	COST	COST	COST	COST	COST
1	Surface Soil Excavation AOC-12 and Backfill	LS	$0	$0	$474,772	$474,772	$474,772	$0
2	Other Surface Soil, Concrete, and Brick Excav and Backfill	LS	$0	$0	$11,419	$11,419	$11,419	$0
3	Subsurface Soil Excavation and Backfill	LS	$0	$0	$0	$751,184	$751,184	$0
4	AOC-1 Area Covering	LS	$0	$0	$1,306,034	$1,306,034	$1,306,034	$0
5	Excavate Entire Site to 8' and Backfill	LS	$0	$0	$0	$0	$0	$92,269,538
6	Collection Trench Installation	LS	$0	$0	$0	$0	$2,380,860	$0
7	GW Treatment by Sedimentation/Carbon	LS	$0	$0	$0	$0	$135,938	$0
8	Sewer Cleaning	LS	$0	$0	$899,924	$899,924	$899,924	$0
9	Manhole Plugging	LS	$0	$0	$51,718	$51,718	$51,718	$0
10	Excavation and Disposal of Sewer Lines	LS	$0	$0	$0	$0	$0	$133,660
11	Installation of Drainage System		$0	$0	$594,817	$594,817	$594,817	$0
12	Temporary Site Facilities	LS	$0	$0	$257,652	$257,652	$257,652	$489,087
	Capital Cost SubTotal		**$0**	**$0**	**$3,596,336**	**$4,347,521**	**$6,864,318**	**$92,892,285**

MARKUPS			Alt 1 Markup	Alt 1 Cost	Alt 2 Markup	Alt 2 Cost	Alt 3 Markup	Alt 3 Cost	Alt 4 Markup	Alt 4 Cost	Alt 5 Markup	Alt 5 Cost	Alt 6 Markup	Alt 6 Cost
Markup 1	Mobilization/Demobilization	%	5%	$0	5%	$0	5%	$179,816.80	5%	$217,376	5%	$343,216	5%	$4,644,614
Markup 2	Bonds and Insurance	%	2%	$0	2%	$0	2%	$71,926.72	2%	$86,950	2%	$137,286	2%	$1,857,846
Markup 3	Engineering & CM, percentage of Capital Cost Subtotal plus Markup 1	%	15%	$0	15%	$0	15%	$566,423	15%	$684,734	15%	$1,081,130	15%	$14,630,535
Markup 4	Contingency, percentage of Capital Cost Subtotal plus Markups 1, 2 and 3	%	20%	$0	20%	$0	20%	$882,901	20%	$1,067,316	20%	$1,685,190	20%	$22,805,056
Markup 5	Escalation to Midpoint of Construction (2021), 3% per year. Percentage of Capital Cost Subtotal plus Markups 1 through 4	%	9.3%	$0	9.3%	$0	9.3%	$492,658	9.3%	$595,562	9.3%	$940,336	9.3%	$12,725,221
	TOTAL CAPITAL COST		**$0**		**$0**		**$5,790,062**		**$6,999,460**		**$11,051,476**		**$149,555,557**	

ANNUAL COSTS			Alt 1 Cost Per Year	Alt 2 Cost Per Year	Alt 3 Cost Per Year	Alt 4 Cost Per Year	Alt 5 Cost Per Year	Alt 6 Cost Per Year
A1	Annual Monitoring (20 wells) - 30 Years	Lump Sum	na	$3,100	$3,100	$3,100	$3,100	na
A2	Annual Reporting & 5-year Review	Lump Sum	na	$11,400	$11,400	$11,400	$11,400	na
A3	Groundwater Treatment System O&M	Lump Sum	na	na	na	na	$29,000	na
	TOTAL ANNUAL COST		**$0**	**$14,500**	**$14,500**	**$14,500**	**$43,500**	**$0**
	PRESENT WORTH of ANNUAL COST (5% for 30 years) (1)		**$0**	**$222,249**	**$222,249**	**$222,249**	**$666,746**	**$0**
			ALTERNATIVE 1	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
	TOTAL CAPITAL plus PW of ANNUAL COST		**$0**	**$222,000**	**$6,012,000**	**$7,222,000**	**$11,718,000**	**$149,556,000**

Notes:
(1) Present Worth Factor = 15.3275

FIGURES



Sources: © 2013 National Geographic TOPO!
ESRI World Street Map

2,000 0 2,000 Feet

URS

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
SITE LOCATION

FIGURE 1-1

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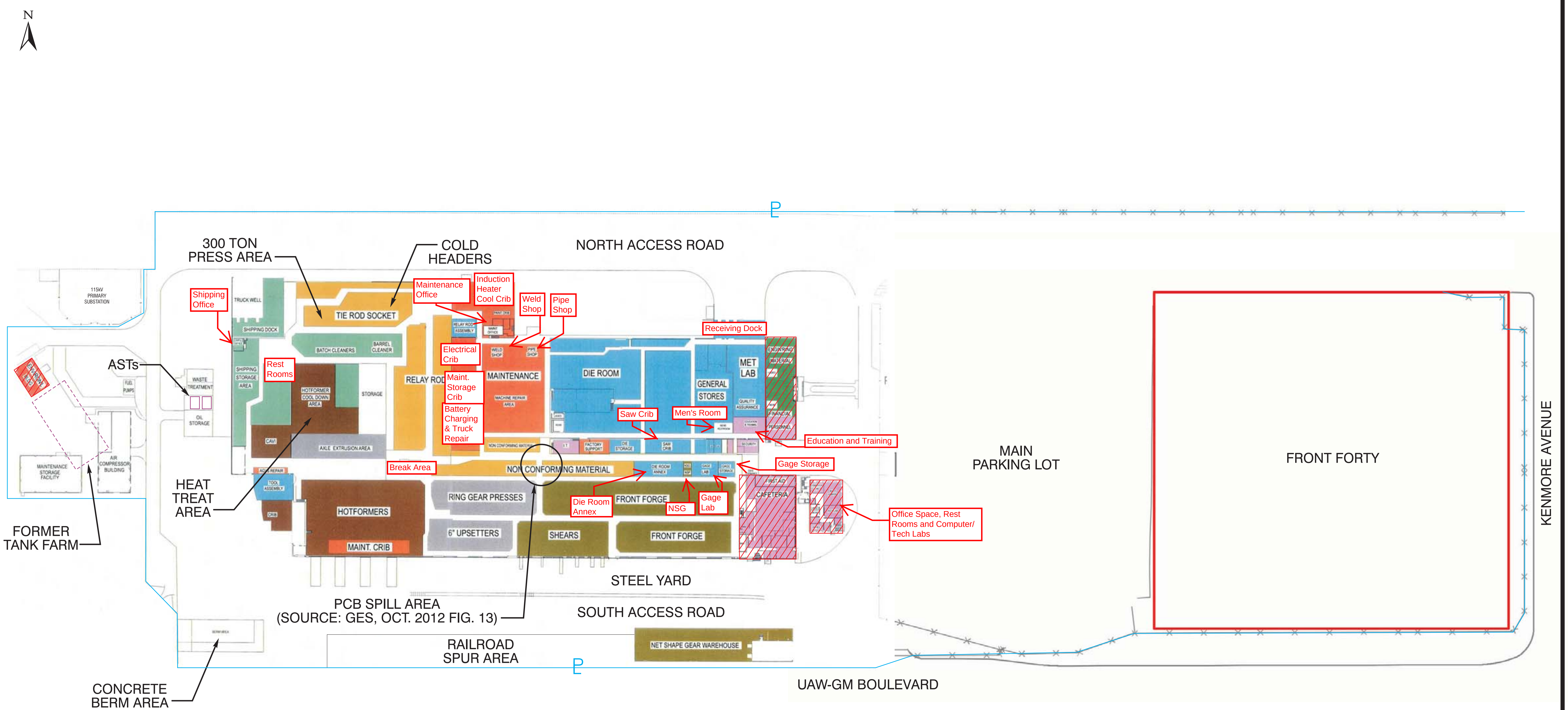


- Existing Structures

P - Approximate Property Line

NOTES: Not to scale.

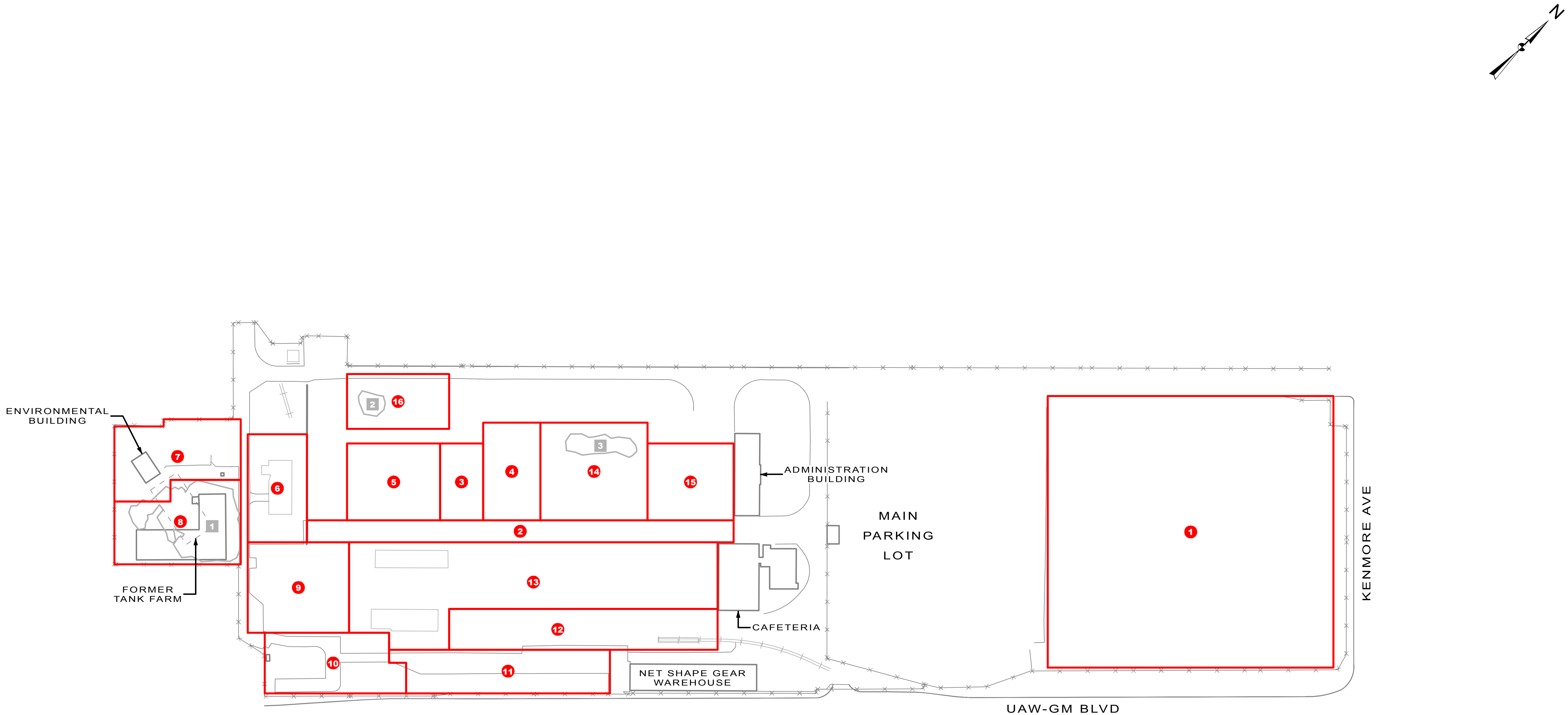
SOURCE: AAM 02/05/2001 Emergency Evacuation and Shelter Plan

AG20961-11176989-051514-GCM

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
HISTORICAL SITE PLAN

URS

FIGURE 1-2



Legend

Area of Concern

Debris/Waste Pile (Removed Feb. 2016)

200 0 200 Feet

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
AREAS OF CONCERN

URS

FIGURE 1-3

J:\Projects\11176989\GIS\MAPS\RI PHASE 2\01-03 AREAS OF CONCERN.mxd 5/19/2017

Legend

- Monitoring Well
- Geoprobe
- Surface Soil Sample
- Soil Boring
- Area of Concern

Notes:
- Units are in mg/kg
- Results only shown where they exceed Part 375 Industrial Use SCOs

160 0 160 Feet

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
SURFACE SOIL SAMPLE LOCATIONS

URS

FIGURE 2-1

Legend

- Monitoring Well
- Geoprobe
- Soil Boring
- Test Trench Sample
- Test Pit
- Area of Concern

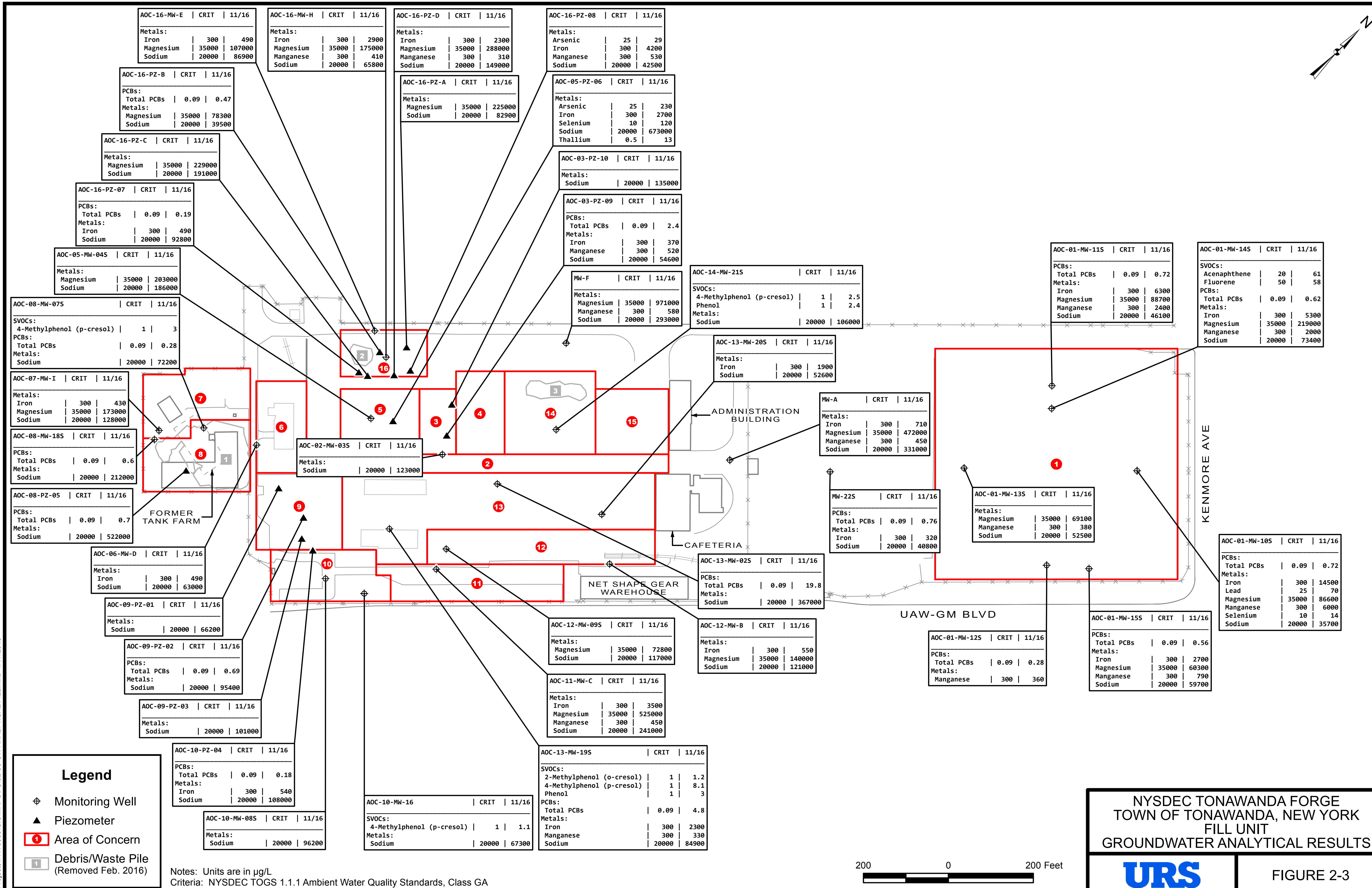
Notes:
- Units are in mg/kg
- Results only shown where they exceed Part 375 Industrial Use SCOs

