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FEASIBILITY STUDY REPORT

MONROE ELECTRONICS SITE
LYNDONVILLE, NEW YORK 14098
NYSDEC Site No. 837013
Work Assignment No. D007620-19

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
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P.E. CERTIFICATION

I, David S. Glass, certify that I am currently a NYS registered professional engineer 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.

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11.9.2015
Date

Signature

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1.0 INTRODUCTION

1.1 Purpose and Organization

This Feasibility Study (FS) Report for the Monroe Electronics Site (the "Site"), located at 100 Housel Avenue in the Village of Lyndonville (refer to *Figure 1*), has been prepared for the New York State Department of Environmental Conservation (NYSDEC) under Work Assignment No. D007620-19. This FS Report has been prepared in accordance NYSDEC 6 NYCRR Part 375 and NYSDEC Technical Guidance for Site Investigation and Remediation (DER-10).

Between May 2011 and June 2013, a Remedial Investigation (RI) was completed for NYSDEC by HRP Associates, Inc. (HRP) to investigate the nature and extent of soil and groundwater contamination associated with the Site. The findings of the RI are presented in a March 2014 RI Report (HRP 2014). A Supplemental Remedial Investigation (SRI) was completed for NYSDEC by TRC in March 2015 to further characterize and delineate the extent of contamination on and surrounding the Site. SRI findings are presented in a SRI Report dated May 2015 (TRC 2015).

This FS Report describes remedial alternatives that may be employed to address soil, groundwater, and soil vapor contamination characterized in the RI and SRI Reports, as well as by previous site investigations. The FS Report has been organized into seven sections as follows:

- Section 1 – Site background and summary of environmental setting.
- Section 2 – Identification of applicable Standards, Criteria and Guidance (SCGs) that are used to screen remedial technologies and assist in the selection process for potential remedial alternatives.
- Section 3 – Identification and screening of technologies and process options.
- Section 4 – Identification and descriptions of selected remedial alternatives.
- Section 5 – Detailed analysis of each proposed remedial alternative including supporting methodology information and preliminary cost estimates for each alternative.
- Section 6 – Comparative analysis of remedial alternatives and recommendation.
- Section 7 – A listing of references used for preparation of the report.

1.2 Site Location and Setting

The Monroe Electronics Site is located at 100 Housel Avenue (Orleans County Tax Map ID: 24.16-1-2) in the Village of Lyndonville, Town of Yates, Orleans County, New York (refer to *Figure 1*). The Site encompasses approximately ten acres and is located adjacent to and north of the L.A. Webber Middle-High School. According to the Village of Lyndonville Zoning Map, the Site is zoned Light Industrial. The developed portion of the property contains two structures, a one-story 15,900-square foot manufacturing building built circa 1960 (occupied by Monroe Electronics) and a one-story 500-square foot residential building, built circa 1940, located south of the manufacturing building (current Site features are shown on *Figure 2*). The manufacturing building is constructed on a concrete block and slab on-grade foundation (i.e., no basement), with the exception of the north-central portion of the building where a crawl space exists beneath the manufacturing area. The manufacturing building is primarily a wood-framed building, although the western portion of the building consists of a metal sided addition to the original building. The residence is a wood-framed structure with a crawl space beneath the majority of the building. Both the residence and manufacturing building are connected to public sewer and water supply. There are gravel parking areas to the south and east of the structures, and a gravel access driveway extends south of the on-site buildings to Housel Avenue.

The area south of the Site buildings is vacant, cleared land. Wooded areas and the Bowman Apple facility are located north of the Site. There is a small drainage swale, oriented east-west, located north of the Site property boundary between Monroe Electronics and the Bowman Apple facility.

The areas surrounding the Site consist of the following:

- North: Bowman Apple, Nanko Foods, Inc. and H.H. Dobbins, Inc., then agricultural land beyond. There is a water tower on the Bowman Apple property; however, the water tower is reportedly not in-service.
- West: Agricultural land.
- South: Housel Avenue and L.A. Webber Middle-High School with athletic fields.
- East: Lynhaven Cemetery, then residential neighborhoods beyond. A former landfill is located northeast of the Site (east of H.H. Dobbins, Inc.).

1.3 Current and Historic Uses

The Site is currently occupied by Monroe Electronics, a manufacturer of electronic devices including electrostatic measuring instruments (voltmeters, coulomb meters, and resistivity meters), emergency alert systems, and cable TV switching and control products. Current manufacturing operations include light machining, component assembly, research and development, and testing. The residence on-site is currently occupied.

Before Monroe Electronics occupied the Site, the property was utilized by the DuPont/Barre Lime and Sulfur Company (DuPont). DuPont began operating on the Site in the 1920s. DuPont manufactured various agricultural products in a plant on the property from approximately 1943 to 1954. Waste lime and sulfur sludge derived from the manufacturing processes were disposed in a nearby landfill which is part of the property currently owned by H.H. Dobbins, Inc.

Monroe Electronics has occupied the Site since 1972. In September 1986, Monroe Electronics submitted a Hazardous Waste Disposal Questionnaire in response to a requirement of the United States Environmental

Protection Agency (USEPA) Community Right to Know (CRTK) Act. In the CRTK survey, Monroe Electronics indicated one to four tons of 1,1,1-trichloroethane (TCA) had been disposed at the Site. The disposal area was not identified on the survey form.

1.4 Geology and Hydrogeology

Based on the information gathered during both the RI and the SRI, the subsurface geology consists of a brown sand and silt above a gray clay beginning at approximately eight feet below ground surface (bgs) and extending up to a maximum depth of approximately 29 feet bgs. Beneath the clay is a weathered shale layer and then a more competent bedrock (brown to red siltstone on top of a predominantly gray shale). Geologic cross-sections prepared as part of the SRI are presented in *Figure 3*, and show the geology on-site and off-site based on the boring logs completed for the RI and SRI.

According to the Surficial Geology Map of New York - Niagara Sheet (1989), the material underlying the Site is classified as lacustrine silt and clay. The material is described as generally laminated silt and clay, deposited by proglacial lakes, generally calcareous, potential land instability, variable thickness (up to 100 meters). The SRI observations are generally consistent with the mapped descriptions. According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), soils at the Site and in the surrounding area are classified as Arkport very fine sandy loam.

As stated above, bedrock at the Site consists of a brown to red siltstone above a predominantly gray shale. Depth to bedrock ranges across the study area from approximately 22 feet bgs north and northeast of the Site to approximately 28 to 30 feet bgs south of the manufacturing building on-site. The bedrock surface is relatively flat across the Site. As part of the SRI, bedrock cores were advanced ten feet into competent bedrock and collected in five foot sections. Each core was characterized and the rock quality designation (RQD) was recorded. RQDs ranged from < 25% to 92%.

According to the Bedrock Geology Map of New York State - Niagara Sheet (1970), bedrock underlying the Site and surrounding area is classified as the Ordovician aged Queenston Shale, part of the Medina Group and Queenston Formation. The Queenston shale is described as “silty red shale” and the findings from the SRI are generally consistent with the mapped descriptions.

Based on relative groundwater surface elevation measurements, the inferred predominant groundwater flow direction in both the overburden and bedrock at the Site was toward the north-northeast in September 2014 and toward the north-northwest in December 2014. This is consistent with the downward topographic slope from south to north. Generally a downward vertical gradient was observed on-site during the SRI. During the SRI, depth to groundwater surface ranged from three to six feet bgs in shallow monitoring wells and from three to eleven feet below ground surface in bedrock monitoring wells.

1.5 Remedial History

A summary of information related to potential sources of contamination, previous investigations, and remedial activities on and associated with the Site is presented below.

1.5.1 Preliminary Investigations (1997 to 2005)

DuPont 1997 - Supplemental Environmental Assessment (SEA)

DuPont conducted an SEA in 1997 to identify the source of sulfur odors north of the Site along West Avenue, and to characterize the Lyndonville West Avenue site, located east of the Site. The Monroe Electronics Site was included as part of this assessment. The assessment focused primarily on pesticide and arsenic contamination identified in a nearby landfill and drainage ditch. Findings of the SEA indicated that the Monroe Electronics property was not a source of sulfur odors. Arsenic and pesticide contamination were not identified at the location of the former DuPont plant (currently the Monroe Electronics property). In 1999, the NYSDEC segregated the Monroe Electronics property from the Lyndonville West Avenue site.

NYSDEC 2000 - Site Investigation

In May 2000, the NYSDEC mobilized to the Site to conduct a Site Investigation (SI) using Zebra Environmental Corporation (Zebra). The scope of the SI included investigation for volatile organic compounds (VOCs) in surface soil, subsurface soil and groundwater in response to the reported hazardous waste disposal on-site (listed on the CRTK survey). The SI included the completion of soil borings and installation of temporary groundwater monitoring wells, and the collection of soil and groundwater samples for laboratory analysis. The objectives of the SI were:

- Define the nature and extent of contamination at the Monroe Electronics Site; and
- Determine if the Site should be listed on the New York State (NYS) Registry of Inactive Hazardous Waste Disposal Sites (the Registry).

Seven direct-push soil borings were advanced to a depth of twelve feet below ground surface (B-1 to B-7), and four surface soil samples (0 to 3 inches below ground surface) were also collected. Surface and subsurface soil samples were submitted for analysis for VOCs, semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals. While elevated levels of pesticides such as 4’,4’-DDT (17 milligrams per kilogram (mg/kg) or parts per million) and arsenic (419 mg/kg) were detected at one isolated surface soil location (SS-03) immediately north of the Monroe Electronics manufacturing building, widespread soil contamination was not identified during the SI. Groundwater sampling at the Site revealed several chlorinated VOCs (CVOCs), including 1,1,1-TCA, trichloroethene (TCE), 1,2-

dichloroethane (1,2-DCA), and 1,2-dichloroethene (1,2-DCE), at concentrations above Class GA Groundwater Standards and Guidance Values (Class GA Values).

A VOC source area was not identified during the SI, nor was there hazardous waste identified at the Site. Based on the results of the SI, the completion of an additional investigation to determine the source of the VOC contamination in groundwater at the Site was recommended. As a result of the groundwater contamination identified at the Site, the NYSDEC listed the property as a Class 2 Site in 2002 and Site No. 837013 was assigned to the Site.

DuPont 2001 - Supplemental Site Investigation

In 2001, a Supplemental Site Investigation was completed by DuPont, which included characterization of metals in soil/sediment in areas which were not fully addressed during previous investigations (DuPont, 2001). Arsenic was detected above background levels in surface soil/sediment in and around the drainage swale north of the Monroe Electronics property boundary. Soil/sediment in this area was excavated and removed as part of the Lyndonville West Avenue Site cleanup in 2005.

DuPont 2005 - Lyndonville West Avenue Site Cleanup

Between May and August 2005, remedial activities were completed at the Lyndonville West Avenue site (NYSDEC Site No. 837002). As part of the remedial activities, soil in the drainage swale located north of the Monroe Electronics manufacturing building was excavated. Approximately 1,792 cubic yards of soil were excavated from the drainage swale and transported off-site for disposal. Following excavation, the drainage swale was backfilled with clean fill material and restored according to approved design drawings. Based on review of the Post-Remediation Engineering Report, soils containing elevated levels of arsenic identified during the NYSDEC 2000 Site investigation were removed as part of the 2005 remedial action.

1.5.2 Remedial Investigations (2011 to 2015)

HRP 2011 to 2013 - Remedial Investigation

Between May 2011 and June 2013, HRP conducted an RI for NYSDEC to investigate the nature and extent of soil and groundwater contamination identified during previous investigations. The findings of the RI are presented in a March 2014 RI Report. The objectives of the RI were to:

- Verify data generated during previous investigations by others and identify geologic and hydrogeologic data gaps;
- Determine if on-site operations had resulted in surface or subsurface contamination;
- Delineate the vertical and horizontal extent of contaminated soil and groundwater;

- Determine potential source area(s);
- Evaluate present and future human health exposure pathways; and
- Collect sufficient data to develop a set of remedial alternatives and recommend remedial options.

The RI field activities consisted of the following:

- Twenty-five passive soil gas samples were collected and analyzed for VOCs.
- A vapor intrusion assessment including the collection and laboratory analysis of sub-slab vapor, crawl space, and indoor air samples within the Monroe Electronics manufacturing building and the on-site residence during two separate sampling events. Ambient air samples were also collected during each event. The vapor intrusion samples were analyzed for VOCs.
- Ten surface soil samples were collected and analyzed for pesticides and Target Analyte List (TAL) metals.
- Thirty-one subsurface soil samples collected from thirty soil borings were analyzed for VOCs, TAL metals, and pesticides.
- Installation and development of nine shallow overburden groundwater monitoring wells (MW-1 through MW-7, MW-9 and MW-10), installation and development of three deep overburden groundwater monitoring wells (MW-2D, MW-7D and MW-10D), and installation and development of nine bedrock groundwater monitoring wells (MW-1B, MW-2B, MW-3B, MW-5B through MW-10B).
- Collection of groundwater samples from select groundwater monitoring wells in September 2011, August 2012, December 2012, March 2013, and June 2013. The groundwater samples were analyzed for VOCs, pesticides and TAL metals.
- An aquifer pumping test of bedrock monitoring well MW-7B.
- The sampling of one private water supply well located approximately a quarter mile north northwest of the Site. The sample was analyzed for VOCs, SVOCs and metals.

The results of the RI indicate that overburden was variable across the Site but generally consisted of sand and silt, followed by clay. Weathered bedrock and bedrock were encountered below the clay. Depth to bedrock ranged from twenty to thirty feet bgs. Bedrock encountered during the RI consisted of a red siltstone or shale.

During installation of the soil borings, depth to groundwater ranged from four to seven feet bgs. The groundwater observed during the RI was free of sheen or odor. Based on water level measurements collected during the RI, groundwater flow direction in the overburden was interpreted to be generally to the north-northwest. The groundwater flow in the bedrock was reportedly difficult to interpret because the potentiometric surfaces were flat with little gradient; however, subsequent gauging events completed during the SRI revealed that groundwater flow direction in the bedrock aquifer is predominantly towards the north/northeast or north/northwest.

Areas of Contamination

The RI Report indicates that the primary contaminants of concern in subsurface soil, soil vapor and groundwater consist of CVOCs (i.e., TCA, TCE and their breakdown products) as well as metals in surface soil (i.e., arsenic and chromium). During the RI, two CVOC source areas were identified on-site by the property owner and further supported with the data collected. The areas where the contaminants of concern were released are under the existing western portion of the manufacturing building (an addition to the manufacturing building was constructed after the material was disposed of) and in a former truck loading and unloading area located near the southeastern corner of the building.

Soil Vapor

VOCs were detected on Site in the sub-slab vapor, crawl space air, indoor air, and outdoor air samples collected to evaluate potential vapor intrusion into the manufacturing building and the residence. As mentioned above, a portion of the manufacturing building has a crawl space and the remaining portion of the manufacturing building is slab on grade. The residential structure is constructed primarily over a crawl space. CVOCs (commonly associated with solvents used in degreasing operations) and non-chlorinated VOCs (commonly associated with petroleum products) were detected in sub-slab vapor, crawl space air, indoor air, and outdoor air samples. The locations of the highest concentrations of contaminants of concern detected in the sub-slab vapor corresponded to areas beneath the western and southeastern portions of the manufacturing building.

The results of the analyses of indoor air samples collected in both the manufacturing building and the residence were below New York State Department of Health (NYSDOH) Air Guideline Values (AGVs). Comparison of the indoor air and sub-slab vapor sampling results to the matrices in the NYSDOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* indicated mitigation is needed for the manufacturing building. Comparison of the results of analysis of the indoor air and crawl space air samples collected in the residence to the NYSDOH Matrices indicated that the appropriate action is to "take reasonable and practical actions to identify source(s) and reduce exposure."

The passive soil vapor sampling identified elevated concentrations of TCE and PCE immediately east of the building. There were also lower concentrations of PCE detected at two locations south of the building.

Soil

During the RI, one VOC, 1,2-DCA, was detected in subsurface soil collected from two soil borings (SB-9 and SB-10, located southeast of the manufacturing building) at concentrations above Unrestricted Use and Protection of Groundwater Soil Cleanup Objectives (SCOs).

In surface soil, pesticides and metals were detected at concentrations exceeding the Unrestricted SCOs. Only one metal, arsenic, was detected at concentrations above the Industrial Use SCO, in five surface soil samples collected.

Groundwater

1,1,1-TCA and TCE, and their breakdown products (1,1,2-trichloroethane, 1,1-dichloroethane (1,1-DCA), 1,1-DCE, 1,2-DCA, and chloroethane) were detected at elevated concentrations in groundwater (in both shallow and bedrock wells) during the RI. The RI groundwater sampling results exhibited higher concentrations of degradation products than primary contaminants (i.e., 1,1,1-TCA and TCE). Shallow and deep overburden and bedrock groundwater consistently exhibited elevated concentrations of CVOCs during multiple groundwater sampling events. Groundwater impacts were detected throughout the Site; however, the highest concentrations of contaminants were encountered adjacent to the north, east, and west sides of the manufacturing building. The extent of groundwater contamination in the shallow overburden and bedrock monitoring wells was not fully defined during the RI.

TRC 2014 to 2015 - Supplemental Remedial Investigation (SRI)

In 2015 TRC completed an SRI for NYSDEC which included the Monroe Electronics property and nearby properties. The SRI field activities were completed between August 2014 and January 2015 and consisted of the following:

- Gauging of monitoring wells to determine predominant groundwater flow directions for overburden and bedrock groundwater;
- Collection and analysis of surface soil samples surrounding a historic surface soil sample which exhibited an elevated concentration of arsenic;
- Advancement of four soil borings inside the manufacturing building and one boring northwest of the manufacturing building and collection of soil and grab groundwater samples for laboratory analysis;
- Installation and development of five shallow overburden groundwater monitoring wells and six bedrock groundwater monitoring wells;
- Collection and analysis of groundwater samples from the eleven newly installed monitoring wells and 20 existing monitoring wells;

- Supplemental groundwater sampling including the collection and analysis of groundwater samples from ten groundwater monitoring wells;
- Slug testing in three shallow monitoring wells, one deep overburden monitoring well, and three bedrock monitoring wells;
- Collection and analysis of two sets of co-located surface water and sediment samples from the drainage ditch located northwest of the manufacturing building; and,
- Soil vapor intrusion sampling in two off-site structures.

Arsenic in Surface Soil

The results of the surface soil sampling revealed that the concentrations of arsenic detected ranged from 3.7 mg/kg to 72.6 mg/kg, below the concentration of arsenic detected in the historic surface soil sampling location SS-7 (124 mg/kg), suggesting that the highest concentrations of arsenic in surface soil are localized in the vicinity of historic sample location SS-7.

Subsurface Soil Contamination

There were no VOCs detected in subsurface soil at concentrations exceeding the Unrestricted Use SCOs (the most stringent SCOs), with the exception of TCE. TCE was detected in a soil sample collected from boring SB-104 within the saturated zone, at a depth of 21.5 to 23.5 feet below the top of the manufacturing building slab. In this sample, TCE was detected at a concentration of 1.3 mg/kg which is slightly above the Unrestricted Use SCO of 0.47 mg/kg. Based on the above, and since no significant evidence of contamination was found in soil, TRC concluded that subsurface soil VOC contamination at the Site is limited.

CVOCs in Groundwater

Groundwater samples collected from thirty-one monitoring wells in September 2014 and from ten monitoring wells in December 2014 were analyzed for VOCs. The concentrations of CVOCs detected in shallow and bedrock monitoring wells in September 2014 are generally consistent with the concentrations detected in December 2014 and the RI sampling results. The concentrations of CVOCs in groundwater across the Site generally support the RI findings that historic disposal occurred on the west and east sides of the manufacturing building. Below is a summary of the findings from the SRI groundwater sampling events.

In the direct-push groundwater grab samples, the highest concentrations of CVOCs were detected in SB-102 (the boring advanced in the western part of the manufacturing building) (refer to *Figure 2*). The total CVOC concentration in the sample collected from 20 to 24 feet below the top of slab (bts) in SB-104 was 1,336 micrograms per liter (µg/L). Total CVOCs were measured at a concentration of 1,059 µg/L in the groundwater sample collected from 8 to 12 feet bgs from the boring advanced northwest of the manufacturing building (SB-105). 1,1,1-TCA, identified as the primary compound historically disposed at the Site, was detected in groundwater collected from two borings (one on the western side of the manufacturing building and one northwest of the manufacturing building) at concentrations above the Class GA Value. TCE, which was detected in one subsurface soil sample at a concentration above the Unrestricted Use SCO as described above, was detected at a concentration above the Class GA Value in the groundwater sample collected from SB-104 at a depth of 20 to 22 feet bts. The remaining CVOCs detected at concentrations above the Class GA Values in the direct-push groundwater samples are degradation products of TCE and 1,1,1-TCA.

Among the shallow wells, the highest concentrations of CVOCs were detected in wells located east of the manufacturing building (total CVOCs up to 83.7 µg/L) and in wells located west of the manufacturing building (total CVOCs up to 59.62 µg/L). 1,1,1-TCA was detected at concentrations above the Class GA Value in two shallow wells located west of the manufacturing building. TCE was detected at concentrations above the Class GA Value in two shallow wells located east of the manufacturing building. The remaining CVOCs detected at concentrations above the Class GA Values in the groundwater samples collected from the shallow wells are primarily degradation products of TCE and 1,1,1-TCA. There were no CVOCs detected at concentrations above the Class GA Values in the three shallow monitoring wells installed north of the Site along West Avenue.

In the two deep monitoring wells (one located west of the manufacturing building and one located north of the manufacturing building) 1,1,1-TCA and TCE were either not detected or were detected at concentrations below the Class GA Values. The degradation products of 1,1,1-TCA (i.e., 1,1-DCA, 1,1,-DCE, 1,2-DCA and chloroethane) were detected in deep wells west of the manufacturing building at concentrations above the Class GA Values, which are generally higher than the concentrations detected in the associated bedrock or shallow well. Degradation products of 1,1,1-TCA (i.e., 1,1-DCA and 1,2-DCA) were detected in the deep well north of the manufacturing building at concentrations above the Class GA Values, which are generally consistent with or lower than the concentrations detected in the associated bedrock or shallow well.

In bedrock wells, the highest concentrations of CVOCs in groundwater were detected in wells west of the manufacturing building (total CVOCs: up to 1,054.6 µg/L), north of the manufacturing building (total CVOCs: up to 1,130.28 µg/L), and northeast of the manufacturing building (total CVOCs: up to 1,185 µg/L). CVOCs were detected at concentrations above Class GA Values in two of the three bedrock monitoring wells downgradient of the Site along West Avenue. However, the concentrations of total CVOCs detected in the two wells along West Avenue are an order of magnitude (or more) less than the concentrations of CVOCs detected in bedrock monitoring wells near the northern property boundary of the Site. 1,1,1-TCA was detected at a concentration above the Class GA Value in one bedrock well located west of the manufacturing building. The remaining CVOCs detected at concentrations above the Class GA

Values in the groundwater samples collected from the bedrock wells are degradation products of TCE and 1,1,1-TCA.

Review of the groundwater sampling data reveals that a reducing environment is present and reductive dechlorination is occurring on-site. Additionally, the results of the analyses of microbiological samples indicated that the levels of most microbial communities are relatively low with localized variability. The presence of supporting microbial communities suggested reductive dechlorination is likely occurring, but at limited rates and capacities and biostimulation (addition of substrate/electron donor) and bioaugmentation (addition of microbial culture) would likely accelerate the process.

VOCs in Surface Water and Sediment

Four VOCs (Freon 113, 1,1,1-TCA, 1,1-DCA, and 1,2-DCA) were detected above Class GA Values in one of the two surface water samples. Two (Freon 113 and 1,1-DCA) of the four VOCs were also detected in the sediment samples. The remaining surface water sampling results were below the Class GA Values and Class C surface water criteria. It was concluded that the concentrations of CVOCs detected in surface water may be in part attributable to shallow groundwater conditions, due to the relative elevation of the groundwater table and surface water. Therefore, in this FS, surface water is addressed as part of the evaluation of alternatives for groundwater.

Acetone was detected in one of the two sediment samples collected from the drainage ditch northwest of the manufacturing building. Freon 113 and 1,1-DCA were detected in the other sediment sample. The VOCs were detected in the sediment at concentrations below the laboratory reporting limit, and in all cases below the Unrestricted Use SCOs. Accordingly, it was concluded that existing and historic operations on-site have not significantly impacted the sediment in the drainage ditch located northwest of the manufacturing building.