160 0 160 Feet

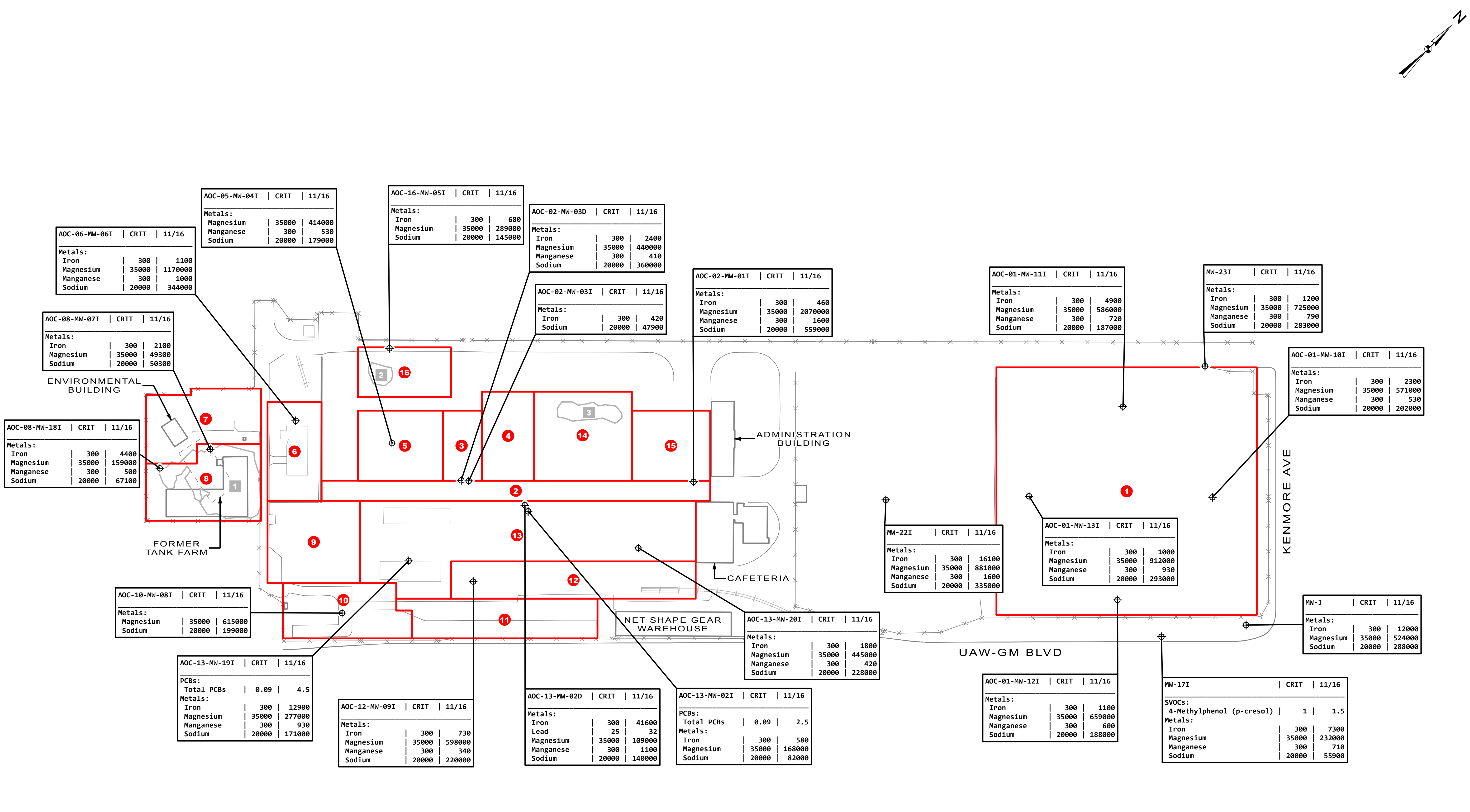
NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
SUBSURFACE SOIL SAMPLE LOCATIONS

URS

FIGURE 2-2



J:\Projects\11176989\GIS\MAPS\FS\02-03 GW ANALYTICAL FILL.mxd 4/17/2018



Legend

- Monitoring Well
- Area of Concern
- Debris/Waste Pile (Removed Feb. 2016)

Notes: Units are in µg/L
Criteria: NYSDEC TOGS 1.1.1 Ambient Water Quality Standards, Class GA

200 0 200 Feet

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
GLACIAL TILL UNIT
GROUNDWATER ANALYTICAL RESULTS

URS

FIGURE 2-4

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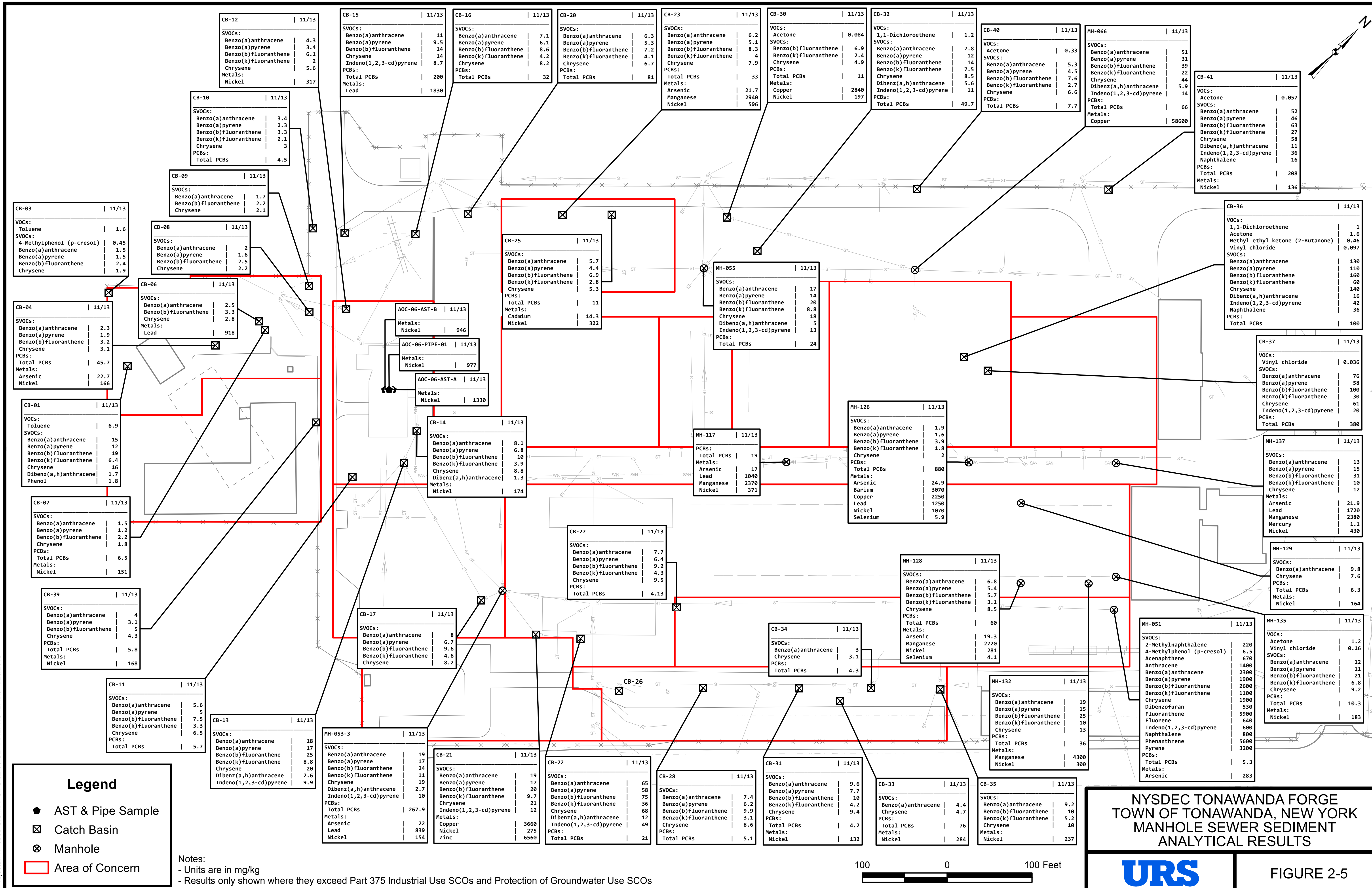
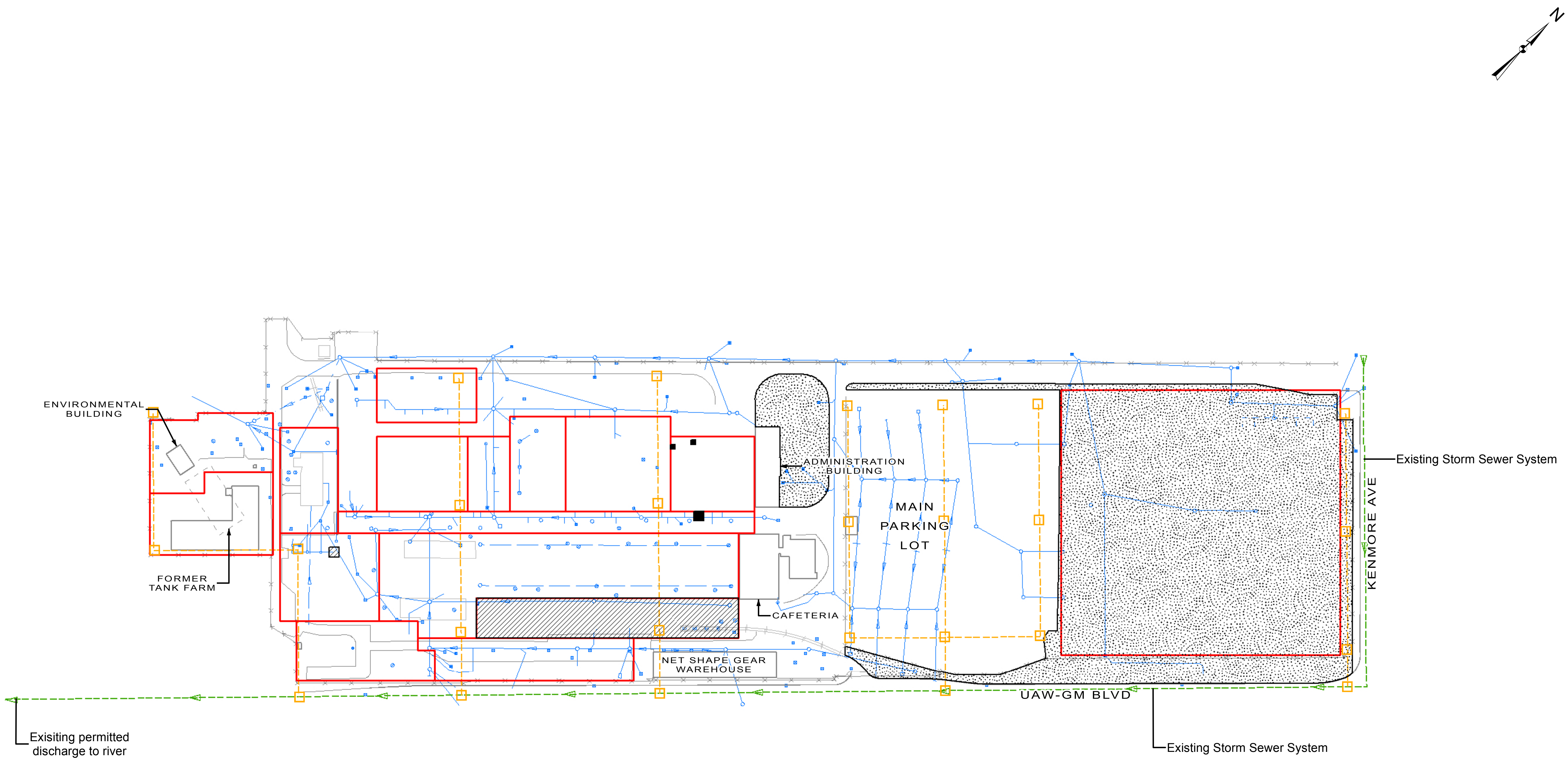


J:\Projects\11176989\GIS\MAPS\FS\02-05 SE ANALYTICAL.mxd 4/23/2018



Legend

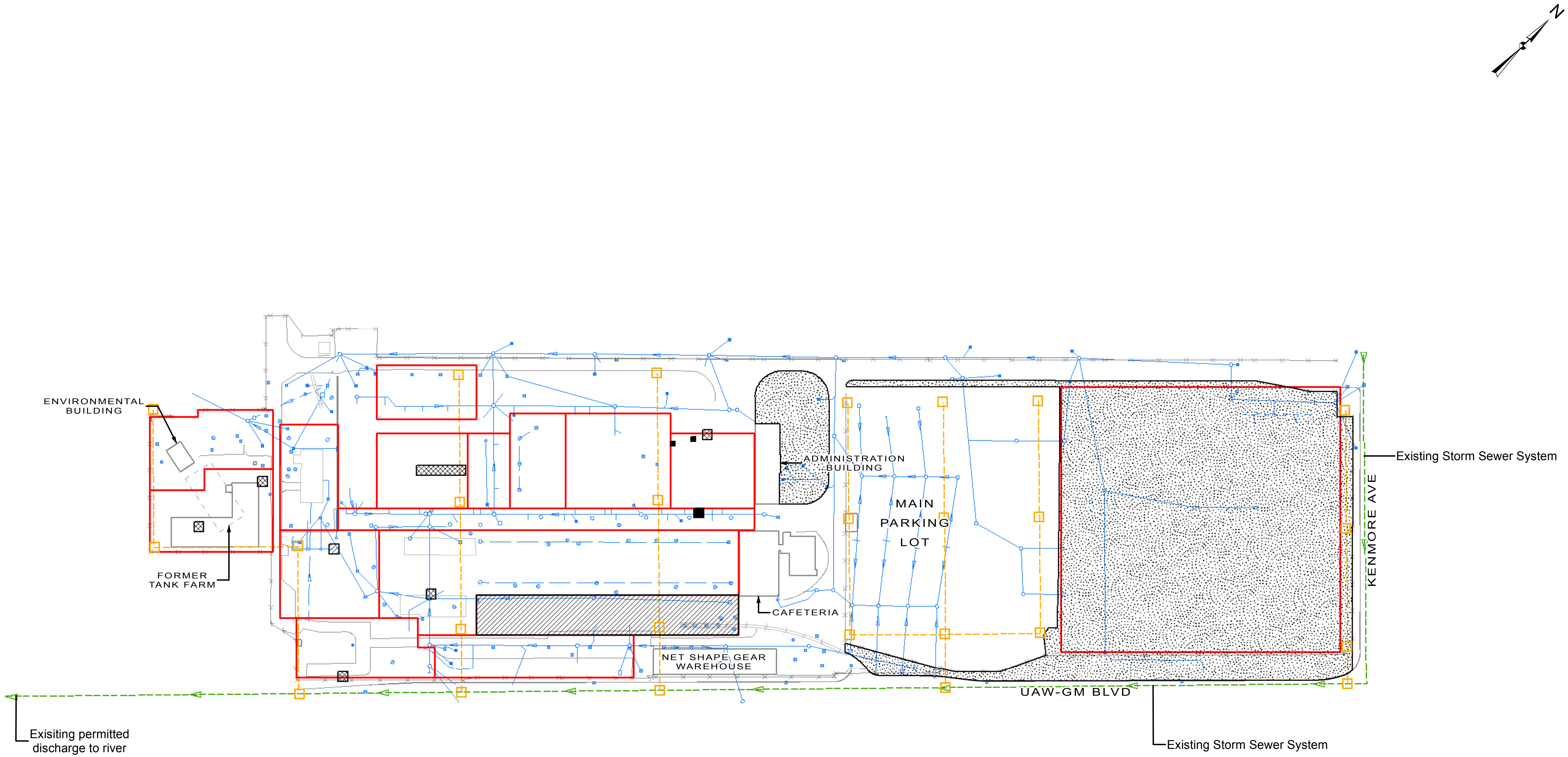
- Existing Storm Sewer System
- Proposed Onsite Sewer System
- Sewer to be cleaned and sealed
- Areas of Concern
- One-foot Surface Cover
- Surface Soil Excavation
- Concrete or Brick Removal