Vapor Intrusion Sampling

There were no VOCs detected at concentrations above the NYSDOH AGVs in indoor air samples collected in the two structures located north of the Site. The results of the vapor intrusion sampling were evaluated by NYSDEC and NYSDOH and no actions were recommended to address potential exposure at those properties.

1.6 Contamination Fate and Transport

Based on available information, the southern and eastern portions of the Site were historically occupied by apple orchards. Historic application of pesticides containing arsenic appears to have impacted surficial soil. Based on the data presented in the RI and SRI Reports, there are no significant arsenic impacts to groundwater.

Based on information from the historic investigations, RI and SRI, infiltration from surficial dumping of chlorinated solvents through the soil pore space appears to be the principal transport mechanism which has resulted in contamination of groundwater beneath and north of the Site. There is no significant evidence of CVOC contamination in soil. Subsurface soil CVOC contamination at the Site is present in saturated soils and is limited. Groundwater sampling at the Site indicates that the primary CVOCs in on-site shallow and bedrock groundwater are 1,1,1-TCA, TCE, and their breakdown products. CVOCs are no longer released on-site and contaminant infiltration is no longer anticipated as a transport mechanism.

The Site exhibits a gradual change in groundwater elevation across the area of study, indicating an inferred predominant groundwater flow direction in a northeasterly and northwesterly direction. Indications are that groundwater flow direction varies seasonally. Groundwater surface elevation measurements in overburden and bedrock well clusters indicate a downward vertical gradient on-site and immediately north of the Site.

There are four distinct geological units including sand and silt, clay, weathered shale, and bedrock (siltstone above a predominantly gray shale). The estimated hydraulic conductivity based on slug tests completed during the SRI ranged in the overburden from 1.02 x 10^{-5} cm/sec to 1.04 x 10^{-4} cm/sec and in the bedrock from 1.30 x 10^{-5} cm/sec to 6.43 x 10^{-5} cm/sec. Based on the SRI slug test results, the average estimated hydraulic conductivities for the overburden and bedrock are 0.12 and 0.09 feet/day, respectively. Based on existing data, groundwater flow is considered to be a significant lateral and vertical mechanism for CVOC contaminant transport both on and off Site.

Soil vapor intrusion assessments confirmed the presence of CVOC impacts in the on-site vadose zone (i.e., above the water table). Preferential pathways for soil vapor migration include permeable soil; utility bedding pathways; as well as asphalt, concrete slab, and footing cracks in buildings.

1.7 Qualitative Human Health Risk Evaluation

Currently the Site is occupied by Monroe Electronics, which is a manufacturer of electronic devices. The residence on-site is currently occupied. Based on these conditions, contaminant exposure was evaluated for manufacturing employees and private residents. In order for a contaminant to pose a risk to human health, a complete exposure pathway must be present with contaminant concentrations high enough to potentially cause an adverse health effect. Human exposure can occur through ingestion, inhalation, and absorption via direct contact pathways.

Ingestion, inhalation, and absorption of soil are potential pathways for human exposure. Investigations have indicated the presence of shallow arsenic impacts to soil, in the southern and eastern parts of the Site. The contamination detected is below a vegetative covering. However, the presence of these impacts at shallow depths (ground surface to six inches bgs) potentially poses a risk for the pathways of absorption via direct contact, ingestion, and inhalation. This risk can be considered minimal as the Site is stabilized with well-established vegetative cover. There are currently no vegetable gardens on-site. However, potential exposure could occur, most likely during surficial soil disturbing activities (e.g., gardening, utility maintenance, or future redevelopment).

Ingestion and absorption of contaminated groundwater are potential pathways for human exposure. The groundwater table is approximately 5 feet below ground surface, therefore absorption of groundwater is generally unlikely. Ingestion is not considered a current human exposure pathway as the Site is connected to public water.

Inhalation of contaminated soil vapor from the subsurface groundwater represents a potential pathway for human exposure. Elevated CVOC concentrations in the crawl space were not detected during the RI beneath the residential building. Therefore, based on existing data, vapor intrusion into the residence is not anticipated to pose a significant risk to human health.

While indoor air sampling results did not exceed NYSDOH guidelines for CVOCs, elevated CVOC concentrations in the sub-slab vapor were detected during the RI beneath the manufacturing building, indicative of a source of contaminated soil vapor with the potential to move into the overlying building and affect indoor air quality. Based on existing data, soil vapor inhalation within the manufacturing building has been identified as a potential exposure pathway for workers and visitors to the Site and poses a risk to human health. Environmental sampling indicates that soil vapor intrusion is not a concern for off-site buildings.

2.0 IDENTIFICATION OF STANDARDS, CRITERIA, GUIDANCE AND REMEDIAL ACTION OBJECTIVES

2.1 Introduction

In order to identify and screen potential remedial technologies, an initial identification of remedial action objectives (RAOs) and preliminary remediation goals (PRGs) is required. RAOs provide a general description of the objectives of a cleanup action. Furthermore, RAOs provide the basis for developing numerical remediation goals (the PRGs), which are used to identify the appropriate extent of a cleanup action. Regulatory criteria and risk-based levels are considered in identifying PRGs. This section also describes the potential standards, criteria, and guidance (SCGs) that a remedial action must achieve.

Once RAOs and PRGs are developed, general response actions (GRAs) are identified which satisfy the objectives. An initial evaluation is made of the areas and volumes of media to which the GRAs will be applied.

The GRAs are then used to develop a list of potential remedial technologies for the environmental matrices to be remediated. An initial screening of the technologies is conducted based on the technical implementability of the various technologies and their applicability to the Site. Site-specific characteristics or waste characteristics limit the applicability of certain technologies and these characteristics are considered in determining which technologies are not appropriate for further consideration.

For those technologies that pass the initial screening, the associated technology process options are evaluated in greater detail to allow the selection of one process option to represent each technology type. The representative process option provides a basis for developing performance specifications that are used in evaluating that technology type; however, the specific process actually used to implement the remedial action may not be selected until the remedial design phase. To select a representative process, each process option is evaluated on the basis of effectiveness, implementability, and cost, with the greatest focus on effectiveness factors.

2.2 Remedial Action Objectives

RAOs are developed in order to set objectives for protecting public health and the environment early in the remedial alternative development process. The objectives should be as specific as possible but should not unduly limit the range of alternatives that can be developed. The contaminants of concern (COCs) discussed in Section 1.5 represent the specific contaminants of interest and allowable exposures are defined based on the SCGs (discussed in more detail in Section 2.3). RAOs should specify (1) the contaminants of concern; (2) the exposure route(s) and receptor(s); and (3) an acceptable contaminant level (or range of levels) for each exposure route.

The RI and SRI have identified an area of arsenic-impacted surface soil (ground surface to 6 inches bgs) that presents a direct contact exposure risk.

The RI and SRI have also identified CVOCs in groundwater in the overburden and bedrock that are likely volatilizing into the vadose zone soil vapor. Remediation of this CVOC-impacted groundwater will minimize the source of soil vapor impacts.

The RAOs for the Site were developed in consideration of current known Site conditions and include the following:

- Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable;
- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards;
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater;
- Prevent migration of contaminants that would result in groundwater or surface water contamination;
- Prevent ingestion/direct contact with contaminated soil; and
- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site.

2.3 Potentially Applicable Standards, Criteria, Guidance (SCGs), and Preliminary Remediation Goals

Standards, Criteria and Guidance (SCGs) are defined below as follows:

> “Standards and criteria are cleanup standards, standards of control, and other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance.”
>
> “Guidance are non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as standards and criteria; however, remedial alternatives should consider guidance documents that, based on professional judgment, may be applicable to the project.”

SCGs may include Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Criteria (TBCs) where:

1. Applicable requirements are cleanup standards, standards of control, or other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site;

2. Relevant and appropriate requirements are those federal and state requirements that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site; and

3. To be considered (TBC) material are non-promulgated advisories or guidance issued by federal or state agencies that, although not legally binding, can be used in determining the level of clean up for protection of health or the environment.

There are three types of SCGs: chemical-specific (i.e., those that pertain to the management of certain chemicals); location-specific (i.e., those that restrict activities at a given location); and action-specific (i.e., those that control specific actions). Chemical-specific SCGs are usually health- or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. Location-specific SCGs prevent damage to unique or sensitive areas, such as floodplains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they take place. Action-specific SCGs are activity or technology based. These SCGs control remedial activities involving the design or use of certain equipment, or regulate discrete actions.

This section of the FS Report focuses on the evaluation of chemical-specific SCGs that are applicable to the COCs detected in the environmental media at the Site, as those are the SCGs that are relevant to the establishment of PRGs. Location-specific and action-specific SCGs are more relevant to the evaluation of remedial alternatives later in the FS process. Therefore the evaluation of location-specific and action-specific SCGs is presented in *Appendix A*.

2.3.1 Chemical-Specific SCGs

2.3.1.1 Soil PRGs

In accordance with NYSDEC 6 NYCRR 375-6, soil remediation is required to achieve compliance with SCOs for the protection of public health, protection of groundwater, and protection of ecological resources. The Site is primarily comprised of disturbed land and is more than 0.5 miles from the nearest downgradient surface water body. Additionally, there are no known ecological resources located on Site. However, the New York State Environmental Resource Mapper[1] and Nature Explorer[2] were checked for the presence of rare plants and animals or significant natural communities in the vicinity of the Site. The Site is located within an area designated as a habitat for Rare Plants and Rare Animals. Therefore, prior to selecting a final remedy, a request for determination whether activity is subject to regulation under 6 NYCRR Part 182 would be made within the NYSDEC.

Additionally, National Wetland Inventory (NWI) mapping and the New York State Environmental Resource Mapper were reviewed for wetlands at or in the vicinity of the Site. The nearest wetland area identified in the

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[1] http://www.dec.ny.gov/imsmaps/ERM/viewer.htm
[2] http://www.dec.ny.gov/natureexplorer/app/

NWI mapping, Johnson Creek, is located approximately 500 feet south of the Site. A freshwater emergent wetland is located approximately 1,800 feet southwest of the Site. Remedial alternatives evaluated in this FS Report would not impact the wetland areas. Therefore, federal Executive Orders 11988 and 11990 and New York regulations (6 NYCRR Part 661 and the Freshwater Wetlands Act) do not apply to the Site.

Based on the above, for this FS Report, Protection of Ecological Resources SCOs are not considered further. Furthermore, the COC for soil, arsenic, has only been detected at concentrations greater than applicable criteria in groundwater samples collected from two monitoring wells. Neither monitoring well is located in the vicinity of arsenic-impacted surface soil. Therefore, only Protection of Human Health SCOs will be considered. Considering the Site is zoned Light Industrial and classified as "manufacturing", the Industrial Use SCO for arsenic in soil is applicable and is shown in *Table 1*[3]. To achieve the requirement of DER-10 to evaluate an "unrestricted alternative", the Unrestricted Use SCOs for metals and pesticides were applied to Alternative 5, as discussed further below.

2.3.1.2 Soil Vapor PRGs

Based on their chemical and physical nature, the COCs identified during the RI Report for soil vapor are limited to VOCs. No chemical-specific ARARs were identified for the soil vapor COCs. Potential chemical-specific soil gas TBCs consist of vapor intrusion screening levels (VISLs) that can be determined using the USEPA VISL Calculator, a spreadsheet tool available on USEPA's website (USEPA, 2013). New York State has also developed soil vapor intrusion guidance that includes chemical-specific TBCs (AGVs) for select VOCs in indoor air (NYSDOH, 2006). While not applicable to soil gas, the guidance also includes matrices for select VOCs that indicate the potential need for mitigation based on sub-slab soil vapor and indoor air concentrations.

2.3.1.3 Groundwater PRGs

COCs in groundwater, as identified in Section 1.5, consist of CVOCs. Potential chemical-specific ARARs for the groundwater COCs are listed in *Table 2*. Chemical-specific ARARs exist for all groundwater COCs.

The New York State groundwater classification for the Site is GA, which indicates waters that could be used as a source of potable water supply. Federal and state drinking water standards were considered as potential groundwater chemical-specific ARARs, based on the groundwater classification. State groundwater quality standards and guidance levels were also considered. Potential federal and state chemical-specific ARARs include Maximum Contaminant Levels (MCLs) published under the Safe Drinking Water Act (40 CFR 141 and 141.61-64), New York MCLs (10 NYCRR 5-1.52), and New York Groundwater Quality Standards (6 NYCRR 703).