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
ALTERNATIVE 3

URS

FIGURE 4-1

J:\Projects\11176989\GIS\MAPS\FS\04-01 ALTERNATIVE 3.mxd 9/17/2019



Legend

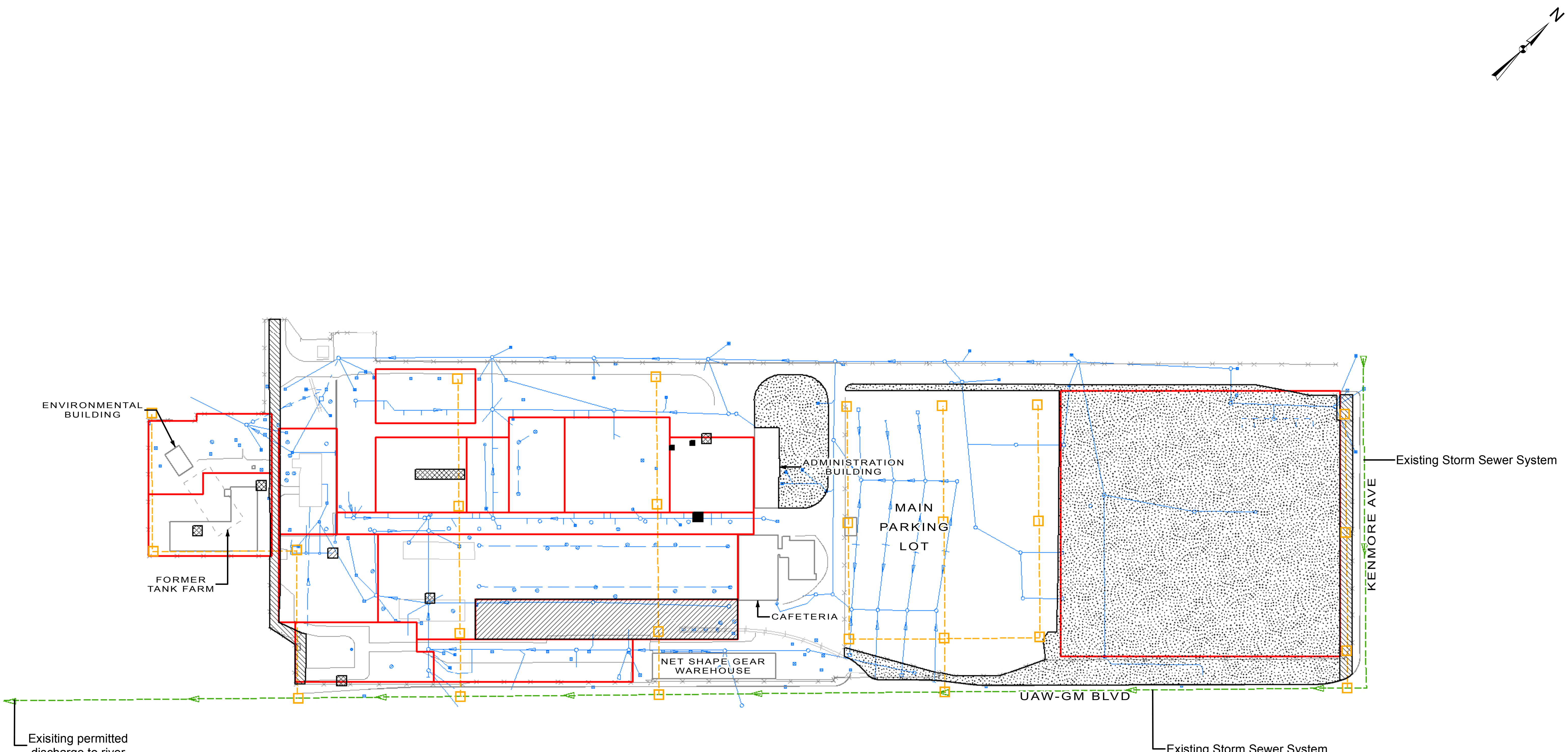
- Existing Storm Sewer System
- Proposed Onsite Sewer System
- Sewer to be cleaned and sealed
- Areas of Concern
- One-foot Surface Cover
- Surface Soil Excavation
- Subsurface Soil Excavation
- Concrete or Brick Removal

200 0 200 Feet

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
ALTERNATIVE 4

URS

FIGURE 4-2



Legend

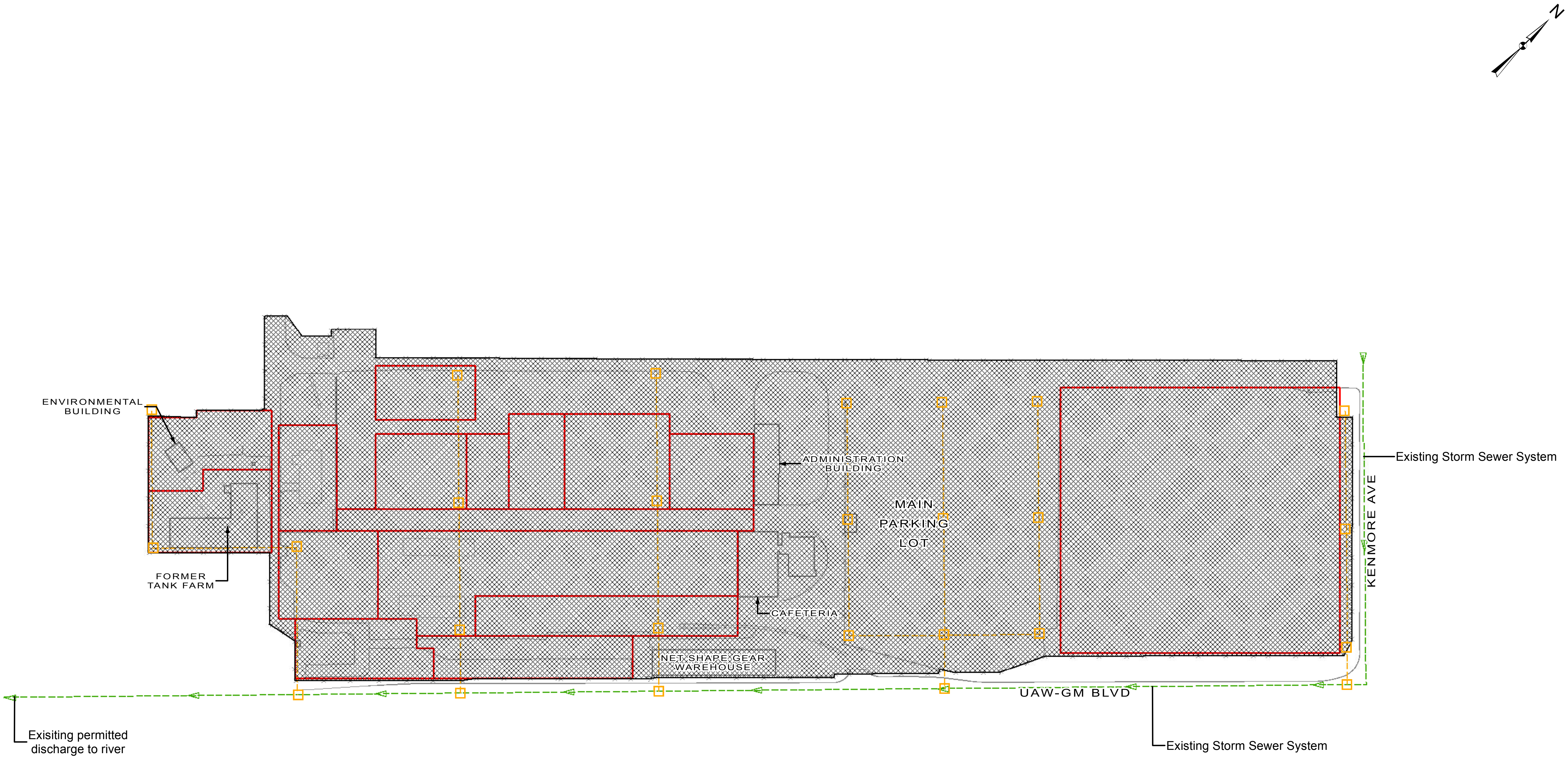
- Existing Storm Sewer System
- Proposed Onsite Sewer System
- Sewer to be cleaned and sealed
- Areas of Concern
- One-foot Surface Cover
- Surface Soil Excavation
- Subsurface Soil Excavation
- Groundwater Collection Trench
- Concrete or Brick Removal

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
ALTERNATIVE 5

URS

FIGURE 4-3

J:\Projects\11176989\GIS\MAPS\FS\04-03 ALTERNATIVE 5.mxd 9/17/2019



Legend

- Existing Storm Sewer System
- Proposed Onsite Sewer System
- Sewer to be cleaned and sealed
- Areas of Concern
- Surface & Subsurface Soil Excavation including Concrete Removal

NYSDEC TONAWANDA FORGE
TOWN OF TONAWANDA, NEW YORK
ALTERNATIVE 6

URS

FIGURE 4-4

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WARNING
IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON OTHER THAN WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NO.	MADE BY	APPROVED BY	DATE	DESCRIPTION

REVISIONS

DESIGNED BY: _
DRAWN BY: RAL
CHECKED BY: _
PROJ. ENGR. _

URS Corporation
New York
257 West Genesee Street, Suite 400, Buffalo, New York 14202
(716)856-5636 - (716)856-2545 fax

JOB NO. 11176989

TONAWANDA FORGE

TOWN OF TONAWANDA NEW YORK

TONAWANDA FORGE
SITE #915274

SEWER SYSTEM
(SHEET 1 OF 2)

Scale: AS SHOWN Date: MAY 2014 PLATE 1

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(SHEET 2 OF 2)

Scale: AS SHOWN | Date: MAY 2014 | PLATE 1

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APPENDIX A

COST ESTIMATES

Tonawanda Forge
Feasibility Study

TABLE 1
COST ESTIMATE SUMMARY

Client NYSDEC
Project Tonawanda Forge FS
Title Feasibility Study Cost Estimate

Project Number 60416128
Calculated By: DNM Date: 04/23/2019
Checked By: KRJ Date: 05/03/2019

CAPITAL COSTS			ALTERNATIVE 1: No Action	ALTERNATIVE 2: Site Management	ALTERNATIVE 3: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls	ALTERNATIVE 4: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Surface Water Control, and Institutional Controls	ALTERNATIVE 5: Sewer Decontamination and Sealing, Excavation or Covering of Contaminated Surface and Subsurface Soil above Industrial Use SCOs, Groundwater Collection and Treatment, Surface Water Control, and Institutional Controls	ALTERNATIVE 6: Remediation to Unrestricted Use Conditions, Including Demolition and Disposal of Former Building Floors, and Excavation of Contaminated Soil and Sewer Lines
Item	Description	Units	COST	COST	COST	COST	COST	COST
1	Surface Soil Excavation AOC-12 and Backfill	LS	$0	$0	$474,772	$474,772	$474,772	$0
2	Other Surface Soil, Concrete, and Brick Excav and Backfill	LS	$0	$0	$11,419	$11,419	$11,419	$0
3	Subsurface Soil Excavation and Backfill	LS	$0	$0	$0	$751,184	$751,184	$0
4	AOC-1 Area Covering	LS	$0	$0	$1,306,034	$1,306,034	$1,306,034	$0
5	Excavate Entire Site to 8' and Backfill	LS	$0	$0	$0	$0	$0	$92,269,538
6	Collection Trench Installation	LS	$0	$0	$0	$0	$2,380,860	$0
7	GW Treatment by Sedimentation/Carbon	LS	$0	$0	$0	$0	$135,938	$0
8	Sewer Cleaning	LS	$0	$0	$899,924	$899,924	$899,924	$0
9	Manhole Plugging	LS	$0	$0	$51,718	$51,718	$51,718	$0
10	Excavation and Disposal of Sewer Lines	LS	$0	$0	$0	$0	$0	$133,660
11	Installation of Drainage System		$0	$0	$594,817	$594,817	$594,817	$0
12	Temporary Site Facilities	LS	$0	$0	$257,652	$257,652	$257,652	$489,087
	Capital Cost SubTotal		**$0**	**$0**	**$3,596,336**	**$4,347,521**	**$6,864,318**	**$92,892,285**

MARKUPS			Alt 1 Markup	Alt 1 Cost	Alt 2 Markup	Alt 2 Cost	Alt 3 Markup	Alt 3 Cost	Alt 4 Markup	Alt 4 Cost	Alt 5 Markup	Alt 5 Cost	Alt 6 Markup	Alt 6 Cost
Markup 1	Mobilization/Demobilization	%	5%	$0	5%	$0	5%	$179,816.80	5%	$217,376	5%	$343,216	5%	$4,644,614
Markup 2	Bonds and Insurance	%	2%	$0	2%	$0	2%	$71,926.72	2%	$86,950	2%	$137,286	2%	$1,857,846
Markup 3	Engineering & CM, percentage of Capital Cost Subtotal plus Markup 1	%	15%	$0	15%	$0	15%	$566,423	15%	$684,734	15%	$1,081,130	15%	$14,630,535
Markup 4	Contingency, percentage of Capital Cost Subtotal plus Markups 1, 2 and 3	%	20%	$0	20%	$0	20%	$882,901	20%	$1,067,316	20%	$1,685,190	20%	$22,805,056
Markup 5	Escalation to Midpoint of Construction (2021), 3% per year. Percentage of Capital Cost Subtotal plus Markups 1 through 4	%	9.3%	$0	9.3%	$0	9.3%	$492,658	9.3%	$595,562	9.3%	$940,336	9.3%	$12,725,221
	TOTAL CAPITAL COST		**$0**		**$0**		**$5,790,062**		**$6,999,460**		**$11,051,476**		**$149,555,557**	

ANNUAL COSTS			Alternative 1 Cost Per Year	Alternative 2 Cost Per Year	Alternative 3 Cost Per Year	Alternative 4 Cost Per Year	Alternative 5 Cost Per Year	Alternative 6 Cost Per Year
A1	Annual Monitoring (20 wells) - 30 Years	Lump Sum	na	$3,100	$3,100	$3,100	$3,100	na
A2	Annual Reporting & 5-year Review	Lump Sum	na	$11,400	$11,400	$11,400	$11,400	na
A3	Groundwater Treatment System O&M	Lump Sum	na	na	na	na	$29,000	na
	TOTAL ANNUAL COST		**$0**	**$14,500**	**$14,500**	**$14,500**	**$43,500**	**$0**
	PRESENT WORTH of ANNUAL COST (5% for 30 years) (1)		**$0**	**$222,249**	**$222,249**	**$222,249**	**$666,746**	**$0**
			ALTERNATIVE 1	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
TOTAL CAPITAL plus PW of ANNUAL COST			**$0**	**$222,000**	**$6,012,000**	**$7,222,000**	**$11,718,000**	**$149,556,000**