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[3] Although the Site includes a "single family residential" classification, NYSDEC has confirmed the Site owner will no longer lease any portion of the Site for residential purposes.

Potential groundwater TBCs include federal secondary MCLs and groundwater quality guidance values established in the Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 (June 1998, last revised 2004) based on the GA groundwater classification. The Class GA Values for COCs in groundwater are shown in *Table 2*.

2.4 General Response Actions (GRAs)

GRAs are remedial actions that will satisfy the RAOs identified in Section 2.2.

Impacts to soil, soil vapor, and groundwater were considered in determining appropriate GRAs. For these media, GRAs are identified and an initial evaluation of the areas or volumes to which the GRAs may be applied was conducted, as described below. In determining the volumes/areas of media, consideration was given to Site conditions, the nature and extent of contamination, acceptable exposure levels, and potential exposure routes.

2.4.1 Surface Soil

The GRAs, as indicated in *Table 3*, for arsenic-impacted surface soil, include the following:

- No Action
- Institutional Control
- Containment
- Ex-Situ Management

A preliminary estimated extent of arsenic-impacted soil, as defined during the SRI, is presented in *Figure 4*. Based on the estimated extent of arsenic-impacts identified, approximately 80,000 square feet requires remediation. Assuming surface soil requires remediation to, on average, 0.5 feet bgs, remediation of an estimated 1,500 cubic yards of soil is required. (Note: it is anticipated that additional delineation will be required to determine vertical and horizontal extent of surface soil impacts for the purpose of remediation.)

2.4.2 Soil Vapor

Remedial investigations have included the collection of sub-slab and crawl space vapor and indoor air samples. Concentrations of CVOCs in soil vapor beneath the on-site manufacturing building are a concern. The locations of impacted groundwater, described above, coincide with the on-site area of impacted soil vapor. Considering that the remediation of groundwater is being evaluated, and the remediation of groundwater will result in a reduction of concentrations of CVOCs in soil vapor, separate GRAs for soil vapor have not been identified or evaluated. However, actions to address potential exposure via soil vapor intrusion in the on-site manufacturing building are recommended. Such actions could include indoor air monitoring to ensure that the concentrations of site-related contaminants are below NYSDOH AGVs, sealing preferential pathways in conjunction with installing a sub-slab depressurization system, or changing the pressurization of the building in conjunction with monitoring.

In accordance with NYSDOH guidance, soil vapor intrusion in the on-site manufacturing building will be monitored via the implementation of an indoor air sampling program. Based on the monitoring results, additional actions may be recommended to address exposures related to soil vapor intrusion.

An evaluation of crawl space vapor and indoor air in the on-site residence indicated that mitigation is not required. Considering this building will no longer be used as a residence, no additional action is necessary.

Additionally, an environmental easement will be imposed on the Site that provides for 1) the evaluation and mitigation of potential exposures related to vapor intrusion associated with new construction; and 2) a vapor intrusion monitoring plan for any new construction and the on-site residence.

2.4.3 Groundwater

GRAs, as indicated in *Table 4*, identified for addressing groundwater impacts, are as follows:

- No Action
- Institutional Control
- Containment
- Extraction/Treatment/Discharge
- In-Situ Treatment

As described in the SRI Report, CVOCs have been detected at concentrations greater than applicable criteria in samples collected from groundwater monitoring wells on Site, and off-site to the north (refer to Figures 9 through 12 of the SRI).

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

The GRAs are developed further through the identification and screening of remedial technologies which would potentially meet the RAOs and PRGs. Following a screening of the remedial technologies on the basis of technical implementability, the process options associated with each technology were screened based on effectiveness, implementability, and cost. Representative process options were chosen for inclusion in the comprehensive remedial alternatives developed for the Site.

3.1 Technology Screening

Technology screening was performed to evaluate technologies for the remediation of soil and groundwater, as presented in *Tables 3 and 4,* respectively. Each table includes a brief description of individual technologies or process options, and presents comments on applicability of each to the Site. With respect to soil, containment via placement of a soil cover and excavation and off-site disposal are considered appropriate to achieve RAOs and fulfill applicable SCGs. With respect to groundwater, the effectiveness of *ex-situ* technologies (e.g., extraction and treatment) is limited by a combination of an unfavorable subsurface environment with a low hydraulic conductivity, the predominately impacted aquifer being in bedrock, and the mass transfer limitations of relying on groundwater as a transport medium. Therefore, the technology screening process results indicate with respect to groundwater that the focus should be on *in-situ* treatment technologies. The technology options that do not pass the screening process on the basis of technical implementability are indicated in the tables and will not be retained for further consideration.

3.2 Process Option Screening

After identification of technologies that are technically implementable, the process options were further evaluated to allow the selection of a representative process option. The process options were evaluated on the basis of effectiveness, implementability, and cost. Soil and groundwater process option evaluations are presented in *Tables 5 and 6*, respectively. No action, containment via placement of a soil cover, excavation and off-site disposal, enhancement of both the biological and chemical reduction processes for CVOCs, as well as *in-situ* thermal remediation (ISTR) were selected as the process options to be included among the alternatives described in Section 4.0.

4.0 IDENTIFICATION OF ALTERNATIVES

4.1 Introduction

This section describes the development of several remedial options to achieve the RAOs identified above. Arsenic in surface soil, CVOCs in soil vapor, and CVOCs in groundwater, have been identified as the potential risks to public health at the Site. The presumed source of CVOCs associated with soil vapor intrusion is CVOCs in groundwater. The focus of this section and the following sections of the FS Report is evaluation of alternatives for arsenic in soil and CVOCs in groundwater, since as mentioned above indoor air monitoring and institutional controls (ICs) have been selected for vapor intrusion control.

In consultation with the NYSDEC, TRC has identified five alternatives for evaluation. These alternatives were selected in consideration of the RAOs based on an evaluation of the results of environmental investigations and site-specific conditions, an analysis of cost, technological implementability, and effectiveness, and professional judgment. A focused review of other remedial technologies and options for applicability and feasibility was completed, as documented in *Tables 3 and 4*.

The technologies and process options identified in Section 3.0 have been combined to form a range of remedial alternatives that meet the criteria set forth in the National Contingency Plan (NCP) for the types of remedial alternatives which must be considered. The criteria include the following:

- For alternatives that provide control of the source of contamination, the range of alternatives should include the following:
    - A range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range should include an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing the need for long term management and resulting in unrestricted use of the Site.
    - One or more alternatives that involve little or no treatment, but provides protectiveness of public health and the environment primarily by preventing or controlling exposure to hazardous substances through engineering controls and/or ICs.
- For soil and groundwater response actions, a limited number of remedial alternatives should be developed that attain site-specific remediation levels within different restoration time periods utilizing one or more different technologies.
- The development of one or more innovative treatment technologies for further consideration.
- The no action alternative.

The development and evaluation of remedial alternatives focuses on alternatives that provide treatment and attain remedial goals within different restoration periods, utilizing innovative technologies (e.g., thermal remediation), where appropriate. Engineering and institutional controls are evaluated as individual components of remediation alternatives involving treatment resulting in residual contamination at the Site following the treatment period.

For the alternatives developed for this Site, general descriptions of the alternatives and associated technologies are provided in Sections 4.3 through 4.7. The remedial alternatives that will undergo detailed analysis are presented in Section 5.0.

4.2 Development of Alternatives

The RAOs, as presented in Section 2.2, are used as a guide in the development of remedial alternatives.

Included in the list of alternatives are the following:

1. No Action;
2. Soil Cover, Groundwater Monitored Natural Attenuation (MNA), Indoor Air Monitoring, and Institutional Controls (ICs);
3. Enhanced In-Situ Bioremediation (EISB) and In-Situ Chemical Reduction (ISCR), Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs;
4. Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs; and,
5. In-Situ Thermal Remediation, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring.

4.3 Alternative 1: No Action

No action as an alternative is only an option at sites that could benefit from natural processes which would degrade the contamination to levels below the cleanup goals. This alternative is considered as a baseline for comparison as required by the NCP. This alternative would not include ICs and would not involve periodic monitoring to evaluate natural attenuation.

4.4 Alternative 2: Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

This alternative consists of implementing an indoor air monitoring program to evaluate soil vapor intrusion of CVOCs into the on-site manufacturing building. Indoor air samples would be collected on an annual basis in accordance with NYSDOH guidance. For cost estimating purposes, a total of thirty years of indoor air monitoring is included in this FS Report. If CVOCs were detected at concentrations greater than NYSDOH guidelines, additional actions would be considered to address exposures related to soil vapor intrusion.

Another element of Alternative 2 would be the containment of arsenic-impacted surface soil exceeding the Industrial Use SCO by placing a one-foot thick layer of clean fill and topsoil cover. After placement, the topsoil would be seeded, and fertilizer and mulch would be added to promote growth of a uniform stand of perennial grasses. A geotextile demarcation layer would be installed between the clean fill layer and the arsenic-impacted soil to indicate underlying residual contaminated soil. The horizontal and vertical extents of contamination, and area to be covered, would be verified as part of a pre-design investigation. Currently, the area of concern is estimated to be approximately 80,000 square feet, and the estimated volume of soil which would be imported to the Site is 3,000 cubic yards (refer to *Figure 4*).

Additionally, implementation of Alternative 2 would include long term groundwater monitoring to monitor contaminant migration and natural attenuation. Refer to *Figures 6 and 7* for estimated extents of total CVOC concentrations in the shallow and bedrock aquifers. Long-term groundwater monitoring would be performed at the following frequency:

- Quarterly for years 1 and 2; and,
- Annually for years 3 through 30.

Long term groundwater monitoring (years 3 through 30) has been selected at an annual frequency for cost estimating purposes only. The actual frequency may be increased or decreased depending on results from years one and two.

ICs would be incorporated and would include the establishment of an environmental easement to document residual soil contamination and soil cover maintenance requirements, prohibit use of the on-site residential building for purposes other than industrial, and prohibit on-site groundwater extraction and use. Additionally, the environmental easement would include provisions for an indoor air monitoring program for the main building and the evaluation of the potential for vapor intrusion for any new buildings developed on the site (and additional actions, as required).

4.5 Alternative 3: EISB and ISCR, Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

Alternative 3 consists of all of the elements of Alternative 2 plus the injection of bio-stimulating and chemical reduction amendments and bio-augmentation cultures into the aquifer to enhance the biological and abiotic reductive dechlorination of CVOCs in groundwater. Among the objectives of Alternative 3 would be to reduce further off-site migration of COCs in the bedrock aquifer via biological and chemical reduction. Existing data indicate that the CVOCs in the groundwater are being naturally degraded under existing Site conditions, but at limited rates. These data include the detection of biodegradation daughter products of 1,1,1-TCA and TCE, the presence of the appropriate biogeochemical conditions [i.e., strongly reducing (methanogenic) conditions that are appropriate for degradation of CVOCs], and the documented presence of microbial populations of *Dehalobacter spp.* (bacteria that degrade CVOCs) and *Desulfuromonas spp.* (a microbial indictor of methanogenic conditions). However, the absence of detected populations of *Dehalococcoides spp.* (bacteria that completely dechlorinate chlorinated ethenes) and ethene concentrations suggest the existing aquifer conditions alone would not support complete reductive dechlorination of TCE. Therefore, amendments would be selected and employed to change these limiting conditions and promote a vigorous population of *Dehalococcoides spp*.

Prior to implementation of EISB and ISCR a pre-design investigation would be performed to delineate the horizontal and vertical extents of groundwater contamination. EISB and ISCR would be implemented by injecting a liquid phase reducing agent (e.g., zero-valent iron) mixed with a controlled-release carbon source for EISB. EISB/ISCR injection wells would be used to inject the reducing agent/carbon source mixture to the targeted remediation areas and depths. Zero-valent iron (or similar) abiotically dechlorinates CVOCs, and the controlled-release carbon acts as a bioamendment to enhance the biological reductive dechlorination concurrently with chemical reduction. Bioaugmentation cultures would be injected subsequently or concurrently. Commercially-available EISB/ISCR mixtures typically have an effective longevity of up to four to five years. It is anticipated that four rounds of EISB/ISCR injections would be required.

The EISB/ISCR injections would target the bedrock aquifer adjacent to the western and north of the northwestern portions of the existing manufacturing building and around monitoring well MW-105B, as shown on *Figure 8*. Groundwater sampling and analysis would be performed during the first year as part of the injection program. Data generated as a result of the sampling would be used to evaluate the effectiveness of injection, and enhancements to the remedial approach may be considered as conditions warrant.

Long-term groundwater monitoring would be performed to monitor the EISB/ISCR performance and groundwater contaminant natural attenuation at the following frequency:

- Quarterly for years 1 and 2; and
- Annually for years 3 through 30.

4.6 Alternative 4: Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs

Alternative 4 consists of all of the indoor air monitoring and groundwater remediation elements of Alternative 3, with the expansion of the groundwater treatment area to include the bedrock aquifer beneath the western portion of the building, as shown on *Figure 9*. It should be noted that implementation of Alternative 4 would require either the demolition of a portion of the manufacturing building or use of specialty drilling techniques for installation of injection wells inside the building. Similar to Alternative 3, a pre-design investigation would be performed prior to implementation of EISB and ISCR and groundwater sampling and analysis would be performed during the first year as part of the injection program. Data generated as a result of the sampling would be used to evaluate the effectiveness of injection, and enhancements to the remedial approach may be considered as conditions warrant. Long-term groundwater monitoring would be performed to monitor ISCR and EISB performance and groundwater contaminant natural attenuation at the frequencies described for Alternative 3.

Another element of Alternative 4 would be excavation and off-site disposal of arsenic-impacted surface soil. The horizontal and vertical extents of contamination would be verified as part of a pre-design investigation. The soil remediation elements of Alternative 4 would target arsenic concentrations exceeding the Industrial Use SCO in surface soil (i.e., the upper 0.5 feet of soil). Therefore, it is anticipated that excavation depths would be limited to 0.5 feet. Currently, the area of concern is estimated to be approximately 80,000 square feet, and, applying a depth of 0.5 feet, the estimated volume of soil which would be removed is 1,500 cubic yards (refer to *Figure 4*).

4.7 Alternative 5: In-Situ Thermal Remediation, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring

Alternative 5 consists of the indoor air monitoring elements of Alternative 4[4] and, with respect to groundwater, utilizing ISTR to heat the subsurface to elevated temperatures, and vaporizes contaminants dissolved in groundwater and adsorbed to the formation. The vaporized volatilized CVOCs would be removed and collected from the overlying unsaturated soil using a vapor extraction system. Vapors would be treated prior to being discharged to the atmosphere, using granular activated carbon (GAC) treatment or other technology. It is expected that implementation of Alternative 5 would require either the demolition of a portion of the manufacturing building or use of specialty drilling techniques for installation of electrodes inside the building. Similar to Alternatives 3 and 4, a pre-design (groundwater) investigation would be performed prior to implementation of ISTR.

For the purposes of developing alternative costs, electrical resistance heating (ERH) is the thermal remediation technology evaluated in this FS, as it is the most appropriate for geologic conditions (i.e., clays and sedimentary bedrock) at the Site. ERH uses arrays of electrodes to create a concentrated flow of current toward a central neutral electrode. Resistance to flow in the formation generates heat up to approximately 100ºC, producing steam and mobilizing contaminants. However, alternative thermal technologies (e.g., thermal conductive heating) may be considered during remedial design if implementation of ERH is determined to not be viable because of physical properties of the soil or rock.

Following the ISTR interval, groundwater monitoring would be proposed to monitor ISTR performance and groundwater contaminant natural attenuation at the following frequency:

- Quarterly for year 1; and
- Annually for years 2 through 5.

Another element of Alternative 5 would be excavation and off-site disposal of contaminated soil to achieve NYSDEC Unrestricted Use SCOs. The horizontal and vertical extents of contamination would be verified as part of a pre-design investigation. The RI Report indicates that metals other than arsenic and pesticides were detected

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[4] It should be noted that the indoor air monitoring period is anticipated to be limited to five years and no ICs would be required for Alternative 5.

in surface soil at concentrations above the NYSDEC Unrestricted Use SCOs. As part of this alternative, pre-design investigation and post-excavation samples would be analyzed for constituents detected above the NYSDEC Unrestricted Use SCOs. It is expected that excavation to depths of up to 2.5 feet would be required. Currently, the area of concern is estimated to be approximately 232,000 square feet, and the estimated volume of soil which would be removed is 21,500 cubic yards (refer to *Figure 4*).

5.0 DETAILED ANALYSIS OF ALTERNATIVES

5.1 Introduction

This section provides a detailed analysis of the remedial alternatives described in Section 4.0 of this FS Report. Each alternative is evaluated with respect to ability to protect against risks to public health and the environment and technical applicability at the Site. Additionally, each alternative is described in detail and compared on the basis of environmental benefits and costs using criteria established in 6 NYCRR Part 375, DER-10, and DER-31. A total of five remedial alternatives (including a "No Action" alternative) are described in this section and compared to the RAOs for soil, soil vapor intrusion, and groundwater for the Site.

5.1.1 Detailed Evaluation of Criteria

This section discusses the evaluation criteria against which each remedial alternative will be compared in accordance with 6 NYCRR Part 375 and Title 40 of the Code of Federal Regulations §300.430 (40 CFR §300.430, as required by DER-10). The evaluation criteria include the following:

- Overall protectiveness of the public health and the environment
- Compliance with SCGs
- Short-term effectiveness and potential impacts during remediation
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility and volume of hazardous waste (e.g., by thermal destruction or biological or chemical treatment)
- Implementation and technical reliability
- Cost
- Community and State acceptance
- Land use

When evaluating alternatives in terms of overall protectiveness of public health and the environment, consideration is given to the manner in which Site-related risks are eliminated, reduced, or controlled through treatment, engineering controls, or ICs. Compliance with SCGs, long-term effectiveness and permanence, and short-term effectiveness are given major consideration in determining the overall protectiveness offered by each alternative.

The alternatives are assessed to determine whether they attain SCGs under applicable federal environmental laws and state environmental or facility siting laws. The identification of SCGs is a site-specific process which is dependent on the specific hazardous substances, pollutants, and contaminants at a site, the physical characteristics and location of a site and the remedial actions under consideration at a site. Therefore, it is an iterative process that requires re-examination throughout the RI/FS process, until the Record of Decision (ROD) is issued. Chemical-specific SCGs were previously discussed in Section 2.3 and the analysis of potential location-specific and action-specific SCGs is presented in *Appendix A*. In the following alternative analyses, the individual remedial alternatives are evaluated in detail to determine compliance with SCGs that are applicable to the specific media being addressed by the alternative, and the potential impacts of SCGs on implementation of each alternative.

Selected remedial actions must meet the threshold criteria, and thereby be protective of public health and the environment. Effectiveness of an alternative is determined by evaluation with respect to the criteria listed above, including cost[5]. The result is a selected alternative that satisfies the threshold criteria and provides the best balance of the criteria, with an emphasis on long-term effectiveness and reduction of toxicity, mobility and volume.

State and Community acceptance are not evaluated in the following sections since the related criteria will be evaluated as part of future activities (e.g., future public participation events). Land use is not evaluated in detail in the following sections as land use will be consistent for all alternatives with the exception of Alternative 1: No Action. Under the No Action alternative, no environmental easement would be put in place; therefore, future land use would not be restricted and no monitoring would be performed.

5.1.2 DER-31 Implementation

As part of the FS process, TRC considered NYSDEC DER-31 implementation objectives. The NYSDEC DER's approach to remediating sites in the context of the larger environment is a concept referred to as "Green Remediation." The approach is intended to minimize overall environmental impacts by promoting the use of more sustainable practices and technologies. Green Remediation practices and technologies are less disruptive to the environment, generate less waste, increase reuse and recycling, and emit fewer pollutants, including greenhouse gases, to the atmosphere. Remedial alternatives and technologies were evaluated with respect to DER-31 throughout the FS process as part of the overall protectiveness of public health and the environment evaluation criteria.

5.2 Remedial Alternatives

5.2.1 Alternative 1: No Action

5.2.1.1 Description

Alternative 1, the No Action Alternative involves no remedial activities. NYSDEC 6 NYCRR Part 375 requires consideration of the No Action Alternative; at a minimum it provides a baseline for comparison with other

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[5] For the purposes of this FS, a discount rate of 7% was used in conducting the present worth analyses.

alternatives. Natural attenuation would be the sole method of remediation. Since the alternative involves no remedial activities, no action-specific or location-specific SCGs can be applied for evaluation. Because contaminants would remain at the Site above levels that would allow for unlimited use and unrestricted exposure, five-year reviews of the No Action decision would be required under 40 CFR 300.430(f)(4)(ii).

Detailed Evaluation of Criteria

5.2.1.2 Overall Protectiveness of Public Health and the Environment

This alternative is not protective of public health and the environment. This alternative would not address arsenic concentrations in surface soil or soil vapor intrusion into on-site buildings. As described in the SRI, natural attenuation of CVOCs in groundwater is occurring at a limited rate. While natural processes may reduce the extent of groundwater contamination over the long-term, Alternative 1 does not limit future use of the Site, and therefore does not limit the potential for future exposures to the groundwater or soil gas contamination which might result from a change in Site use. Overall, this alternative is not effective in the long-term or short-term and does not meet remedial action objectives in a timely manner. An evaluation of ecological risk was not performed as indicated in Section 2.3.1.1.

With respect to sustainability, Alternative 1 utilizes very few natural resources and does not include the disturbance of the existing landscape. The only consumption of resources would be associated with limited field and administrative work associated with periodic regulatory review.

5.2.1.3 Compliance with SCGs

Chemical-specific SCGs for arsenic in soil would not be achieved with Alternative 1. Since this alternative does not address the presence of groundwater contaminants above chemical-specific SCGs, chemical-specific ARARs would not be met unless long-term natural attenuation processes eventually result in lower contaminant levels in soil vapor and groundwater. No location-specific SCGs or action-specific SCGs were identified as being directly applicable to this alternative.

5.2.1.4 Short-Term Impacts and Effectiveness

Alternative 1 does not result in any increased short-term risks, due to the lack of activities associated with its implementation. However, health risks associated with the potential inhalation by workers of volatiles due to vapor intrusion from groundwater would not be addressed. Therefore, no action does pose a significant short-term risk under the current Site use. RAOs are not achieved over the short-term.

5.2.1.5 Long-Term Effectiveness and Permanence

Alternative 1 offers limited long-term effectiveness. Due to the current limited rate of reductive dechlorination of CVOCs in Site groundwater, it is unlikely that natural attenuation processes would achieve remedial action objectives in a reasonable timeframe. Arsenic risks would be expected to remain relatively the same in the long-term under this alternative. Alternative 1 also does not offer any long-term monitoring or Site use restrictions to prevent exposures to remaining contamination. Due to the residual risk that would be associated with the No Action Alternative, five-year reviews of the no action decision would be required.

5.2.1.6 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 1 does not include any treatment methods other than naturally occurring degradation or attenuation processes. Therefore, the alternative offers no significant reductions in the toxicity, mobility, or volume of contamination through treatment.

5.2.1.7 Implementability

Alternative 1 would require no implementation other than the performance of five-year reviews. Its implementation would not limit the future implementation of additional remedial actions, if needed.

5.2.1.8 Cost

Costs associated with implementation of the Alternative 1 would involve the minimal costs associated with the performance of five-year reviews. A period of 30 years is used in the cost estimate as the period over which five-year reviews would be conducted for Alternative 1. The estimated present value of this alternative, including contingency, is approximately $15,000. A detailed cost estimate is presented in *Table 6*.

5.2.2 Alternative 2: Soil Cover, Groundwater MNA, and ICs

5.2.2.1 Description

Alternative 2 includes the following components:

- Implementation of an Indoor Air Monitoring Program;
- Cover of arsenic-impacted shallow soil with a one-foot thick soil cover;
- Groundwater monitoring; and
- Institutional controls.

Alternative 2 consists of implementing an indoor air monitoring program to evaluate soil vapor intrusion of CVOCs into the on-site manufacturing building. Indoor air samples would be collected in accordance with NYSDOH guidance on an annual basis. If CVOCs were detected at elevated concentrations in indoor air, additional actions would be recommended to address exposures related to soil vapor intrusion.

Also included in Alternative 2 is the on-site containment of arsenic-impacted surface soil in the southern and eastern portions of the Site. The soil remediation elements of Alternative 2 would target concentrations exceeding the Industrial Use SCO in surface soil (i.e., the upper 0.5 feet of soil). A pre-design investigation would be performed to determine the area to be covered. A geotextile demarcation layer would be installed over the entire area to be covered. Certified environmentally clean fill would be imported to the Site, placed over the demarcation layer, and compacted to provide an approximately 8-inch thick layer of clean soil cover. A 4-inch thick layer of imported topsoil would be placed over the clean fill. The entire covered area would then be vegetated via hydro-seeding. For budgetary purposes, it is estimated that 80,000 square feet would be covered, requiring approximately 3,000 cubic yards of clean fill and topsoil (refer to *Figure 4*).