Notes:

(1) Present Worth Factor = 15.3275

Tonawanda Forge
Feasibility Study
TABLE 2
ALTERNATIVE 3 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
1	**Surface Soil Excavation AOC-12 and Backfill**				**$455,784**	**$474,772**		
	Saw-Cut Asphalt	309	lf	$3.26	$1,007	$1,095	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Pavement Excavation and Stockpile	108	cy	$15.86	$1,714	$1,714	Ronkonkoma Average Bid	
	Saw-Cut Concrete	62	lf	$4.31	$266	$290	MII 2016 Costbook	
	Demolish Concrete	243	sy	$5.97	$1,452	$1,579	MII 2016 Costbook	
	Concrete Excavation and Stockpile	81	cy	$15.86	$1,286	$1,286	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	1,432	bcy	$15.86	$22,714	$22,714	Ronkonkoma Average Bid	
	End Point Sample Analysis	18	ea	$299.16	$5,385	$5,385	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	2	ea	$629.54	$1,259	$1,259	Standby Contract Average (2018)	
	Transportation and Disposal - Asphalt	162	ton	$183.00	$29,670	$32,266	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris	122	ton	$89.00	$10,822	$11,769	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	215	ton	$387.00	$83,136	$90,410	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	2,127	ton	$88.26	$187,706	$187,706	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	1,081	ecy	$4.27	$4,615	$4,615	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	1,297	lcy	$43.75	$56,745	$61,711	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	4,864	sy	$0.89	$4,329	$4,329	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	649	lcy	$30.75	$19,942	$21,687	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	4,864	sy	$2.87	$13,959	$15,181	MII 2016 Costbook	Includes grading and raking items
	Seeding	4,864	sy	$2.01	$9,776	$9,776	Ronkonkoma Average Bid	
2	**Other Surface Soil, Concrete, and Brick Excavation and Backfill**				**$10,657**	**$11,419**		
	Saw-Cut Concrete	240	lf	$4.31	$1,034	$1,125	MII 2016 Costbook	
	Demolish Concrete	111	sy	$5.97	$663	$721	MII 2016 Costbook	
	Concrete Excavation and Stockpile	37	cy	$15.86	$587	$587	Ronkonkoma Average Bid	
	End Point Sample Analysis	1	ea	$299.16	$299	$299	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	1	ea	$629.54	$630	$630	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	56	ton	$89.00	$4,944	$5,377	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction	25	ecy	$4.27	$105	$105	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	30	lcy	$43.75	$1,296	$1,410	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	111	sy	$0.89	$99	$99	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	15	lcy	$30.75	$456	$495	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	111	sy	$2.87	$319	$347	MII 2016 Costbook	Includes grading and raking items
	Seeding	111	sy	$2.01	$223	$223	Ronkonkoma Average Bid	
3	**Subsurface Soil Excavation and Backfill**				**$0**	**$0**		
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
	Dewatering and Water Treatment		ls	$80,326.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 25% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011

Tonawanda Forge
Feasibility Study
TABLE 2
ALTERNATIVE 3 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
4 AOC-1 Area Covering					**$1,224,703**	**$1,306,034**		
	Tree Clearing and Grubbing	37	ea	$373.13	$13,806	$15,014	MII 2016 Costbook	
	Brush Clearing and Grubbing	1	ac	$237.10	$310	$337	MII 2016 Costbook	
	Saw-Cut Concrete	245	lf	$4.31	$1,057	$1,149	MII 2016 Costbook	
	Demolish Concrete	461	sy	$5.97	$2,754	$2,995	MII 2016 Costbook	
	Concrete Excavation and Stockpile	154	cy	$15.86	$2,439	$2,439	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	769	bcy	$15.86	$12,193	$12,193	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis	2	ea	$629.54	$1,259	$1,259	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	231	ton	$89.00	$20,527	$22,323	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	1,153	ton	$88.26	$101,781	$101,781	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	10,251	ecy	$4.27	$43,770	$43,770	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	12,301	lcy	$43.75	$538,159	$585,248	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	46,128	sy	$0.89	$41,054	$41,054	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	6,150	lcy	$30.75	$189,124	$205,673	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	46,128	sy	$2.87	$132,387	$143,971	MII 2016 Costbook	Includes grading and raking items
	Seeding	46,128	sy	$2.01	$92,717	$92,717	Ronkonkoma Average Bid	
	Demarcation Layer	46,128	sy	$0.68	$31,367	$34,112	Home Deopt (2018)	Assume orange snow fence visual barrier

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
5 Excavate Entire Site to 8' and Backfill					**$0**	**$0**		
	Tree Clearing and Grubbing		ea	$373.13	$0	$0	MII 2016 Costbook	
	Brush Clearing and Grubbing		ac	$237.01	$0	$0	MII 2016 Costbook	
	Poly Sheeting for temporary stockpiles		sy	$0.53	$0	$0	Uline (2016)	Assume poly sheeting for overnight stockpile cover, escalated from2016
	Saw-Cut Asphalt		lf	$3.26	$0	$0	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Excavation and Stockpile		bcy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Soil Excavation and Stockpile		bcy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average	
	Transportation and Disposal - Asphalt		ton	$183.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$167.00	$0	$0	Clean Harbors (2018)	Quantity is too large for local disposal
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
	Dewatering and Water Treatment		ls	$624,610.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but double cost for larger excavation and more groundwater. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
5a Building Demolition and Disposal								
	Building Demolition - 1-Storey		sf	$7.29	$0	$0	URS Cost Estimate	Not Escalated
	Building Demolition - 2-Storey		sf	$10.94	$0	$0	URS Cost Estimate	Assume 50% higher unit cost for 2-storey bldg. Not escalated
	Asbestos Abatement		sf	$31.70	$0	$0	Average of "Asbestos Reference" cost and URS 2017 Estimate	Asbestos Reference: $60/sf (occupued bldg), URS Estimated cost $3.40/sf. Not escalated
	Transportation and Disposal - Building Materials		ton	$89.00	$0	$0	Clean Harbors	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - ACM		ton	$750.00	$0	$0	Clean Harbors	Assume 0.25 ton/drum, 40 drums per shipment

Tonawanda Forge
Feasibility Study
TABLE 2
ALTERNATIVE 3 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
6	**Collection Trench Installation**				**$0**	**$0**		
	Brush Clearing and Grubbing		ac	$237.01	$0	$0	MII 2016 Costbook	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$88.26	$0	$0	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill Trench		ecy	$10.21	$0	$0	MII 2016 Costbook	Material cost removed from unit cost
	Permeable Bedding Stone Purchase		lcy	$52.75	$0	$0	Niagara Topsoil (2018)	20 cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Dewatering and Water Treatment		ls	$160,652.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but half cost for smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
	Trench Box Rental		day	$191.00	$0	$0	MII 2016 Costbook	
	Sump		ea	$615.00	$0	$0	MII 2016 Costbook	Assume 8 ft deep sumps (24" pipe with gravel collar), $76.81/lf to install
	Perforated Drain Pipe		lf	$4.81	$0	$0	MII 2016 Costbook	Assume 8" perforated corrugated plastic
	Non-Perforated Drain Pipe		lf	$4.81	$0	$0	MII 2016 Costbook	Conveyance piping from trench to sump, and from sump to treatment system, 8"
	Filter Fabric		sf	$1.64	$0	$0	MII 2016 Costbook	
7	**GW Treatment by Sedimentation/Carbon**				**$0**	**$0**		
	GW Treatment system delivery and installation		ls	$125,000.00	$0	$0	ProAct Telecon (2018)	Includes all costs for delivery and installation
8	**Sewer Cleaning**				**$827,516**	**$899,924**		
	Jet Cleaning	18,590	lf	$2.98	$55,398	$60,246	Roto Rooter Quote (2016)	$2.81/lf escalated from 2016. 100 lf/hour per quote from vendor
	Sludge Removal	109,212	gal	$0.04	$4,368	$4,751	Frank's Vac Quote (2018)	$125/hr, assume 50 gpm so $0.04/gal
	Vac Truck Cleaning	4	ea	$3,000.00	$12,000	$13,050	Frank's Vac Quote (2018)	Assume 4 trucks are used, and only need to be cleaned once job is completed
	Sludge Transport and Disposal	109,212	gal	$6.92	$755,750	$821,878	Frank's Vac Quote (2018)	$0.75/lb disposal, $0.52/gal transport, assume sludge is 8.5 lb/gal
9	**Manhole and Sewer Sealing**				**$50,250**	**$51,718**		
	Sewer Filling - Material Purchase, Delivered	45	cy	$68.00	$3,064	$3,332	Iroquios Quote (2018)	Assume Flowable Fill
	Manhole Filling - Material Purchase, Delivered	141	cy	$68.00	$9,588	$10,427	Iroquios Quote (2018)	Assume Flowable Fill
	Sewer Filling - Labor and equipment	186	cy	$11.95	$2,223	$2,418	MII 2016 Costbook	3 laborers with a concrete vibrator
	Excavation for Clay Dam	50	bcy	$15.86	$793	$793	Ronkonkoma Average Bid	
	Backfill Clay Dam	10	ecy	$4.27	$43	$43	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Clay Purchase	12	lcy	$30.75	$369	$401	Niagara Topsoil (2018)	Assume same cost as topsoil
	Backfill and Compaction	35	ecy	$4.27	$149	$149	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	42	lcy	$31.75	$1,334	$1,450	Niagara Topsoil (2018)	Assume same cost as topsoil
	Topsoil Placement	405	sy	$0.89	$360	$360	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	6	lcy	$32.75	$197	$214	Niagara Topsoil (2018)	Assume same cost as topsoil
	Dewatering and Water Treatment	1	ls	$32,130.00	$32,130	$32,130	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 10% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
10	**Excavation and Disposal of Sewer Lines**				**$0**	**$0**		
	Manhole Demolition		ea	$383.68	$0	$0	MII 2016 Costbook	
	Concrete Sewer Demolition		lf	$7.67	$0	$0	MII 2016 Costbook	Assume average cost for 12" lines. Only concrete pipes require additional demo
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load

Tonawanda Forge
Feasibility Study
TABLE 2
ALTERNATIVE 3 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
11	**Installation of Drainage System**				**$549,131**	**$594,817**		
	Saw-Cut Concrete (Pipe Trench)	9,400	lf	$4.39	$41,288	$44,900	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Saw-Cut Concrete (Catch Basins)	520	lf	$4.39	$2,284	$2,484	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Pipe Trench)	1,044	sy	$14.28	$14,913	$16,217	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Catch Basins)	58	sy	$14.28	$825	$897	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Pipe Trench)	218	lcy	$10.65	$2,317	$2,519	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Catch Basin)	15	lcy	$10.65	$160	$174	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Pipe Trench)	348	ton	$77.70	$27,051	$29,418	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Catch Basin)	24	ton	$77.70	$1,871	$2,034	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Excavation (Pipe Trench)	1,741	bcy	$3.82	$6,656	$7,238	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavation (Catch Basin)	120	bcy	$3.82	$460	$501	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Soil Hauling (Up to 50 miles) (Pipe Trench and Catch Basin)	2,326	lcy	$10.65	$24,769	$26,936	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Soil Disposal (Pipe Trench and Catch Basin)	2,754	ton	$10.65	$29,327	$31,893	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Backfilling (Pipe Trench and Catch Basin)	1,874	lcy	$2.54	$4,762	$5,178	R.S. Means Online 2019	Includes 21% for overhead and profit.
	12" PVC Pipe Installation	4,700	lf	$27.90	$131,142	$142,617	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Material (Top 2 ft.)	666	bcy	$21.48	$14,310	$15,562	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Hauling Up to 50 Miles	833	lcy	$12.27	$10,218	$11,113	R.S. Means Online 2020	Includes 21% for overhead and profit.
	Pea Gravel Material (Bottom 2.5 ft.)	1,233	ton	$19.66	$24,236	$26,357	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Pea Gravel Hauling (Up to 50 miles)	1,041	lcy	$12.27	$12,773	$13,891	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Catch Basin with Frame and Grate	26	each	$3,267.00	$84,942	$92,374	Kistner Concrete	Includes 21% for overhead and profit.
	Laborer (Catch Basin Installation)	52	hour	$79.32	$4,125	$4,486	NYSDOL	Includes 21% for overhead and profit.
	Equipment Operator (Catch Basin Installation)	26	hour	$96.20	$2,501	$2,720	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavator (Catch Basin Installation)	26	hour	$106.54	$2,770	$3,012	NYSDOL	Includes 21% for overhead and profit.
	Plumber (Connections to Existing Storm Sewer)	10	hour	$84.77	$848	$922	NYSDOL	Includes 21% for overhead and profit.
	Connections to Existing Storm Sewer (Misc. Items Allowance)	1	each	$20,000.00	$20,000	$20,000		Engineer's Judgement
	Pavement Restoration (Pipe Trench and Catch Basin)	1,117	sy	$69.48	$77,584	$84,373	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Permit Application Fee	1	each	$7,000.00	$7,000	$7,000		Per communication with (T) Tonawanda Engineer

TOTAL DIRECT COST OF ALTERNATIVE	**$3,338,684**
Temporary Site Services	**$257,652**
TOTAL CAPITAL COST	**$3,596,336**

Tonawanda Forge
Feasibility Study
TABLE 3
ALTERNATIVE 4 COST BREAKDOWN

Client NYSDEC	**Project Number**	60416128	
Project Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
1	**Surface Soil Excavation AOC-12 and Backfill**				**$455,784**	**$474,772**		
	Saw-Cut Asphalt	309	lf	$3.26	$1,007	$1,095	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Pavement Excavation and Stockpile	108	cy	$15.86	$1,714	$1,714	Ronkonkoma Average Bid	
	Saw-Cut Concrete	62	lf	$4.31	$266	$290	MII 2016 Costbook	
	Demolish Concrete	243	sy	$5.97	$1,452	$1,579	MII 2016 Costbook	
	Concrete Excavation and Stockpile	81	cy	$15.86	$1,286	$1,286	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	1,432	bcy	$15.86	$22,714	$22,714	Ronkonkoma Average Bid	
	End Point Sample Analysis	18	ea	$299.16	$5,385	$5,385	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	2	ea	$629.54	$1,259	$1,259	Standby Contract Average (2018)	
	Transportation and Disposal - Asphalt	162	ton	$183.00	$29,670	$32,266	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris	122	ton	$89.00	$10,822	$11,769	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	215	ton	$387.00	$83,136	$90,410	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	2,127	ton	$88.26	$187,706	$187,706	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	1,081	ecy	$4.27	$4,615	$4,615	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	1,297	lcy	$43.75	$56,745	$61,711	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	4,864	sy	$0.89	$4,329	$4,329	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	649	lcy	$30.75	$19,942	$21,687	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	4,864	sy	$2.87	$13,959	$15,181	MII 2016 Costbook	Includes grading and raking items
	Seeding	4,864	sy	$2.01	$9,776	$9,776	Ronkonkoma Average Bid	
2	**Other Surface Soil, Concrete, and Brick Excavation and Backfill**				**$10,657**	**$11,419**		
	Saw-Cut Concrete	240	lf	$4.31	$1,034	$1,125	MII 2016 Costbook	
	Demolish Concrete	111	sy	$5.97	$663	$721	MII 2016 Costbook	
	Concrete Excavation and Stockpile	37	cy	$15.86	$587	$587	Ronkonkoma Average Bid	
	End Point Sample Analysis	1	ea	$299.16	$299	$299	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	1	ea	$629.54	$630	$630	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	56	ton	$89.00	$4,944	$5,377	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction	25	ecy	$4.27	$105	$105	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	30	lcy	$43.75	$1,296	$1,410	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	111	sy	$0.89	$99	$99	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	15	lcy	$30.75	$456	$495	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	111	sy	$2.87	$319	$347	MII 2016 Costbook	Includes grading and raking items
	Seeding	111	sy	$2.01	$223	$223	Ronkonkoma Average Bid	
3	**Subsurface Soil Excavation and Backfill**				**$699,843**	**$751,184**		
	Saw-Cut Concrete	640	lf	$4.31	$2,758	$3,000	MII 2016 Costbook	
	Demolish Concrete	444	sy	$5.97	$2,653	$2,886	MII 2016 Costbook	
	Concrete Excavation and Stockpile	148	cy	$15.86	$2,350	$2,350	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	874	bcy	$15.86	$13,863	$13,863	Ronkonkoma Average Bid	
	End Point Sample Analysis	35	ea	$299.16	$10,471	$10,471	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	1	ea	$629.54	$630	$630	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	222	ton	$89.00	$19,778	$21,508	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	1,311	ton	$387.00	$507,400	$551,798	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction	973	ecy	$4.27	$4,154	$4,154	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	1,167	lcy	$43.75	$51,074	$55,543	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	444	sy	$0.89	$396	$396	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	59	lcy	$30.75	$1,822	$1,982	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	444	sy	$2.87	$1,276	$1,387	MII 2016 Costbook	Includes grading and raking items
	Seeding	444	sy	$2.01	$893	$893	Ronkonkoma Average Bid	
	Dewatering and Water Treatment	1	ls	$80,326.00	$80,326	$80,326	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 25% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011

Tonawanda Forge
Feasibility Study
TABLE 3
ALTERNATIVE 4 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
4	**AOC-1 Area Covering**				**$1,224,703**	**$1,306,034**		
	Tree Clearing and Grubbing	37	ea	$373.13	$13,806	$15,014	MII 2016 Costbook	
	Brush Clearing and Grubbing	1	ac	$237.10	$310	$337	MII 2016 Costbook	
	Saw-Cut Concrete	245	lf	$4.31	$1,057	$1,149	MII 2016 Costbook	
	Demolish Concrete	461	sy	$5.97	$2,754	$2,995	MII 2016 Costbook	
	Concrete Excavation and Stockpile	154	cy	$15.86	$2,439	$2,439	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	769	bcy	$15.86	$12,193	$12,193	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis	2	ea	$629.54	$1,259	$1,259	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	231	ton	$89.00	$20,527	$22,323	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	1,153	ton	$88.26	$101,781	$101,781	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	10,251	ecy	$4.27	$43,770	$43,770	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	12,301	lcy	$43.75	$538,159	$585,248	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	46,128	sy	$0.89	$41,054	$41,054	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	6,150	lcy	$30.75	$189,124	$205,673	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	46,128	sy	$2.87	$132,387	$143,971	MII 2016 Costbook	Includes grading and raking items
	Seeding	46,128	sy	$2.01	$92,717	$92,717	Ronkonkoma Average Bid	
	Demarcation Layer	46,128	sy	$0.68	$31,367	$34,112	Home Deopt (2018)	Assume orange snow fence visual barrier
5	**Excavate Entire Site to 8' and Backfill**				**$0**	**$0**		
	Tree Clearing and Grubbing		ea	$373.13	$0	$0	MII 2016 Costbook	
	Brush Clearing and Grubbing		ac	$237.01	$0	$0	MII 2016 Costbook	
	Poly Sheeting for temporary stockpiles		sy	$0.53	$0	$0	Uline (2016)	Assume poly sheeting for overnight stockpile cover, escalated from2016
	Saw-Cut Asphalt		lf	$3.26	$0	$0	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Excavation and Stockpile		bcy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Soil Excavation and Stockpile		bcy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average	
	Transportation and Disposal - Asphalt		ton	$183.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$167.00	$0	$0	Clean Harbors (2018)	Quantity is too large for local disposal
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
	Dewatering and Water Treatment		ls	$624,610.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but double cost for larger excavation and more groundwater. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
5a	**Building Demolition and Disposal**							
	Building Demolition - 1-Storey		sf	$7.29	$0	$0	URS Cost Estimate	Not Escalated
	Building Demolition - 2-Storey		sf	$10.94	$0	$0	URS Cost Estimate	Assume 50% higher unit cost for 2-storey bldg. Not escalated
	Asbestos Abatement		sf	$31.70	$0	$0	Average of "Asbestos Reference" cost and URS 2017 Estimate	Asbestos Reference: $60/sf (occupued bldg), URS Estimated cost $3.40/sf. Not escalated
	Transportation and Disposal - Building Materials		ton	$89.00	$0	$0	Clean Harbors	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - ACM		ton	$750.00	$0	$0	Clean Harbors	Assume 0.25 ton/drum, 40 drums per shipment

Tonawanda Forge
Feasibility Study
TABLE 3
ALTERNATIVE 4 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128
Project	Tonawanda Forge FS	**Calculated By:**	DNM Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
6	**Collection Trench Installation**				**$0**	**$0**		
	Brush Clearing and Grubbing		ac	$237.01	$0	$0	MII 2016 Costbook	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$88.26	$0	$0	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill Trench		ecy	$10.21	$0	$0	MII 2016 Costbook	Material cost removed from unit cost
	Permeable Bedding Stone Purchase		lcy	$52.75	$0	$0	Niagara Topsoil (2018)	20 cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Dewatering and Water Treatment		ls	$160,652.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but half cost for smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
	Trench Box Rental		day	$191.00	$0	$0	MII 2016 Costbook	
	Sump		ea	$615.00	$0	$0	MII 2016 Costbook	Assume 8 ft deep sumps (24" pipe with gravel collar), $76.81/lf to install
	Perforated Drain Pipe		lf	$4.81	$0	$0	MII 2016 Costbook	Assume 8" perforated corrugated plastic
	Non-Perforated Drain Pipe		lf	$4.81	$0	$0	MII 2016 Costbook	Conveyance piping from trench to sump, and from sump to treatment system, 8"
	Filter Fabric		sf	$1.64	$0	$0	MII 2016 Costbook	
7	**GW Treatment by Sedimentation/Carbon**				**$0**	**$0**		
	GW Treatment system delivery and installation		ls	$125,000.00	$0	$0	ProAct Telecon (2018)	Includes all costs for delivery and installation
8	**Sewer Cleaning**				**$827,516**	**$899,924**		
	Jet Cleaning	18,590	lf	$2.98	$55,398	$60,246	Roto Rooter Quote (2016)	$2.81/lf escalated from 2016. 100 lf/hour per quote from vendor
	Sludge Removal	109,212	gal	$0.04	$4,368	$4,751	Frank's Vac Quote (2018)	$125/hr, assume 50 gpm so $0.04/gal
	Vac Truck Cleaning	4	ea	$3,000.00	$12,000	$13,050	Frank's Vac Quote (2018)	Assume 4 trucks are used, and only need to be cleaned once job is completed
	Sludge Transport and Disposal	109,212	gal	$6.92	$755,750	$821,878	Frank's Vac Quote (2018)	$0.75/lb disposal, $0.52/gal transport, assume sludge is 8.5 lb/gal
9	**Manhole and Sewer Sealing**				**$50,250**	**$51,718**		
	Sewer Filling - Material Purchase, Delivered	45	cy	$68.00	$3,064	$3,332	Iroquios Quote (2018)	Assume Flowable Fill
	Manhole Filling - Material Purchase, Delivered	141	cy	$68.00	$9,588	$10,427	Iroquios Quote (2018)	Assume Flowable Fill
	Sewer Filling - Labor and equipment	186	cy	$11.95	$2,223	$2,418	MII 2016 Costbook	3 laborers with a concrete vibrator
	Excavation for Clay Dam	50	bcy	$15.86	$793	$793	Ronkonkoma Average Bid	
	Backfill Clay Dam	10	ecy	$4.27	$43	$43	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Clay Purchase	12	lcy	$30.75	$369	$401	Niagara Topsoil (2018)	Assume same cost as topsoil
	Backfill and Compaction	35	ecy	$4.27	$149	$149	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	42	lcy	$31.75	$1,334	$1,450	Niagara Topsoil (2018)	Assume same cost as topsoil
	Topsoil Placement	405	sy	$0.89	$360	$360	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	6	lcy	$32.75	$197	$214	Niagara Topsoil (2018)	Assume same cost as topsoil
	Dewatering and Water Treatment	1	ls	$32,130.00	$32,130	$32,130	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 10% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
10	**Excavation and Disposal of Sewer Lines**				**$0**	**$0**		
	Manhole Demolition		ea	$383.68	$0	$0	MII 2016 Costbook	
	Concrete Sewer Demolition		lf	$7.67	$0	$0	MII 2016 Costbook	Assume average cost for 12" lines. Only concrete pipes require additional demo
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load

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Tonawanda Forge
Feasibility Study
TABLE 3
ALTERNATIVE 4 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
11	**Installation of Drainage System**				**$549,131**	**$594,817**		
	Saw-Cut Concrete (Pipe Trench)	9,400	lf	$4.39	$41,288	$44,900	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Saw-Cut Concrete (Catch Basins)	520	lf	$4.39	$2,284	$2,484	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Pipe Trench)	1,044	sy	$14.28	$14,913	$16,217	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Catch Basins)	58	sy	$14.28	$825	$897	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Pipe Trench)	218	lcy	$10.65	$2,317	$2,519	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Catch Basin)	15	lcy	$10.65	$160	$174	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Pipe Trench)	348	ton	$77.70	$27,051	$29,418	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Catch Basin)	24	ton	$77.70	$1,871	$2,034	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Excavation (Pipe Trench)	1,741	bcy	$3.82	$6,656	$7,238	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavation (Catch Basin)	120	bcy	$3.82	$460	$501	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Soil Hauling (Up to 50 miles) (Pipe Trench and Catch Basin)	2,326	lcy	$10.65	$24,769	$26,936	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Soil Disposal (Pipe Trench and Catch Basin)	2,754	ton	$10.65	$29,327	$31,893	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Backfilling (Pipe Trench and Catch Basin)	1,874	lcy	$2.54	$4,762	$5,178	R.S. Means Online 2019	Includes 21% for overhead and profit.
	12" PVC Pipe Installation	4,700	lf	$27.90	$131,142	$142,617	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Material (Top 2 ft.)	666	bcy	$21.48	$14,310	$15,562	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Hauling Up to 50 Miles	833	lcy	$12.27	$10,218	$11,113	R.S. Means Online 2020	Includes 21% for overhead and profit.
	Pea Gravel Material (Bottom 2.5 ft.)	1,233	ton	$19.66	$24,236	$26,357	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Pea Gravel Hauling (Up to 50 miles)	1,041	lcy	$12.27	$12,773	$13,891	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Catch Basin with Frame and Grate	26	each	$3,267.00	$84,942	$92,374	Kistner Concrete	Includes 21% for overhead and profit.
	Laborer (Catch Basin Installation)	52	hour	$79.32	$4,125	$4,486	NYSDOL	Includes 21% for overhead and profit.
	Equipment Operator (Catch Basin Installation)	26	hour	$96.20	$2,501	$2,720	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavator (Catch Basin Installation)	26	hour	$106.54	$2,770	$3,012	NYSDOL	Includes 21% for overhead and profit.
	Plumber (Connections to Existing Storm Sewer)	10	hour	$84.77	$848	$922	NYSDOL	Includes 21% for overhead and profit.
	Connections to Existing Storm Sewer (Misc. Items Allowance)	1	each	$20,000.00	$20,000	$20,000		Engineer's Judgement
	Pavement Restoration (Pipe Trench and Catch Basin)	1,117	sy	$69.48	$77,584	$84,373	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Permit Application Fee	1	each	$7,000.00	$7,000	$7,000		Per communication with (T) Tonawanda Engineer

TOTAL DIRECT COST OF ALTERNATIVE	**$4,089,868**
Temporary Site Services	**$257,652**
TOTAL CAPITAL COST	**$4,347,521**

Abbreviations:
bcy - In-Place Cubic Yards
lcy - Loose Cubic Yards
sy - Square Yards
lf - Linear Feet
sf - Square Feet
cy - Cubic Yards

Tonawanda Forge
Feasibility Study
TABLE 4
ALTERNATIVE 5 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
1	**Surface Soil Excavation AOC-12 and Backfill**				**$455,784**	**$474,772**		
	Saw-Cut Asphalt	309	lf	$3.26	$1,007	$1,095	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Pavement Excavation and Stockpile	108	cy	$15.86	$1,714	$1,714	Ronkonkoma Average Bid	
	Saw-Cut Concrete	62	lf	$4.31	$266	$290	MII 2016 Costbook	
	Demolish Concrete	243	sy	$5.97	$1,452	$1,579	MII 2016 Costbook	
	Concrete Excavation and Stockpile	81	cy	$15.86	$1,286	$1,286	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	1,432	bcy	$15.86	$22,714	$22,714	Ronkonkoma Average Bid	
	End Point Sample Analysis	18	ea	$299.16	$5,385	$5,385	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	2	ea	$629.54	$1,259	$1,259	Standby Contract Average (2018)	
	Transportation and Disposal - Asphalt	162	ton	$183.00	$29,670	$32,266	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris	122	ton	$89.00	$10,822	$11,769	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	215	ton	$387.00	$83,136	$90,410	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	2,127	ton	$88.26	$187,706	$187,706	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	1,081	ecy	$4.27	$4,615	$4,615	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	1,297	lcy	$43.75	$56,745	$61,711	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	4,864	sy	$0.89	$4,329	$4,329	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	649	lcy	$30.75	$19,942	$21,687	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	4,864	sy	$2.87	$13,959	$15,181	MII 2016 Costbook	Includes grading and raking items
	Seeding	4,864	sy	$2.01	$9,776	$9,776	Ronkonkoma Average Bid	
2	**Other Surface Soil, Concrete, and Brick Excavation and Backfill**				**$10,657**	**$11,419**		
	Saw-Cut Concrete	240	lf	$4.31	$1,034	$1,125	MII 2016 Costbook	
	Demolish Concrete	111	sy	$5.97	$663	$721	MII 2016 Costbook	
	Concrete Excavation and Stockpile	37	cy	$15.86	$587	$587	Ronkonkoma Average Bid	
	End Point Sample Analysis	1	ea	$299.16	$299	$299	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	1	ea	$629.54	$630	$630	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	56	ton	$89.00	$4,944	$5,377	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction	25	ecy	$4.27	$105	$105	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	30	lcy	$43.75	$1,296	$1,410	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	111	sy	$0.89	$99	$99	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	15	lcy	$30.75	$456	$495	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	111	sy	$2.87	$319	$347	MII 2016 Costbook	Includes grading and raking items
	Seeding	111	sy	$2.01	$223	$223	Ronkonkoma Average Bid	
3	**Subsurface Soil Excavation and Backfill**				**$699,843**	**$751,184**		
	Saw-Cut Concrete	640	lf	$4.31	$2,758	$3,000	MII 2016 Costbook	
	Demolish Concrete	444	sy	$5.97	$2,653	$2,886	MII 2016 Costbook	
	Concrete Excavation and Stockpile	148	cy	$15.86	$2,350	$2,350	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	874	bcy	$15.86	$13,863	$13,863	Ronkonkoma Average Bid	
	End Point Sample Analysis	35	ea	$299.16	$10,471	$10,471	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis	1	ea	$629.54	$630	$630	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	222	ton	$89.00	$19,778	$21,508	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	1,311	ton	$387.00	$507,400	$551,798	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction	973	ecy	$4.27	$4,154	$4,154	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	1,167	lcy	$43.75	$51,074	$55,543	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	444	sy	$0.89	$396	$396	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	59	lcy	$30.75	$1,822	$1,982	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	444	sy	$2.87	$1,276	$1,387	MII 2016 Costbook	Includes grading and raking items
	Seeding	444	sy	$2.01	$893	$893	Ronkonkoma Average Bid	
	Dewatering and Water Treatment	1	ls	$80,326.00	$80,326	$80,326	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 25% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011