To monitor the effectiveness of MNA, groundwater monitoring would be conducted. The scope of the groundwater monitoring program used for development of remedial cost estimates includes a network of approximately 31 wells. The actual number and location of the wells included in the monitoring program would be determined as part of final remedy selection, subject to future revisions if the areal extent of groundwater impacts is reduced. Existing monitoring wells are shown on *Figures 6 and 7*.

Groundwater monitoring under Alternative 2 would initially be performed on a quarterly basis for the first two years, then reduced to annual sampling for years 3 through 30. For costing purposes, it has been assumed that the groundwater samples would be analyzed for Target Compound List (TCL) VOCs, MNA parameters and geochemical parameters. However, an alternative-specific groundwater monitoring program would be developed as part of the final remedy selection.

ICs would include an environmental easement to ensure the soil cover is maintained and to restrict use of portions of the Site containing residual contamination. Additional ICs would include an environmental easement to prevent use of on-site groundwater. Additionally, ICs would include requirements for SVI evaluation/mitigation with respect to potential future Site uses. New York State has established various templates[6] that could be considered in the development of an environmental easement for the Site.

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[6] http://www.dec.ny.gov/chemical/48236.html

Detailed Evaluation of Criteria

5.2.2.2 Overall Protectiveness of Public Health and the Environment

Alternative 2 provides protectiveness to public health by monitoring the exposure risk to on-site workers by contaminated soil vapor. Alternative 2 also provides protectiveness of public health by minimizing the risks associated with exposure to shallow soil arsenic concentrations greater than applicable SCOs. Short-term risks include exposure to contaminants during soil cover activities. Exposure to contaminants would be minimized by use of personal protective equipment (PPE). Soil cover provides long-term effectiveness by acting as a physical barrier to the source of exposure risk. Groundwater monitoring would not provide protectiveness of public health other than providing evidence of groundwater plume stability. The mobility and toxicity of groundwater contaminants would be reduced through natural attenuation. Both short-term and long-term effectiveness would be limited as achievement of SCGs for groundwater would likely take over 30 years.

The implementation of ICs protects public health by ensuring the implementation of the indoor air monitoring program, maintenance of the soil cover, and incorporating appropriate SVI mitigation in buildings associated with future Site development, as warranted. Additional ICs prohibiting on-site groundwater use would minimize exposure to CVOCs in groundwater.

With respect to sustainability, Alternative 2 would consume a nominal amount of energy in the short term, as a result of soil cover construction. Long-term inspection of the soil cover, and groundwater sampling would consume a minor amount of energy.

5.2.2.3 Compliance with SCGs

Alternative 2 uses indoor air sampling and analysis to monitor human exposure to concentrations of sub-slab vapor greater than chemical-specific SCGs in the Matrices in NYSDOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). Additionally, Alternative 2 includes covering of arsenic-impacted shallow soil addressing applicable chemical-specific SCGs for soil. However, neither the long-term monitoring of concentrations of CVOCs nor the implementation of ICs addresses exceedances of chemical-specific SCGs for groundwater.

No location-specific SCGs were identified as being directly applicable to this alternative. Action-specific SCGs are those applicable to the importation of clean fill in support of covering arsenic-impacted soil. Appropriate measures would be taken for compliance with the action-specific SCGs.

5.2.2.4 Short-Term Impacts and Effectiveness

Monitoring concentrations of CVOCs in indoor air of the existing Site manufacturing building would provide short-term protection to on-site employees. If CVOCs were detected at elevated concentrations in indoor air, additional actions would be recommended to maintain protectiveness of public health.

Covering of soil impacted with arsenic at concentrations greater than SCOs provides short-term elimination of exposure risks. However, during importation of fill and soil cover construction there would be short-term risk to on-site workers. Appropriate use of PPE and implementation of best management practices (BMPs) would mitigate these risks.

The implementation of a groundwater monitoring program is not effective in the short-term at minimizing the exposure risk associated with CVOCs in groundwater, other than providing evidence of groundwater plume stability. Implementation of groundwater monitoring poses minimal short-term risks to on-site workers who may be exposed to contaminated groundwater. These risks would be mitigated by using appropriate PPE and procedures.

The implementation of ICs is effective in the short-term by ensuring implementation of the indoor air monitoring plan, maintenance of the soil cover, and that future development incorporates SVI evaluation and, as warranted, mitigation technologies. Additional ICs prohibiting on-site groundwater use would minimize exposure to CVOCs in groundwater. There is no short-term public health risk associated with implementing ICs.

5.2.2.5 Long-Term Effectiveness and Permanence

The collection and analysis of indoor air samples from the existing Site manufacturing building would provide long-term protection to on-site employees. However, since indoor air monitoring is not designed to address the source of sub-slab vapor contamination, CVOCs in groundwater, it is not considered effective for the protectiveness of overall public health in the long-term.

Covering of surface soil impacted with arsenic at concentrations greater than SCOs provides long-term elimination of exposure risks.

The implementation of a groundwater monitoring program is not effective in the long-term at minimizing the exposure risk associated with COCs in groundwater, other than providing evidence of groundwater plume stability. Implementation of groundwater monitoring poses minimal long-term risks to on-site workers who may be exposed to contaminated groundwater. These risks would be mitigated by using appropriate PPE and procedures.

The implementation of ICs is effective in the long-term by ensuring implementation of the indoor air monitoring program, maintenance of the soil cover, and requiring that future development incorporates SVI evaluation, and, as warranted, mitigation technologies. Additional ICs prohibiting on-site groundwater use would be effective in the long-term at minimizing exposure to CVOCs in groundwater. If natural attenuation reduces concentrations of groundwater CVOCs to meet RAOs, it is possible that ICs could be removed in the long-term.

5.2.2.6 Reduction of Toxicity, Mobility, and Volume through Treatment

The primary elements of Alternative 2 are not intended to treat concentrations of CVOCs in groundwater. Covering of arsenic-impacted soil with clean fill and topsoil provides no reduction of toxicity, mobility, or volume of the contaminated media other than erosion mitigation.

5.2.2.7 Implementability

Alternative 2 requires the design and implementation of an indoor air monitoring program, design and implementation of a soil cover, design and implementation of a groundwater monitoring program, and development of an appropriate IC (e.g., an environmental easement). All of the primary elements of Alternative 2 would utilize well-proven technologies at reasonable cost, and vendors with the qualifications to implement the alternative are readily available. Additionally, all elements of Alternative 2 could be implemented concurrently.

5.2.2.8 Cost

The primary costs of Alternative 2 are those associated with indoor air monitoring, covering arsenic-impacted shallow soil, and long-term groundwater monitoring. The cost of implementation for Alternative 2 is estimated to include $170,000 in direct capital costs and $60,000 in indirect capital costs. The present value of indoor air and groundwater monitoring is estimated at $240,000. The estimated present value of this alternative, including contingency ($90,000), is $560,000. A detailed cost estimate is presented in *Table 8*.

5.2.3 Alternative 3: EISB and ISCR, Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

5.2.3.1 Description

Alternative 3 is identical to Alternative 2, with the addition of EISB and ISCR for treatment of groundwater at the Site. Therefore, this description focuses on the EISB and ISCR components that differentiate this alternative from Alternative 2. Alternative 2 is evaluated in detail in Section 5.2.2. The objective of the EISB/ISCR component of Alternative 3 would be to reduce further off-site migration of COCs in the bedrock aquifer via biological and chemical reduction.

EISB relies on anaerobic bacteria in a reducing environment to effectively dechlorinate CVOCs to less chlorinated compounds, with ultimate conversion to ethene and ethane. ISCR relies on the abiotic reduction of CVOCs. A pre-design investigation would be required to further delineate concentrations of CVOCs in bedrock groundwater. Vertical injection bedrock wells would be constructed in the vicinity of the existing manufacturing building where elevated concentrations of CVOCs have been detected in the groundwater, as shown on *Figure 8*. MNA would apply to impacted groundwater beyond the limits of the targeted treatment zones. Groundwater monitoring wells installed as part of the pre-design investigation would be utilized to monitor the effectiveness of the remedy.

EISB involves the injection of a carbon source, electron donors, pH buffer, and microbes and ISCR involves the injection of a reducing agent (e.g., zero-valent iron particles), to facilitate or optimize the anaerobic degradation and abiotic reduction of CVOCs in groundwater. The SRI Report documented that abiotic reduction and biological reductive dechlorination of CVOCs is occurring at the Site, but at limited rates. Furthermore, the SRI Report documented the absence of *Dehalococcoides spp.*, the specific microbes needed to metabolize chlorinated ethanes and ethenes, in groundwater. Therefore, CVOCs in groundwater in the vicinity of the manufacturing building would require injection of a chemical reducing agent, bioamendments (carbon source and electron donor), and bioaugmentation cultures (microbial population).

Elevated concentrations of various CVOCs are present in the bedrock aquifer in the vicinity of the manufacturing building, but there are limited amounts of other carbon sources available to facilitate the metabolism of the CVOCs. Conditions in this area generally are not sufficiently reducing to degrade the CVOCs. To enhance the biological and abiotic degradation of CVOCs, a chemical reducing reagent mixed with a carbon source would be injected. Following or concurrently with the injection of the chemical reagent and bioamendment, a bioaugmentation culture injection consisting of *Dehalococcoides spp.* would be performed. The stronger reducing conditions would enable the growth of the *Dehalococcoides spp.* needed to degrade the chlorinated ethenes and ethanes. Sampling would be conducted to verify the presence of *Dehalococcoides spp.*, as well as other microbial species, at suitable concentrations. Data generated as a result of the sampling would be used to evaluate the effectiveness of injection, and enhancements to the remedial approach may be considered as conditions warrant. Multiple injections of the chemical reducing reagent, bioamendment, and bioaugmentation cultures may be required to achieve RAOs.

The low permeable formation (bedrock) represents challenges for injection. The bedrock consists of competent siltstone and shale with evidence of few fractures observed. Therefore, EISB and ISCR would likely be a slow process as the injected reagents may require a long residence time to permeate bedrock. Additionally, the focused treatment zone targeted in Alternative 3 does not encompass the entire Site groundwater contaminant plume, representing overall a low probability of achievement of area-wide chemical-specific groundwater SCGs in the short-term.

For the purposes of this assessment, it is assumed that the EISB/ISCR alternative would consist of the installation of approximately 26 vertical injection wells, as shown of *Figure 8*. Mobilization of a mixing tank and associated pumps, piping and instrumentation would be required to implement Alternative 3.

To monitor the effectiveness of the EISB and ISCR, groundwater monitoring would be conducted for specific biological and abiotic reductive dechlorination parameters as well as the targeted VOCs. Groundwater monitoring was previously described in Section 5.2.2.

The required number and frequency of EISB/ISCR injection events is difficult to estimate based on currently available data. In general, reported EISB and ISCR cleanup time frames are typically short (on the order of 24 to 36 months or less) for limited contaminant plumes and for relatively permeable aquifers. However, given the limited extent of the treatment zone, the low permeability formation, and that it is likely CVOCs have permeated deep into bedrock, achievement of groundwater RAOs via EISB and ISCR would likely take considerably longer. For the purposes of this assessment, a series of four injection events over a period of nine years is assumed followed by an extended period for MNA of groundwater. The actual operating period of Alternative 3 would be determined based on progress towards achieving remedial action objectives.

Detailed Evaluation of Criteria

5.2.3.2 Overall Protectiveness of Public Health and the Environment

Alternative 3 provides protectiveness of public health and the environment as described for Alternative 2, with the addition of EISB and ISCR of CVOCs in bedrock groundwater, through the injection of a chemical reagent, bioamendments, and bioaugmentation cultures (as needed). The toxicity of the groundwater contaminants would be reduced through in-situ biological and chemical treatment, with treatment accelerated through the injection of enhancements that would facilitate or optimize the biological and chemical reductive dechlorination processes that are already occurring at the Site. Alternative 3 would result in minor increased short-term risks during installation of the injection wells. While EISB and ISCR would be effective in increasing CVOC destruction rates over the short-term and possibly achievement of SCGs at certain specific locations, the long-term achievement of groundwater SCGs at all locations (on-site and off-site) would ultimately rely in part on MNA of the groundwater. The addition of bioremediation and chemical amendments would optimize conditions for the anaerobic and abiotic degradation of the CVOCs and thereby accelerate the naturally occurring degradation.

Alternative 3 is similar to Alternative 2 with respect to sustainability. Alternative 3, however, would consume more energy in the short term as a result of the installation of injection wells, and the subsurface injection of reagents.

5.2.3.3 Compliance with SCGs

In addition to the elements of Alternative 2, Alternative 3 uses EISB and ISCR to address the presence of bedrock groundwater contaminants above chemical-specific SCGs. The ultimate achievement of groundwater SCGs using this alternative would have to rely in significant part on natural attenuation processes; however, the addition of a chemical reagent, bioamendments, and bioaugmentation cultures would optimize conditions for the biological and chemical reductive dechlorination of CVOCs and thereby accelerate the naturally occurring degradation, primarily in the targeted treatment zone. No location-specific SCGs were identified as being directly applicable to this alternative. Action-specific SCGs are those that are applicable to the installation of injection wells and injection of substances into the groundwater. Appropriate measures would be taken for compliance with action-specific SCGs for injection well installations and injections.

5.2.3.4 Short-Term Impacts and Effectiveness

In addition to the impacts and effectiveness of Alternative 2, the pre-design investigation and installation of injection wells could present minor increased short-term risks to workers. These risks would be minimized through the use of proper PPE and procedures. No adverse impacts to the surrounding community would result from implementation. Remedial action objectives may be achieved at certain limited locations, but not at all locations, in the short-term, and the length of the MNA period required to achieve groundwater SCGs may be slightly reduced.

5.2.3.5 Long-Term Effectiveness and Permanence

In addition to long-term effectiveness and permanence considerations related to Alternative 2, in the locations targeted for treatment, Alternative 3 would reduce the potential long-term risks associated with the presence of CVOCs in the bedrock aquifer through EISB and ISCR of groundwater. The treatment method provides a permanent reduction of the toxicity of the CVOCs in the groundwater. Long-term monitoring of groundwater conditions produced by the EISB and ISCR operations would be required. Current bioremediation and chemical reduction rates would be accelerated by injecting a chemical reducing agent, sources of carbon and electron donors, pH buffers, and microbes, as needed, to create the proper conditions to degrade CVOCs. Specifically, the injections would maintain proper reducing conditions to treat the CVOCs present in certain areas at certain times. However, EISB and ISCR would not permanently change the geochemical conditions of the bedrock aquifer. Five-year reviews of the action would be required until RAOs are achieved.

5.2.3.6 Reduction of Toxicity, Mobility, and Volume through Treatment

Again, in locations targeted for treatment, Alternative 3 provides reductions in the toxicity of the groundwater contaminants through EISB and ISCR of CVOCs to less toxic compounds, in addition to the effects of Alternative 2. The injection of a chemical reagent, electron donors, carbon sources, pH buffers and microbes, as needed, to optimize the biological and abiotic reductive dechlorination rates, would result in a potentially greater reduction of CVOCs and minimization of pockets of elevated CVOCs in groundwater.

5.2.3.7 Implementability

Alternative 3 requires the installation of injection wells. The alternative utilizes well-proven technologies, and vendors with the qualifications to implement the alternative are readily available. The installation technologies are well-defined, and Site topography should generally contribute to an uncomplicated layout and design of injection wells. However, injection into competent bedrock represents challenges for effective distribution of the chemical reagent, bioamendments, and bioaugmentation cultures.

Implementability of the primary elements of Alternative 2 is discussed in Section 5.2.2.7.

5.2.3.8 Cost

In addition to the costs associated with Alternative 2, the principal costs of Alternative 3 are associated with the installation of injection wells and injection of the chemical reagent, bioamendments, and bioaugmentation cultures. The cost of implementation for Alternative 3 is estimated to include $650,000 in direct capital costs and $230,000 in indirect capital costs. The estimated present value of additional injections, indoor air monitoring, and groundwater monitoring is $530,000. The present value of this alternative, including contingency ($280,000), is estimated at $1.7 million. A detailed cost estimate is presented in *Table 9*.

5.2.4 Alternative 4: Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs

5.2.4.1 Description

The soil vapor intrusion monitoring/mitigation and groundwater remediation components of Alternative 4 are identical to Alternative 3, with the expansion of the treatment area to beneath the western portion of the building, as shown on *Figure 9*, to encompass additional CVOC-impacted groundwater in bedrock. Alternative 4 would include installation and injection into 42 vertical bedrock injection wells. It should be noted that implementation of Alternative 4 would require either the demolition of a portion of the manufacturing building or use of specialty drilling techniques for installation of injection wells inside the building. The soil vapor intrusion monitoring/mitigation and groundwater remediation components of Alternative 3 are described in detail in Section 5.2.3.1.

Also included in Alternative 4 is the excavation and off-site disposal of shallow arsenic-impacted soil in the southern and eastern portions of the Site. The soil remediation elements of Alternative 4 would target concentrations exceeding the Industrial Use SCO in surface soil (i.e., the upper 0.5 feet of soil). A pre-design investigation would be performed to determine the vertical and horizontal extents of arsenic impacts. Soil would be excavated using traditional soil excavation techniques, loaded into trucks, and transported to a licensed facility for disposal. The collection and laboratory analysis of post-excavation soil samples would be performed to confirm the adequacy of excavation efforts. After receipt of post-excavation sampling results confirming arsenic concentrations are below the Industrial Use SCO, the excavation would be backfilled with certified environmentally-clean soil and vegetation re-established. For budgetary purposes, it is estimated that 1,500 cubic yards of soil would be excavated and transported off-site for disposal (refer to *Figure 4*).

Detailed Evaluation of Criteria

5.2.4.2 Overall Protectiveness of Public Health and the Environment

Alternative 4 provides protectiveness of public health and the environment with respect to soil vapor and groundwater as described for Alternatives 2 and 3, with increased protectiveness as a result of expanding the groundwater treatment zone. Alternative 4 provides greater protectiveness of public health with respect to soil contamination by removing the source of the risks associated with exposure to surface soil arsenic concentrations greater than the Industrial Use SCOs. Short-term risks in addition to those described in Alternative 3 include those associated with soil removal activities and installation of injection wells inside the existing manufacturing building. The toxicity of the groundwater contaminants would be reduced via the same mechanisms as Alternative 3 (described in Section 5.2.3.2). Long-term effectiveness and degradation of CVOCs under Alternative 4 would be nominally greater than Alternative 3, considering the increased size of the treatment area.

Alternative 4 is similar to Alternative 3 with respect to sustainability. However, Alternative 4 would result in greater consumption of energy and resources and increased waste disposal as a result of excavation, transportation, and disposal of arsenic-impacted soil and the greater number of injection wells. Additionally, landfill capacity would be consumed under Alternative 4.

5.2.4.3 Compliance with SCGs

With the exceptions of the increase in the size of the treatment zone and corresponding potential increase in size of the area of higher probability of achieving SCGs in the short-term in bedrock groundwater, Alternative 4 is identical with respect to compliance with soil vapor and groundwater SCGs as Alternative 3, described in Section 5.2.3.3. Additionally, Alternative 4 includes the excavation and disposal of arsenic-impacted surface soil addressing applicable chemical-specific SCGs for soil. Action-specific SCGs in addition to those applicable to Alternative 3 are those applicable to the excavation, transportation and disposal of arsenic-impacted soil. Appropriate measures would be taken for compliance with action-specific SCGs during soil removal, transport and disposal.

5.2.4.4 Short-Term Impacts and Effectiveness

In addition to the short-term effectiveness and risks associated with soil vapor intrusion monitoring/mitigation and groundwater remediation described for Alternative 3, Alternative 4 would be nominally more effective at achieving RAOs in the short-term as a result of the increased treatment zone, but represents increased short-term impacts associated with either the demolition of the western portion of the manufacturing building or the installation of injection wells inside the building.

Additionally, excavation and disposal of surface soil impacted with arsenic at concentrations greater than the Industrial Use SCO provides short-term elimination of exposure risks. However, during excavation and transportation activities there would be short-term risk to both on-site workers and the surrounding community. Appropriate use of PPE, implementation of a Community Air Monitoring Program (CAMP) and BMPs, and restricting access to the excavation area would mitigate these risks.

5.2.4.5 Long-Term Effectiveness and Permanence

In addition to other long-term effectiveness and permanence considerations described with respect to soil vapor intrusion monitoring/mitigation and groundwater remediation in Alternatives 2 and 3, Alternative 4 would reduce the potential long-term risks associated with the presence of CVOCs in bedrock groundwater in the same manner as Alternative 3, described in Section 5.2.3.6, but over a larger footprint. Additionally, excavation and disposal of surface soil impacted with arsenic at concentrations greater than the Industrial Use SCO provides long-term elimination of exposure risks. Five-year reviews of the action would be required until RAOs are achieved.

5.2.4.6 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 4 provides reductions in toxicity, mobility and volume of contaminants in soil vapor and groundwater through the same mechanisms as Alternative 3, described in Section 5.2.3.7, although encompassing a greater volume of groundwater via EISB/ISCR. Additionally, excavation and disposal of arsenic-impacted soil reduces the on-site volume and mobility of arsenic by transferring the contaminated media to a location with a lower exposure risk.

5.2.4.7 Implementability

The implementability of the soil vapor intrusion monitoring/mitigation and groundwater remediation components of Alternative 4 is similar to that of Alternative 3, described in Section 5.2.3.8, with the added challenge of installing bedrock injection wells within the footprint of the building, which may require either demolition of the western portion of the building or use of specialized drilling techniques. Additionally, Alternative 4 requires the design and implementation of a shallow soil excavation and disposal program, which would utilize well-proven technologies that can be easily implemented. Finally, all elements of Alternative 4 could be implemented concurrently.

5.2.4.8 Cost

The additional costs associated with Alternative 4, above the costs of Alternative 3, are associated with the increased area of the treatment zone, shown on *Figure 9*, and the excavation and disposal instead of covering arsenic-impacted soil. The cost of implementation for Alternative 4 is estimated to include $990,000 in direct capital costs and $350,000 in indirect capital costs. The estimated present value of additional chemical injections, indoor air monitoring, and groundwater monitoring is $780,000. The present value of this alternative, including contingency ($420,000), is estimated at $2.5 million. A detailed cost estimate is presented in *Table 10*.

5.2.5 Alternative 5: ISTR, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring

5.2.5.1 Description

The indoor air monitoring and soil components of Alternative 5[7] are similar to these components of Alternative 4, with the addition of removal of all soil with contaminant concentrations above Unrestricted Use SCOs and ISTR of the soil and groundwater. Therefore, this description focuses on the ISTR component that differentiates this alternative from Alternative 4. Alternative 4 is described in detail in Section 5.2.4.1. Alternative 5 would include a pre-design investigation to further delineate CVOCs in overburden and bedrock groundwater. MNA would apply to groundwater with low level impacts beyond the limits of the targeted treatment zones.

Pending final design, it is estimated that the in-situ ERH system would include approximately 43 electrodes installed 17 feet apart on average. There would also be approximately 43 co-located vapor extraction wells, based on currently known hydrogeologic conditions, contaminant concentrations in groundwater, existing physical site features, topography, existing utilities, and other remedial features (e.g., groundwater monitoring wells). Conceptual electrode locations are shown on *Figure 10*. The approach described and shown is intended to be preliminary and conceptual only.

Installation of a power control unit, electrodes, vapor extraction wells, and vapor control system (e.g., activated carbon) as well as subsurface temperature and pressure monitoring points would be required to implement Alternative 5.

It is expected that the ISTR system would provide a 98% average reduction of the CVOC concentrations in the areas being treated and approximately 120 days of heating of the soil and groundwater would be required. The actual operating period would be determined based on progress towards achieving RAOs.

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[7] It is anticipated that the indoor air monitoring period would be limited to five years and soil excavation would be to depths of up to 2.5 feet. Since no ICs are included in Alternative 5, no geotextile demarcation layer or soil vapor intrusion monitoring past five years is included.

To monitor the effectiveness of the ISTR, groundwater monitoring would be conducted for targeted VOCs. Groundwater monitoring was previously described in Section 5.2.2.