Tonawanda Forge
Feasibility Study
TABLE 4
ALTERNATIVE 5 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
4	**AOC-1 Area Covering**				**$1,224,703**	**$1,306,034**		
	Tree Clearing and Grubbing	37	ea	$373.13	$13,806	$15,014	MII 2016 Costbook	
	Brush Clearing and Grubbing	1	ac	$237.10	$310	$337	MII 2016 Costbook	
	Saw-Cut Concrete	245	lf	$4.31	$1,057	$1,149	MII 2016 Costbook	
	Demolish Concrete	461	sy	$5.97	$2,754	$2,995	MII 2016 Costbook	
	Concrete Excavation and Stockpile	154	cy	$15.86	$2,439	$2,439	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	769	bcy	$15.86	$12,193	$12,193	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis	2	ea	$629.54	$1,259	$1,259	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris	231	ton	$89.00	$20,527	$22,323	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	1,153	ton	$88.26	$101,781	$101,781	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	10,251	ecy	$4.27	$43,770	$43,770	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	12,301	lcy	$43.75	$538,159	$585,248	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	46,128	sy	$0.89	$41,054	$41,054	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	6,150	lcy	$30.75	$189,124	$205,673	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	46,128	sy	$2.87	$132,387	$143,971	MII 2016 Costbook	Includes grading and raking items
	Seeding	46,128	sy	$2.01	$92,717	$92,717	Ronkonkoma Average Bid	
	Demarcation Layer	46,128	sy	$0.68	$31,367	$34,112	Home Deopt (2018)	Assume orange snow fence visual barrier
5	**Excavate Entire Site to 8' and Backfill**				**$0**	**$0**		
	Tree Clearing and Grubbing		ea	$373.13	$0	$0	MII 2016 Costbook	
	Brush Clearing and Grubbing		ac	$237.01	$0	$0	MII 2016 Costbook	
	Poly Sheeting for temporary stockpiles		sy	$0.53	$0	$0	Uline (2016)	Assume poly sheeting for overnight stockpile cover, escalated from2016
	Saw-Cut Asphalt		lf	$3.26	$0	$0	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Excavation and Stockpile		bcy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Soil Excavation and Stockpile		bcy	$7.93	$0	$0	Ronkonkoma Average Bid, reduced by half due to scale of project	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average	
	Transportation and Disposal - Asphalt		ton	$183.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$167.00	$0	$0	Clean Harbors (2018)	Quantity is too large for local disposal
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
	Dewatering and Water Treatment		ls	$624,610.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but double cost for larger excavation and more groundwater. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
5a	**Building Demolition and Disposal**							
	Building Demolition - 1-Storey		sf	$7.29	$0	$0	URS Cost Estimate	Not Escalated
	Building Demolition - 2-Storey		sf	$10.94	$0	$0	URS Cost Estimate	Assume 50% higher unit cost for 2-storey bldg. Not escalated
	Asbestos Abatement		sf	$31.70	$0	$0	Average of "Asbestos Reference" cost and URS 2017 Estimate	Asbestos Reference: $60/sf (occupued bldg), URS Estimated cost $3.40/sf. Not escalated
	Transportation and Disposal - Building Materials		ton	$89.00	$0	$0	Clean Harbors	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - ACM		ton	$750.00	$0	$0	Clean Harbors	Assume 0.25 ton/drum, 40 drums per shipment

Tonawanda Forge
Feasibility Study
TABLE 4
ALTERNATIVE 5 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
6	**Collection Trench Installation**				**$2,294,923**	**$2,380,860**		
	Brush Clearing and Grubbing	0.10	ac	$237.01	$23	$25	MII 2016 Costbook	
	Saw-Cut Concrete	362	lf	$4.31	$1,559	$1,696	MII 2016 Costbook	
	Demolish Concrete	32	sy	$5.97	$191	$208	MII 2016 Costbook	
	Concrete Excavation and Stockpile	11	cy	$15.86	$169	$169	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile	7,806	bcy	$15.86	$123,806	$123,806	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis	8	ea	$629.54	$5,036	$5,036	Standby Contract Average	
	Transportation and Disposal - Concrete/Debris	16	ton	$89.00	$1,425	$1,549	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	1,171	ton	$387.00	$453,149	$492,800	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	11,592	ton	$88.26	$1,023,126	$1,023,126	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill Trench	7,728	ecy	$10.21	$78,904	$85,808	MII 2016 Costbook	Material cost removed from unit cost
	Permeable Bedding Stone Purchase	7,728	lcy	$52.75	$407,659	$443,329	Niagara Topsoil (2018)	20 cy delivery
	Fine Grading and Raking	3,202	sy	$2.87	$9,189	$9,993	MII 2016 Costbook	Includes grading and raking items
	Dewatering and Water Treatment	1	ls	$160,652.00	$160,652	$160,652	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but half cost for smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
	Trench Box Rental	36	day	$191.00	$6,880	$7,482	MII 2016 Costbook	
	Sump	2	ea	$615.00	$1,230	$1,338	MII 2016 Costbook	Assume 8 ft deep sumps (24" pipe with gravel collar), $76.81/lf to install
	Perforated Drain Pipe	1,402	lf	$4.81	$6,744	$7,334	MII 2016 Costbook	Assume 8" perforated corrugated plastic
	Non-Perforated Drain Pipe	2,200	lf	$4.81	$10,582	$11,508	MII 2016 Costbook	Conveyance piping from trench to sump, and from sump to treatment system, 8"
	Filter Fabric	2,804	sf	$1.64	$4,599	$5,001	MII 2016 Costbook	
7	**GW Treatment by Sedimentation/Carbon**				**$125,000**	**$135,938**		
	GW Treatment system delivery and installation	1	ls	$125,000.00	$125,000	$135,938	ProAct Telecon (2018)	Includes all costs for delivery and installation
8	**Sewer Cleaning**				**$827,516**	**$899,924**		
	Jet Cleaning	18,590	lf	$2.98	$55,398	$60,246	Roto Rooter Quote (2016)	$2.81/lf escalated from 2016. 100 lf/hour per quote from vendor
	Sludge Removal	109,212	gal	$0.04	$4,368	$4,751	Frank's Vac Quote (2018)	$125/hr, assume 50 gpm so $0.04/gal
	Vac Truck Cleaning	4	ea	$3,000.00	$12,000	$13,050	Frank's Vac Quote (2018)	Assume 4 trucks are used, and only need to be cleaned once job is completed
	Sludge Transport and Disposal	109,212	gal	$6.92	$755,750	$821,878	Frank's Vac Quote (2018)	$0.75/lb disposal, $0.52/gal transport, assume sludge is 8.5 lb/gal
9	**Manhole and Sewer Sealing**				**$50,250**	**$51,718**		
	Sewer Filling - Material Purchase, Delivered	45	cy	$68.00	$3,064	$3,332	Iroquios Quote (2018)	Assume Flowable Fill
	Manhole Filling - Material Purchase, Delivered	141	cy	$68.00	$9,588	$10,427	Iroquios Quote (2018)	Assume Flowable Fill
	Sewer Filling - Labor and equipment	186	cy	$11.95	$2,223	$2,418	MII 2016 Costbook	3 laborers with a concrete vibrator
	Excavation for Clay Dam	50	bcy	$15.86	$793	$793	Ronkonkoma Average Bid	
	Backfill Clay Dam	10	ecy	$4.27	$43	$43	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Clay Purchase	12	lcy	$30.75	$369	$401	Niagara Topsoil (2018)	Assume same cost as topsoil
	Backfill and Compaction	35	ecy	$4.27	$149	$149	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	42	lcy	$31.75	$1,334	$1,450	Niagara Topsoil (2018)	Assume same cost as topsoil
	Topsoil Placement	405	sy	$0.89	$360	$360	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	6	lcy	$32.75	$197	$214	Niagara Topsoil (2018)	Assume same cost as topsoil
	Dewatering and Water Treatment	1	ls	$32,130.00	$32,130	$32,130	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 10% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
10	**Excavation and Disposal of Sewer Lines**				**$0**	**$0**		
	Manhole Demolition		ea	$383.68	$0	$0	MII 2016 Costbook	
	Concrete Sewer Demolition		lf	$7.67	$0	$0	MII 2016 Costbook	Assume average cost for 12" lines. Only concrete pipes require additional demo
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load

Tonawanda Forge
Feasibility Study
TABLE 4
ALTERNATIVE 5 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
11	**Installation of Drainage System**				**$549,131**	**$594,817**		
	Saw-Cut Concrete (Pipe Trench)	9,400	lf	$4.39	$41,288	$44,900	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Saw-Cut Concrete (Catch Basins)	520	lf	$4.39	$2,284	$2,484	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Pipe Trench)	1,044	sy	$14.28	$14,913	$16,217	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Catch Basins)	58	sy	$14.28	$825	$897	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Pipe Trench)	218	lcy	$10.65	$2,317	$2,519	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Catch Basin)	15	lcy	$10.65	$160	$174	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Pipe Trench)	348	ton	$77.70	$27,051	$29,418	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Catch Basin)	24	ton	$77.70	$1,871	$2,034	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Excavation (Pipe Trench)	1,741	bcy	$3.82	$6,656	$7,238	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavation (Catch Basin)	120	bcy	$3.82	$460	$501	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Soil Hauling (Up to 50 miles) (Pipe Trench and Catch Basin)	2,326	lcy	$10.65	$24,769	$26,936	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Soil Disposal (Pipe Trench and Catch Basin)	2,754	ton	$10.65	$29,327	$31,893	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Backfilling (Pipe Trench and Catch Basin)	1,874	lcy	$2.54	$4,762	$5,178	R.S. Means Online 2019	Includes 21% for overhead and profit.
	12" PVC Pipe Installation	4,700	lf	$27.90	$131,142	$142,617	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Material (Top 2 ft.)	666	bcy	$21.48	$14,310	$15,562	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Hauling Up to 50 Miles	833	lcy	$12.27	$10,218	$11,113	R.S. Means Online 2020	Includes 21% for overhead and profit.
	Pea Gravel Material (Bottom 2.5 ft.)	1,233	ton	$19.66	$24,236	$26,357	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Pea Gravel Hauling (Up to 50 miles)	1,041	lcy	$12.27	$12,773	$13,891	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Catch Basin with Frame and Grate	26	each	$3,267.00	$84,942	$92,374	Kistner Concrete	Includes 21% for overhead and profit.
	Laborer (Catch Basin Installation)	52	hour	$79.32	$4,125	$4,486	NYSDOL	Includes 21% for overhead and profit.
	Equipment Operator (Catch Basin Installation)	26	hour	$96.20	$2,501	$2,720	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavator (Catch Basin Installation)	26	hour	$106.54	$2,770	$3,012	NYSDOL	Includes 21% for overhead and profit.
	Plumber (Connections to Existing Storm Sewer)	10	hour	$84.77	$848	$922	NYSDOL	Includes 21% for overhead and profit.
	Connections to Existing Storm Sewer (Misc. Items Allowance)	1	each	$20,000.00	$20,000	$20,000		Engineer's Judgement
	Pavement Restoration (Pipe Trench and Catch Basin)	1,117	sy	$69.48	$77,584	$84,373	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Permit Application Fee	1	each	$7,000.00	$7,000	$7,000		Per communication with (T) Tonawanda Engineer

TOTAL DIRECT COST OF ALTERNATIVE	**$6,606,666**
Temporary Site Services	**$257,652**
TOTAL CAPITAL COST	**$6,864,318**

Abbreviations:
bcy - In-Place Cubic Yards
lcy - Loose Cubic Yards
sy - Square Yards
lf - Linear Feet
sf - Square Feet
cy - Cubic Yards

Tonawanda Forge
Feasibility Study
TABLE 5
ALTERNATIVE 6 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
1	**Surface Soil Excavation AOC-12 and Backfill**				**$0**	**$0**		
	Saw-Cut Asphalt		lf	$3.26	$0	$0	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Pavement Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average (2018)	
	Transportation and Disposal - Asphalt		ton	$183.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$88.26	$0	$0	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
2	**Other Surface Soil, Concrete, and Brick Excavation and Backfill**				**$0**	**$0**		
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
3	**Subsurface Soil Excavation and Backfill**				**$0**	**$0**		
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	End Point Sample Analysis		ea	$299.16	$0	$0	Standby Contract Average (2018)	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
	Dewatering and Water Treatment		ls	$80,326.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 25% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011

Tonawanda Forge
Feasibility Study
TABLE 5
ALTERNATIVE 6 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
4 AOC-1 Area Covering					**$0**	**$0**		
	Tree Clearing and Grubbing		ea	$373.13	$0	$0	MII 2016 Costbook	
	Brush Clearing and Grubbing		ac	$237.10	$0	$0	MII 2016 Costbook	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average (2018)	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$88.26	$0	$0	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$43.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Seeding		sy	$2.01	$0	$0	Ronkonkoma Average Bid	
	Demarcation Layer		sy	$0.68	$0	$0	Home Deopt (2018)	Assume orange snow fence visual barrier
5 Excavate Entire Site to 8' and Backfill					**$89,517,593**	**$92,269,538**		
	Tree Clearing and Grubbing	37	ea	$373.13	$13,806	$15,014	MII 2016 Costbook	
	Brush Clearing and Grubbing	1	ac	$237.01	$209	$227	MII 2016 Costbook	
	Poly Sheeting for temporary stockpiles	100,000	sy	$0.53	$53,000	$57,638	Uline (2016)	Assume poly sheeting for overnight stockpile cover, escalated from2016
	Saw-Cut Asphalt	1,397	lf	$3.26	$4,553	$4,951	MII 2016 Costbook	Cost is $1.63 for 3", assume double cost for thicker pavement
	Asphalt Excavation and Stockpile	8,081	bcy	$7.93	$64,086	$64,086	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Saw-Cut Concrete	317	lf	$4.31	$1,368	$1,488	MII 2016 Costbook	
	Demolish Concrete	82,651	sy	$5.97	$493,426	$536,601	MII 2016 Costbook	
	Concrete Excavation and Stockpile	27,550	cy	$7.93	$218,474	$218,474	Ronkonkoma Average Bid, reduced by half due to scale of project	
	Soil Excavation and Stockpile	393,575	bcy	$7.93	$3,121,050	$3,121,050	Ronkonkoma Average Bid, reduced by half due to scale of project	
	End Point Sample Analysis	394	ea	$299.16	$117,869	$117,869	Standby Contract Average	
	Waste Characterization Sample Analysis	394	ea	$629.54	$248,039	$248,039	Standby Contract Average	
	Transportation and Disposal - Asphalt	12,122	ton	$183.00	$2,218,353	$2,412,459	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Concrete/Debris	41,326	ton	$89.00	$3,677,970	$3,999,792	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB	5,904	ton	$387.00	$2,284,703	$2,484,615	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB	584,459	ton	$88.26	$51,584,347	$51,584,347	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill and Compaction	410,840	ecy	$4.27	$1,754,286	$1,754,286	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase	493,008	lcy	$43.75	$21,569,096	$23,456,392	Niagara Topsoil (2018)	Assume same cost as Crusher Run, 20cy delivery
	Topsoil Placement	1,987	sy	$0.89	$1,768	$1,768	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase	21,460	lcy	$30.75	$659,905	$717,647	Niagara Topsoil (2018)	20cy delivery
	Fine Grading and Raking	165,302	sy	$2.87	$474,417	$515,928	MII 2016 Costbook	Includes grading and raking items
	Seeding	165,302	sy	$2.01	$332,257	$332,257	Ronkonkoma Average Bid	
	Dewatering and Water Treatment	1	ls	$624,610.00	$624,610	$624,610	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but double cost for larger excavation and more groundwater. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
5a Building Demolition and Disposal								
	Building Demolition - 1-Storey		sf	$7.29	$0	$0	URS Cost Estimate	Not Escalated
	Building Demolition - 2-Storey		sf	$10.94	$0	$0	URS Cost Estimate	Assume 50% higher unit cost for 2-storey bldg. Not escalated
	Asbestos Abatement		sf	$31.70	$0	$0	Average of "Asbestos Reference" cost and URS 2017 Estimate	Asbestos Reference: $60/sf (occupued bldg), URS Estimated cost $3.40/sf. Not escalated
	Transportation and Disposal - Building Materials		ton	$89.00	$0	$0	Clean Harbors	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - ACM		ton	$750.00	$0	$0	Clean Harbors	Assume 0.25 ton/drum, 40 drums per shipment

Tonawanda Forge
Feasibility Study
TABLE 5
ALTERNATIVE 6 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128		
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019	
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
6	**Collection Trench Installation**				**$0**	**$0**		
	Brush Clearing and Grubbing		ac	$237.01	$0	$0	MII 2016 Costbook	
	Saw-Cut Concrete		lf	$4.31	$0	$0	MII 2016 Costbook	
	Demolish Concrete		sy	$5.97	$0	$0	MII 2016 Costbook	
	Concrete Excavation and Stockpile		cy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Soil Excavation and Stockpile		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Waste Characterization Sample Analysis		ea	$629.54	$0	$0	Standby Contract Average	
	Transportation and Disposal - Concrete/Debris		ton	$89.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil >50ppm PCB		ton	$387.00	$0	$0	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load
	Transportation and Disposal - Soil <50ppm PCB		ton	$88.26	$0	$0	Ronkonkoma Average Bid	Material can be disposed of at a local Part 360 landfill
	Backfill Trench		ecy	$10.21	$0	$0	MII 2016 Costbook	Material cost removed from unit cost
	Permeable Bedding Stone Purchase		lcy	$52.75	$0	$0	Niagara Topsoil (2018)	20 cy delivery
	Fine Grading and Raking		sy	$2.87	$0	$0	MII 2016 Costbook	Includes grading and raking items
	Dewatering and Water Treatment		ls	$160,652.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but half cost for smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
	Trench Box Rental		day	$191.00	$0	$0	MII 2016 Costbook	
	Sump		ea	$615.00	$0	$0	MII 2016 Costbook	Assume 8 ft deep sumps (24" pipe with gravel collar), $76.81/lf to install
	Perforated Drain Pipe		lf	$4.81	$0	$0	MII 2016 Costbook	Assume 8" perforated corrugated plastic
	Non-Perforated Drain Pipe		lf	$4.81	$0	$0	MII 2016 Costbook	Conveyance piping from trench to sump, and from sump to treatment system, 8"
	Filter Fabric		sf	$1.64	$0	$0	MII 2016 Costbook	
7	**GW Treatment by Sedimentation/Carbon**				**$0**	**$0**		
	GW Treatment system delivery and installation		ls	$125,000.00	$0	$0	ProAct Telecon (2018)	Includes all costs for delivery and installation
8	**Sewer Cleaning**				**$0**	**$0**		
	Jet Cleaning		lf	$2.98	$0	$0	Roto Rooter Quote (2016)	$2.81/lf escalated from 2016. 100 lf/hour per quote from vendor
	Sludge Removal		gal	$0.04	$0	$0	Frank's Vac Quote (2018)	$125/hr, assume 50 gpm so $0.04/gal
	Vac Truck Cleaning		ea	$3,000.00	$0	$0	Frank's Vac Quote (2018)	Assume 4 trucks are used, and only need to be cleaned once job is completed
	Sludge Transport and Disposal		gal	$6.92	$0	$0	Frank's Vac Quote (2018)	$0.75/lb disposal, $0.52/gal transport, assume sludge is 8.5 lb/gal
9	**Manhole and Sewer Sealing**				**$0**	**$0**		
	Sewer Filling - Material Purchase, Delivered		cy	$68.00	$0	$0	Iroquios Quote (2018)	Assume Flowable Fill
	Manhole Filling - Material Purchase, Delivered		cy	$68.00	$0	$0	Iroquios Quote (2018)	Assume Flowable Fill
	Sewer Filling - Labor and equipment		cy	$11.95	$0	$0	MII 2016 Costbook	3 laborers with a concrete vibrator
	Excavation for Clay Dam		bcy	$15.86	$0	$0	Ronkonkoma Average Bid	
	Backfill Clay Dam		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Clay Purchase		lcy	$30.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as topsoil
	Backfill and Compaction		ecy	$4.27	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Backfill Purchase		lcy	$31.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as topsoil
	Topsoil Placement		sy	$0.89	$0	$0	Ronkonkoma Average Bid	Assume 10% of bid cost, to account for material purchase
	Topsoil Purchase		lcy	$32.75	$0	$0	Niagara Topsoil (2018)	Assume same cost as topsoil
	Dewatering and Water Treatment		ls	$32,130.00	$0	$0	Polymer Applications Site Bid Breakdown	Nearby site, similar soil conditions, but 10% cost for much smaller scale excavation. Original bid cost $261,250 for approx. 20,000 cy, escalated from 2011
10	**Excavation and Disposal of Sewer Lines**				**$122,905**	**$133,660**		
	Manhole Demolition	141	ea	$383.68	$54,099	$58,833	MII 2016 Costbook	
	Concrete Sewer Demolition	4,648	lf	$7.67	$35,646	$38,765	MII 2016 Costbook	Assume average cost for 12" lines. Only concrete pipes require additional demo
	Transportation and Disposal - Concrete/Debris	373	ton	$89.00	$33,160	$36,062	Clean Harbors (2018)	Assume tri-axle trucks so no rolloff rental; 30 ton/load

Tonawanda Forge
Feasibility Study
TABLE 5
ALTERNATIVE 6 COST BREAKDOWN

Client	NYSDEC	**Project Number**	60416128	
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date: 04/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date: 05/03/2019

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Unit Cost Assumptions
11	**Installation of Drainage System**				**$0**	**$0**		
	Saw-Cut Concrete (Pipe Trench)		lf	$4.39	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Saw-Cut Concrete (Catch Basins)		lf	$4.39	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Pipe Trench)		sy	$14.28	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete with Breaker (Catch Basins)		sy	$14.28	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Pipe Trench)		lcy	$10.65	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Hauling (Up to 50 miles) (Catch Basin)		lcy	$10.65	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Pipe Trench)		ton	$77.70	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Demolish Concrete - Debris Disposal (Catch Basin)		ton	$77.70	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Excavation (Pipe Trench)		bcy	$3.82	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavation (Catch Basin)		bcy	$3.82	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Soil Hauling (Up to 50 miles) (Pipe Trench and Catch Basin)		lcy	$10.65	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Soil Disposal (Pipe Trench and Catch Basin)		ton	$10.65	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Backfilling (Pipe Trench and Catch Basin)		lcy	$2.54	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	12" PVC Pipe Installation		lf	$27.90	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Material (Top 2 ft.)		bcy	$21.48	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	General Fill Hauling Up to 50 Miles		lcy	$12.27	$0	$0	R.S. Means Online 2020	Includes 21% for overhead and profit.
	Pea Gravel Material (Bottom 2.5 ft.)		ton	$19.66	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Pea Gravel Hauling (Up to 50 miles)		lcy	$12.27	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Catch Basin with Frame and Grate		each	$3,267.00	$0	$0	Kistner Concrete	Includes 21% for overhead and profit.
	Laborer (Catch Basin Installation)		hour	$79.32	$0	$0	NYSDOL	Includes 21% for overhead and profit.
	Equipment Operator (Catch Basin Installation)		hour	$96.20	$0	$0	R.S. Means Online 2019	Includes 21% for overhead and profit.
	Excavator (Catch Basin Installation)		hour	$106.54	$0	$0	NYSDOL	Includes 21% for overhead and profit.
	Plumber (Connections to Existing Storm Sewer)		hour	$84.77	$0	$0	NYSDOL	Includes 21% for overhead and profit.
	Connections to Existing Storm Sewer (Misc. Items Allowance)		each	$20,000.00	$0	$0		Engineer's Judgement
	Pavement Restoration (Pipe Trench and Catch Basin)		sy	$69.48	$0	$0	R.S. Means Online 2019	Includes 5% for overhead and profit.
	Permit Application Fee		each	$7,000.00	$0	$0		Per communication with (T) Tonawanda Engineer

TOTAL DIRECT COST OF ALTERNATIVE	**$92,403,198**
Temporary Site Services	**$489,087**
TOTAL CAPITAL COST	**$92,892,285**

Abbreviations:
bcy - In-Place Cubic Yards
lcy - Loose Cubic Yards
sy - Square Yards
lf - Linear Feet
sf - Square Feet
cy - Cubic Yards

Tonawanda Forge
Feasibility Study
TABLE 6
TEMPORARY SITE FACILITIES

Client	NYSDEC	**Project Number**	60416128		
Project	Tonawanda Forge FS	**Calculated By:**	DNM	Date:	4/23/2019
Title	Alternative 2 - Sewer Decon, Surface Excavation, Covering	**Checked By:**	KRJ	Date:	5/3/2019

Reference	Description	Unit Cost	UOM	Alt 2		Alt 3		Alt 4		Alt 5	
				Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
MII Cost Book	Temporary Electric - Transformer	$2,324.40	ea	1	$2,324.40	1	$2,324.40	1	$2,324.40	1	$2,324.40
MII Cost Book	Temporary Electric - Overhead Feed	$1,140.00	ea	1	$1,140.00	1	$1,140.00	1	$1,140.00	1	$1,140.00
MII Cost Book	Temporary Electric - Office Trailer Connection	$662.20	ea	2	$1,324.40	2	$1,324.40	2	$1,324.40	2	$1,324.40
MII Cost Book	Office Trailer Rental	$440.00	mo	3	$1,320.00	3	$1,320.00	3	$1,320.00	6	$2,640.00
MII Cost Book	Storage Box Rental	$108.00	mo	3	$324.00	3	$324.00	3	$324.00	6	$648.00
MII Cost Book	Phone/Internet Bill	$85.00	mo	3	$255.00	3	$255.00	3	$255.00	6	$510.00
MII Cost Book	HVAC/Light	$160.00	mo	3	$480.00	3	$480.00	3	$480.00	6	$960.00
MII Cost Book	Office supplies	$80.00	mo	3	$240.00	3	$240.00	3	$240.00	6	$480.00
MII Cost Book	Office equipment	$200.00	mo	3	$600.00	3	$600.00	3	$600.00	6	$1,200.00
MII Cost Book	Port-A-John Rental (2ea)	$188.00	mo	3	$564.00	3	$564.00	3	$564.00	6	$1,128.00
MII Cost Book	20 CY C&D/Rubbish Dumpster	$565.00	wk	13	$7,345.00	13	$7,345.00	13	$7,345.00	27	$15,255.00
salary.com	Security Guard (assume during non-work hours) $2,423/mo. 50% markup for overtime = $3,635/mo, 10% OH&P markup = $3,998/mo	$3,998.00	mo	3	$11,994.00	3	$11,994.00	3	$11,994.00	3	$11,994.00
Allowance	Survey	$1,000.00	day	5	$5,000.00	5	$5,000.00	5	$5,000.00	5	$5,000.00
Allowance	Health and Safety	$2,000.00	ls	1	$2,000.00	1	$2,000.00	1	$2,000.00	1	$2,000.00
Allowance	Erosion and Sediment Control	$2,000.00	ls	1	$2,000.00	1	$2,000.00	1	$2,000.00	1	$2,000.00
Allowance	Snow Removal	$1,000.00	ls	1	$1,000.00	1	$1,000.00	1	$1,000.00	1	$1,000.00
MII Cost Book	Field Personnel - Civil Superintendent	$15,455.17	mo	3	$46,365.51	3	$46,365.51	3	$46,365.51	6	$92,731.02
MII Cost Book	Project Manager (Assume 16 hr/week)	$11,592.00	mo	3	$34,776.00	3	$34,776.00	3	$34,776.00	6	$69,552.00
Ronkonkoma Winning Bid	Community Air Monitoring (cost reduced by 10% to adjust from New York City to Buffalo Rate)	$2,100.00	day	66	$138,600.00	66	$138,600.00	66	$138,600.00	132	$277,200.00
	Total				$257,652.31		$257,652.31		$257,652.31		$489,086.82

Tonawanda Forge
Feasibility Study
TABLE 7
QUANTITY TAKEOFFS

Client	NYSDEC	**Project Number**	60416128		
Project	Tonawanda Forge FS	**Calculated By:**	EM	Date:	4/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date:	5/3/2019

Item	Description	Each	Hour	LF	SF	SY	CY	BCY	LCY	TON	Assumptions
1	**Surface Soil Excavation AOC-12 and backfill (1 ft)**			1,236	43,775						See Figure 1-3 markup with quantities measured from GIS.
	Saw-Cut Asphalt Pavement			309							Assumed 25% of total perimeter
	Excavate Asphalt Pavement				4,378		108			162	Assumed 10% of total area, 8" thick on average
	Saw-Cut Concrete Pavement			62							Assumed 5% of total perimeter, 12" thick on average
	Demo Concrete				2,189		81			122	Assumed 5% of total area, 12" thick on average
	Excavate and Stockpile Concrete						81			122	Assumed 5% of total area, 12" thick on average
	Excavation and stockpiling Soil on site (Grassy Areas)						*1,378*			*2,067*	*Assumed 85% of total area, 1' depth*
	Excavation and stockpiling Soil on site (Under Asphalt)						*54*			*81*	*Assumed remaining 4" depth under asphalt*
	Excavation and stockpiling Soil on site (Total)						1,432			2,148	Total
	End Point Samples	18									Assume 1 sample per 2,500 sf
	Waste Characterization Samples	2									Assume 1 sample per 1,000 cy
	Transportation and Disposal (Asphalt)						108			162	From above
	Transport and Disposal (Concrete/Debris)						81			122	From above
	Transportation and Disposal (Soil >50ppm PCB)						143			215	See Figure 7-1, assume 1% of site contains PCBs >50ppm
	Transportation and Disposal (Soil <50ppm PCB)						1,418			2,127	See Figure 7-1, assume 99% of site contains PCBs <50ppm
	Backfill and Compaction of Clean Fill						1,081			1,621	Assumed 8" clean fill.
	Clean Fill Material Purchase						1,297			1,946	Assume loose fill to compacted fill ratio of 1.2
	Topsoil Material Placement				43,775		540			811	Assume 4" topsoil entire area.
	Topsoil Material Purchased						649			973	Assume loose fill to settled ratio of 1.2
	Final Grading and Seeding				43,775						Assume entire area graded and seeded.
2	**Other Surface Soil, Concrete, and Brick Excavation and Backfill**										See Figure 1-3 markup with quantities measured from GIS.
	Combined Quantities for AOC-09-GP-05, 2 Concrete Wipe Sample Areas and Brick										
	Saw-Cut Concrete Pavement			240							Assumed 100% of total perimeter, 12" thick on average
	Demo Concrete				1,000		37			56	Assumed 100% of total area, 12" thick on average
	Excavate and Stockpile Concrete						37			56	Assumed 100% of total area, 12" thick on average
	End Point Samples	1									Assume 1 sample per 2,500 sf
	Waste Characterization Samples	1									Assume 1 sample per 1,000 cy
	Transport and Dispose of Concrete/Debris						37			56	Determination of disposal classification TBD
	Backfill and Compaction of Clean Fill						25			37	Assumed 8" clean fill.
	Clean Fill Material Purchase						30			44	Assume loose fill to compacted fill ratio of 1.2
	Topsoil Material Placement				1,000		12			19	Assume 4" topsoil entire area.
	Topsoil Material Purchased						15			22	Assume loose fill to settled ratio of 1.2
	Final Grading and Seeding				1,000						Assume entire area graded and seeded.

Tonawanda Forge
Feasibility Study
TABLE 7
QUANTITY TAKEOFFS

Client	NYSDEC	**Project Number**	60416128		
Project	Tonawanda Forge FS	**Calculated By:**	EM	Date:	4/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date:	5/3/2019

Item	Description	Each	Hour	LF	SF	SY	CY	BCY	LCY	TON	Assumptions
3	**Subsurface Soil Excavation and Backfill**										
	Combined Quantities for All Areas										See Figure 1-3 markup with quantities measured from GIS.
	Saw-Cut Concrete Pavement			640							Assumed 100% of total perimeter, 12" thick on average
	Demo Concrete				4,000						Assumed 100% of total area, 12" thick on average
	Excavate and Stockpile Concrete						148				Assumed 100% of total area, 12" thick on average
	Excavate and stockpile Soil						874				Assume top 1 ft is concrete and remainder is soil
	End Point Samples	35									Assume 5 samples per excavation
	Waste Characterization Samples	1									Assume 1 sample per 1,000 cy
	Transport and Dispose of Concrete/Debris									222	
	Transportation and Disposal (Soil >50ppm PCB)									1,311	See Figure 7-1, this is a PCB hot spot area so assume 100%
	Backfill and Compaction of Clean Fill						973				Assumed 3'-8" clean fill.
	Clean Fill Material Purchase						1,167				Assumed loose fill to compacted fill ratio of 1.2
	Topsoil Material Placement				4,000		49				Assumed 4" topsoil entire area.
	Topsoil Material Purchased						59				Assumed loose fill to settled ratio of 1.2
	Final Grading and Seeding				4,000						Assumed entire area graded and seeded.
4	**AOC-1 Area Covering**										
	Combined Quantities for All Areas	0		4904	415151		0			0	See Figure 1-3 markup with quantities measured from GIS.
	Tree Clearing & Grubbing	37		0	0		0			0	Assumed from Figure 1-3 and Aerial Imagery
	Brush Clearing & Grubbing	0		0	56904		0			0	Assumed 10% of total area
	Saw-Cut Concrete Pavement	0		245	0		0			0	Assumed 5% of total perimeter, 12" thick on average
	Demo Concrete	0		0	4152		154			231	Assumed 1% of total area, 12" thick on average
	Excavate and Stockpile Concrete	0		0	0		154			231	Assumed 1% of total area, 12" thick on average
	Saw-Cut Asphalt Pavement	0		0	0		0			0	Assumed 25% of total perimeter
	Excavate Asphalt Pavement	0		0	415		10			15	Assumed 10% of total area, 8" thick on average
	Excavate and stockpile Soil	0		0	0		769			1153	Assumed 5% around perimeter for grading transition
	Waste Characterization Samples	2		0	0		0			0	Assume 1 sample per 1,000 cy
	Transport and Dispose of Concrete/Debris	0		0	0		154			231	
	Transportation and Disposal (Soil)	0		0	0		769			1153	Assume no PCB contaimination
	Backfill and Compaction of Clean Fill	0		0	0		10251			15376	Assumed 8" clean fill.
	Clean Fill Material Purchase	0		0	0		12301			18451	Assumed loose fill to compacted fill ratio of 1.2
	Topsoil Material Placement	0		0	415151		5125			7688	Assumed 4" topsoil entire area.
	Topsoil Material Purchased	0		0	0		6150			9226	Assumed loose fill to settled ratio of 1.2
	Final Grading and Seeding	0		0	415151		0			0	Assumed entire area graded and seeded.
	Visual Barrier	0		4904	0		0			0	Assumed along perimeter of excavation

Tonawanda Forge
Feasibility Study
TABLE 7
QUANTITY TAKEOFFS

Client	NYSDEC	**Project Number**	60416128		
Project	Tonawanda Forge FS	**Calculated By:**	EM	Date:	4/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date:	5/3/2019

Item	Description	Each	Hour	LF	SF	SY	CY	BCY	LCY	TON	Assumptions
5	**Excavate Entire Site to 8ft and Backfill**			6,348	1,487,718						See Figure 1-3 markup with quantities measured from GIS.
	Tree Clearing & Grubbing	37									From AOC-1 Above
	Brush Clearing & Grubbing				38,437						From AOC-1 Above
	Stockpile Cover - Poly Sheeting				100,000						Assume 5,000 sf per stockpile, 20 stockpiles
	Saw-Cut Asphalt Pavement			1,397							Assumed 22% of total perimeter
	Excavate Asphalt Pavement				327,298		8,081			12,122	Assumed 22% of total area, 8" thick on average
	Saw-Cut Concrete Pavement			317							Assumed 5% of total perimeter, 12" thick on average
	Demo Concrete				743,859		27,550			41,326	Assumed 50% of total area, 12" thick on average
	Excavate and Stockpile Concrete						27,550			41,326	Assumed 50% of total area, 12" thick on average
	Excavation and stockpiling Soil on site (Total)						393,575			590,363	Total, minus 11,599 cy of soil beneath existing buildings
	End Point Samples	394									Assume 1 sample per 1,000 cy
	Waste Characterization Samples	394									Assume 1 sample per 1,000 cy
	Transportation and Disposal (Asphalt)						8,081			12,122	From above
	Transport and Dispose of Concrete/Debris						27,550			41,326	From above
	Transportation and Disposal (Soil >50ppm PCB)						3,936			5,904	See Figure 7-1, assume 1% of site contains PCBs >50ppm
	Transportation and Disposal (Soil <50ppm PCB)						389,639			584,459	See Figure 7-1, assume 99% of site contains PCBs <50ppm
	Backfill and Compaction of Clean Fill						410,839.93			616,260	Assumed 7'-8" clean fill.
	Clean Fill Material Purchase						493,008			739,512	Assume loose fill to compacted fill ratio of 1.2
	Topsoil Material Placement				1,448,573		17,884			26,825	Assume 4" topsoil entire area, minus existing building footprints.
	Topsoil Material Purchased						21,460			32,191	Assume loose fill to settled ratio of 1.2
	Final Grading and Seeding				1,487,718						Assume entire area graded and seeded.
5a	**Building Demolition and Disposal**										
	Total Square footage of 1-storey buildings				7,058						See Figure 4-3
	Total Square footage of 2-storey buildings				32,087						
	Total Building Area				39,145						Area for calculating asbestos abatement
	Building Material T&D									1,424.64	Assume 2 ton for every 100 sf of floor area
	Asbestos Material T&D									142.46	Assume 10 % of building material

Item	Description	Each	Hour	LF	SF	SY	CY	BCY	LCY	TON	Assumptions
6	**Collection Trench Installation (East and West Ends)**										
	Length of West Trench			747							See Figure 1-3 markup with quantities measured from GIS.
	Length of East Trench			655							See Figure 1-3 markup with quantities measured from GIS.
	Total Length of Perforated Pipe			1,402							
	Filter Fabric				2,804						2 sf per lf of perforated pipe
	Length of Conveyance Trench			2,200							Assume length of site
	Volume of Conveyance Trench						1,467				Assume 6 ft deep x 3ft wide
	Conveyance Piping			2,200							Assume length of site, piping from trenches to treatment system
	Average Width of Trench			8							Assumed
	Perimeter of Trenches			7,236							Calculated
	Area of Trenches				28,816						Calculated
	Brush Clearing and Grubbing				4,192						Assumed 80% of East Trench
	Saw-Cut Concrete Pavement			362							Assumed 5% of total perimeter, 12" thick on average
	Demo Concrete				288		11			16	Assumed 1% of total area, 12" thick on average
	Excavate and Stockpile Concrete						11			16	Assumed 1% of total area, 12" thick on average
	Excavation and stockpiling Soil on site						7,806			11,709	
	Waste Characterization Samples	8									Assume 1 sample per 1,000 cy
	Transport and Dispose of Concrete/Debris						11			16	
	Transportation and Disposal (Soil >50ppm PCB)						781			1,171	See Figure 7-1, assume 1% of site contains PCBs >50ppm
	Transportation and Disposal (Soil <50 ppb PCB)						7,728			11,592	See Figure 7-1, assume 99% of site contains PCBs <50ppm
	Bedding Stone						7,728				For simplicity, assume entire trench is backfilled with stone
	Trench Box Rental (days)	36									Assume 100 lf per day for trench excavation, pipe install, and backfill

Tonawanda Forge
Feasibility Study
TABLE 7
QUANTITY TAKEOFFS

Client	NYSDEC	**Project Number**	60416128		
Project	Tonawanda Forge FS	**Calculated By:**	EM	Date:	4/23/2019
Title	Feasibility Study Cost Estimate	**Checked By:**	KRJ	Date:	5/3/2019

Item / Description	Each	Hour	LF	SF	SY	CY	BCY	LCY	TON	Assumptions
7 GW Treatment by Sedimentation/Carbon	**No Quantity Takeoff - Estimated as a Lump Sum**									
8 Sewer Cleaning										
Total Length of Pipe to be cleaned			18,590							
Storm Sewer			*15,820*							Quantities approximated from Plate 2. Assume all piping shown reqires cleaning.
Sanitary Sewer			*1,095*							
Industrial Waste Line			*1,165*							
Assumed Storm Sewer			*510*							
Volume of water (gallons)						109,212				Assume full volume of all sewer pipes, assume 12" dia.
9 Manhole and Sewer Sealing										
Manhole Grouting	141					141				See Plate 2. Assume all manholes and pipes shown will be cleaned and filled with flowable fill. Assume 1 cy average per manhole
Storm Manholes	*58*					*58*				
Sanitary Manholes	*10*					*10*				
Catch Basins	*73*					*73*				
Sewer Grouting Volume						45				Assume 12" dia pipes on average
Storm Sewer						*38*				
Sanitary Sewer						*3*				
Industrial Waste Line						*3*				
Assumed Storm Sewer						*1*				
Excavation for Clay Dam						*50*				
Backfill Clay Dam						*10*				
General Fill						*35*				Assume 5 cy per location, assume 10 locations along downgradients edges of site perimiter and adjacent to GM property.
Topsoil (sy)				405		*5*				Assume 1 cy clay, 3.5 cy fill, 0.5 cy topsoil per excavation. 4" topsoil
Transportation and Disposal (Soil <50ppm PCB)									75	Assume all excavated material is disposed of and replaced with clean
10 Excavation and Disposal of Sewer Lines										
Manhole Demolition	141									See Plate 2, all manholes will be removed
Concrete Sewer Demolition			4,648							Assume 25% of quantity (Item 8 - Sewer Cleaning) is concrete
Transportation and Disposal - Concrete/Debris									373	Assume 130 lb/lf of concrete pipe, and 1/2 ton per manhole
11 Installation of Drainage System										
Saw-Cut Concrete (Pipe Trench)			9,400							4,700 linear feet x 2 (length of pipe trench)
Saw-Cut Concrete (Catch Basins)			520							20 linear feet x 26 (Length Around Catch Basins)
Demolish Concrete with Breaker (Pipe Trench)					1,044					Assume that a 2 ft. wide section of concrete, 6 in. thick, will be demolished along the length (4,700 ft.) of the trench.
Demolish Concrete with Breaker (Catch Basins)					58					Assume that a 5 ft. wide x 5 ft. long section of concrete, 6 in. thick, will be demolished at the catch basins.
Demolish Concrete - Debris Hauling (Up to 50 miles) (Pipe Trench)							174	218		1 LCY = 1.25 BCY
Demolish Concrete - Debris Hauling (Up to 50 miles)(Catch Basin)							12	15		1 LCY = 1.25 BCY
Demolish Concrete - Debris Disposal (Pipe Trench)									348	Density of Concrete = 2 tons per BCY
Demolish Concrete - Debris Disposal (Catch Basin)									24	Density of Concrete = 2 tons per BCY
Excavation (Pipe Trench)							1,741			Assume that a 2 ft. wide x 5 ft. deep excavation will be completed for the length of the pipe trench. Assume that no excavation support is required.
Excavation (Catch Basin)							120			Assume that a 5 ft. wide x 5 ft. wide x 5 ft. deep excavation will be completed at each of the catch basins. Assume that no excavation support is required.
Soil Hauling (Up to 50 miles) (Pipe Trench and Catch Basin)								2,326		1 LCY = 1.25 BCY
Soil Disposal (Pipe Trench and Catch Basin)									2,754	Density of Soil at the Site = 1.65 tons per BCY
Backfilling (Pipe Trench and Catch Basin)							1,499	1,874		Backfill quantity excludes pipe volume 4,700 ft. x 3.14159 x (0.5 ft.^2) = 3,691 cf = 137 cy. Backfill quantity excludes catch basin volume 26 x 3 ft. x 3 ft. x 4.5 ft. = 1,053 cf = 39 cy. Backfill quantity excludes restored pavement volume: (4,700 ft. x 2 ft. x 0.5 ft.) + (26 x 5 ft. x 5 ft. x 0.5 ft.) = 5,025 cf = 186 cy
12" PVC Pipe Installation			4,700							4,560 lf of pipe will be installed
General Fill Material (Top 2 ft.)							666			
General Fill Hauling Up to 50 Miles							666	833		The excavation will be backfilled to 0.5 ft. below existing grade with general fill.
Pea Gravel Material (Bottom 2.5 ft.)									1,233	Density of Pea Gravel at the Site = 1.48 tons per BCY
Pea Gravel Hauling (Up to 50 miles)							833	1,041		The excavation will be backfilled to 2.5 ft. below existing grade with pea gravel.
Catch Basin with Frame and Grate	26									24 catch basins will be installed
Laborer (Catch Basin Installation)		52								Assume that two laborers, one equipment operator, and one excavator will be required for 1 hour each to set each catch basin.
Equipment Operator (Catch Basin Installation)		26								
Excavator (Catch Basin Installation)		26								
Plumber (Connections to Existing Storm Sewer)		10								Assume that two plumbers will be required for 1 hour each to make each of the three connections at the existing storm sewer system.
Connections to Existing Storm Sewer (Materials Allowance)	1									Assumed to be $20,000.00
Pavement Restoration (Pipe Trench and Catch Basin)				10,050	1,117					The top of the pipe trench (4,700 ft. x 2 ft. = 9,400 sf) will be restored with pavement. The area excavated at top of the catch basins (26 x 5 ft. x 5 ft. = 650 sf) will be restored with pavement
Permit Application Fee	1									Assumed to be +/- $7,000.00 per communication with (T) Tonawanda Engineer

Tonawanda Forge
Feasibility Study
TABLE 8
ANNUAL COSTS

Client		**Project Number**	60416128		
Project	Feasibility Study Cost	**Calculated By:**	DNM	Date:	4/23/2019
Title	Alternative 5 - Excavation of Entire Site	**Checked By:**	KRJ	Date:	5/3/2019

Description	QTY	UNITS	UNIT COST	TOTAL COST
1 Annual Groundwater Monitoring				**$3,100.00**
Groundwater Analysis - VOCs	20	ea	$70.00	$1,400.00
Sampling Labor	24	hr	$50.00	$1,200.00
Supplies	1	ls	$500.00	$500.00
2 Annual and 5-year Reporting				**$11,400.00**
Labor for Annual Report	120	hr	$80.00	$9,600.00
Direct Cost for Annual Report	1	ls	$200.00	$200.00
Labor for 5-Year Review (on annual basis)	20	hr	$80.00	$1,600.00
Direct Cost for 5-Year Review (on annual basis)	1	ls	$100.00	$100.00
3 Groundwater Treatment System O&M (Annual)				**$29,000.00**
Labor (1 eight-hour site visit per week)	416	hr	$50.00	$20,800.00
Supplies/tools	1	ls	$1,000.00	$1,000.00
Carbon Vessel Replacement (once per year)	2	ea	$3,600.00	$7,200.00
Bag Filter Replacement (12 times per year)	24	ea	$5.00	$120.00