Detailed Evaluation of Criteria

5.2.5.2 Overall Protectiveness of Public Health and the Environment

Alternative 5 provides protectiveness of public health and the environment as described for the soil components of Alternative 4, with additional protectiveness by removing all soil with contaminant concentrations above Unrestricted Use SCOs and by treating both the soil and groundwater by removing CVOCs to levels protective of public health via ISTR. Alternative 5 would result in short-term remedial effectiveness from contaminated soil removal and the operation of the ISTR system. Over the long-term, ISTR would also provide greater permanency and increased treatment of CVOCs on-site.

The soil components of Alternative 5 are similar to Alternative 4 with respect to sustainability, but more greenhouse gases would be generated and more landfill capacity would be consumed. However, additional significant energy associated with the thermal remediation system would be used. Additionally, spent vapor treatment carbon (or similar) would be landfilled, consuming available landfill capacity. However, the operational period of the remedial actions would be short. Therefore, long-term energy use would be negligible.

5.2.5.3 Compliance with SCGs

In addition to the soil components of Alternative 2, Alternative 5 uses ISTR to address the presence of groundwater contaminants above chemical-specific SCGs. The ultimate achievement of groundwater SCGs using this alternative would rely on contaminant transport from groundwater to soil vapor, and then to GAC[8]. In addition, MNA would be relied upon for remediation of groundwater contamination beyond the treatment zone. No location-specific ARARs were identified as being directly applicable to this alternative. Action-specific SCGs are those that are applicable to air emissions and treatment of waste generated (e.g., condensate, spent GAC, etc.), and the installation of electrodes and vapor extraction wells. Appropriate measures would be taken for compliance with action-specific SCGs associated with these actions.

5.2.5.4 Short-Term Impacts and Effectiveness

The installation of electrodes and vapor extraction wells could present increased short-term risks to workers. These risks would be minimized through the use of proper PPE and procedures. Short-term risks to the surrounding community associated with air emissions during ISTR system operation would be mitigated via

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[8] Note, alternative vapor treatment technologies, such as thermal oxidation, may also be used.

vapor treatment. Additionally, risks associated with high voltage electrical equipment and application of ERH to the subsurface would be mitigated via proper site security, fencing and warning signs. Remedial action objectives would be achieved quickly within the treated area, but not at all locations over the short-term. Nevertheless, the length of the MNA period required to achieve groundwater SCGs would be significantly reduced.

5.2.5.5 Long-Term Effectiveness and Permanence

Alternative 5 would provide an additional element of long-term control of impacted groundwater and soil vapor by both removing and treating contaminant mass by ISTR. After the estimated 120-day operating period is completed, contaminants in the treated soil and groundwater zones would be expected to be largely eliminated. As a result, Alternative 5 is predicted to be the most effective among the alternatives long-term in meeting the groundwater SCGs, and the time required to achieve the groundwater cleanup standards in the treated area would be significantly shortened in comparison to the other alternatives. Long-term operation and maintenance would consist of groundwater monitoring to confirm effectiveness. Five-year reviews of this alternative would be required until RAOs are achieved.

5.2.5.6 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 5 provides additional removal of contaminated soil via excavation and off-site disposal and additional treatment of CVOC-contaminated media via ISTR, which would permanently reduce the volume/mass of contaminants in soil and groundwater. The subsequent treatment of the contaminants in the extracted soil vapor would, in parallel, irreversibly reduce the toxicity of groundwater in the treated area.

Reduction of toxicity, mobility, and volume of contaminants in soil by the primary elements of Alternatives 4 is discussed in Sections 5.2.4.6.

5.2.5.7 Implementability

Although it has been successfully implemented in buildings, implementation of Alternative 5 would be complicated by the installation of electrodes within the footprint of the on-site manufacturing building. ISTR technology is readily available from vendors and the technology has been successfully implemented at other similar sites. However, there is a limited number of vendors capable of implementing ISTR and due to high demand, procurement of a qualified ISTR vendor can be challenging.

Confirmation of adequate clearance from existing utilities and other site features which could be impacted by ISTR would be necessary, and arrangements with the electrical utility company will be required for a power drop. Requirements for construction and operation of an ISTR system also apply to the air discharge from the soil vapor extraction system. In addition, electrical code requirements apply. Disposal of waste materials generated during system construction and operation would be required as well.

Implementability of the primary soil components of Alternative 4 is discussed in Sections 5.2.4.7.

5.2.5.8 Cost

The principal costs associated with this alternative beyond those already described for Alternative 4 are associated with the greater amount of soil to be excavated and the installation and operation of the ISTR system. The cost of implementation for Alternative 5 is estimated to include \$8.2 million in direct capital costs and \$2.9 million in indirect capital costs. The present value of this alternative, including contingency (\$2.2 million), is estimated at \$13.4 million. A detailed cost estimate is presented in *Table 11*.

6.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

6.1 Introduction

The comparative analysis presented in this section evaluates the relative performance of each alternative using the same criteria by which the detailed analysis of each alternative was conducted. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another to aid in selecting an overall remedy for the Monroe Electronics site.

The comparative analysis includes a narrative discussion of the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance, as applicable. The comparative analysis presented in this document uses a qualitative approach to comparison, with the exceptions of comparing estimated alternative costs and the required time to implement each alternative.

6.2 Comparison of Alternatives

Overall Protectiveness of Public Health and the Environment – Alternative 1 is the least protective of public health and the environment, and does not include ICs to prevent potential existing exposure pathways as well as potential exposure as a result of future Site development. Alternative 2 provides greater protectiveness of public health and the environment with respect to soil, soil vapor, and groundwater exposure, but does not include active groundwater remediation. Alternatives 3, which includes active groundwater remediation, provides greater protectiveness of public health and the environment than Alternative 2. Alternative 4 provides greater protectiveness due to the increased area targeted for groundwater treatment and the removal of arsenic-impacted soil from the Site. However, given the limitations of Alternatives 3 and 4 with respect to achieving RAOs, their overall protectiveness of the public health and the environment is only nominally greater than Alternative 2. Alternative 5 provides the highest level of protectiveness of the public health and the environment since it includes all the elements of Alternative 2 and represents the most rigorous approach to soil and groundwater remediation and restores the site to unrestricted use.

Compliance with SCGs – Alternative 1 would not be expected to result in compliance with SCGs, except with respect to groundwater possibly after an extended timeframe via natural attenuation. Alternative 2 will generally result in compliance with SCGs with respect to vapor intrusion and surface soil, but similar to Alternative 1 would rely on natural attenuation with respect to compliance with groundwater SCGs. Alternatives 3 and 4 may result in compliance with groundwater SCGs in a shorter period of time, within the targeted treatment zones. Alternatives 4 and 5 result in greater compliance with soil SCGs due to the removal of arsenic-impacted surface soil from the Site. Alternative 5 is most likely to result in compliance with groundwater SCGs in the quickest timeframe.

Short-term Impacts and Effectiveness – Alternative 1 is not effective in the short-term and would have no impacts. Soil excavation and vapor intrusion mitigation components of Alternative 2 would be effective in the short-term and would have limited short-term impacts. Alternative 2 would not be effective in the short term with respect to groundwater contamination (although ICs would minimize potential for exposure). Alternative 3 would be equal to Alternative 2 with respect to vapor intrusion and soil contamination. Alternative 4 would be somewhat more effective in the short-term with respect to groundwater contamination and surface soil than Alternative 3, but would cause greater impacts (soil excavation, CAMP, and interference with manufacturing operations to install wells indoors or demolish the building). Alternative 5 would be the most effective in the short-term but would result in the greatest short-term impacts. Short-term impacts include air emissions and interference with manufacturing operations associated with the ISTR system and increased soil excavation.

Long-term Effectiveness and Permanence – Alternative 1 is not effective and would have no permanent impact on contaminants in soil, soil vapor, and groundwater, except potentially after a significant timeframe via natural attenuation of groundwater. The soil excavation and vapor intrusion mitigation components of Alternative 2 along with ICs would permanently address exposure to contaminants in soil and soil vapor. However, Alternative 2 would not be any more effective than Alternative 1 in the long-term with respect to groundwater contamination. Alternatives 3 would be equally effective in the long-term with respect to permanently addressing vapor intrusion and soil contamination as Alternative 2. Alternative 4 would be somewhat more effective than Alternative 3 in the long-term with respect to soil and groundwater contamination. Alternative 5 would be the most effective in the long-term and would permanently address COCs in soil, soil vapor, and groundwater, to the greatest extent.

Reduction of Toxicity, Mobility, and Volume by Treatment – Alternative 1 provides no reduction of toxicity, mobility, or volume of contaminants other than through naturally occurring attenuation processes. The vapor intrusion mitigation component of Alternatives 2, 3, 4, and 5 reduces the potential for exposure to contaminants. The soil cover component of Alternatives 2 and 3 provides reduction in the potential mobility of contaminants in soil by erosion, but provides no reduction in toxicity or volume. The excavation and disposal component of Alternatives 4 and 5 reduces the potential mobility of contaminants in soil by transfer to a controlled disposal site. Alternative 2 provides no reduction of toxicity, mobility, or volume of groundwater contaminants other than through naturally occurring attenuation processes. In addition to the reductions achieved by the elements of Alternative 2, Alternatives 3 and 4 would reduce the toxicity, mobility, and volume of contaminants in groundwater via degradation to less toxic substances. Alternative 5 would reduce the mobility and volume of contaminants in groundwater at the Site via extraction and treatment, and transport off-site for disposal.

Implementability – Alternative 1 is the most easily implemented since it requires no action. Alternatives 2 and 3 are equally implementable as both would not require any specialized procedures and both would not significantly impact areas with active operations. The implementation of either Alternative 4 or 5 would be challenging considering the requirements for installation of active remediation system components within the manufacturing building footprint. Additionally, although ISTR technology (Alternative 5) is readily available from vendors and the technology has been successfully implemented at other similar sites, there is a limited number of vendors capable of implementing ISTR and due to high demand, procurement of a qualified ISTR vendor can be challenging.

Cost-Effectiveness. Alternatives 1, 2, 3, 4, and 5 are progressively more expensive. The estimated total present value cost of Alternative 5 is over five times greater than the estimated total present value cost of Alternative 4. A summary comparison of the remedial alternative costs is presented in *Table 12*.

Land Use. The Site is zoned as Light Industrial. The current and reasonably anticipated future land use of the Site is manufacturing. Alternative 5 considers “unrestricted use”. Alternatives 1, 2, 3, and 4, include an environmental easement restricting the land use and are equal with respect to land use.

Green Remediation (DER-31) – Alternative 5 rates lowest with respect to green remediation due to the amount of power required for ISTR, as well as resources required for construction of an ISTR system, and the amount of soil cuttings and spent media (e.g., GAC) requiring disposal which would result from treatment of extracted vapors and groundwater.

Alternative 3 rates slightly higher than Alternative 4 for green remediation considering there are fewer injection well locations and does not require off-site transportation and disposal of soil, requiring the consumption of less fuel and resources. Additionally, Alternative 4 may require the demolition of the western portion of the existing manufacturing building to access the injection well locations, requiring the use of heavy equipment and demolition waste disposal. Alternative 2 rates higher than Alternatives 3, 4 and 5 with respect to green remediation since it would require the least use of heavy equipment, consumption of resources and waste disposal (primarily only purge water). Alternative 1 rates highest with respect to green remediation since it does not require any consumption of resources or impacts to the environment.

6.3 Ranking of Alternatives

A points-based ranking system was developed as a means to provide a comparative analysis with respect to the evaluation criteria. A relative ranking score that is intended to be representative of the relative strengths and weaknesses of each alternative, was assigned for each of the evaluation criteria: 1 being lowest and 3 being highest.

To address the cost component of this alternatives ranking effort (refer to *Table 12* for a summary comparison of estimated remedial alternative costs), points were assigned as follow:

- Lowest Cost – 3 points
- Moderate Cost – 2 points
- Highest Cost – 1 point

Based upon this points ranking system, the treatment alternative that provides the best relative overall balance in achieving the evaluation criteria, at a reasonable relative cost will necessarily score the highest. A summary of the results of the ranking of alternatives is presented in the table below.

Comparative Analysis Ranking of Alternatives

EVALUATION CRITERIA	**ALT 1 No Action**	**ALT 2 Soil Cover, Groundwater MNA, Indoor Air Monitoring and ICs**	**ALT 3 EISB and ISCR, Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs**	**ALT 4 Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs**	**ALT 5 ISTR, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring**
Overall Protectiveness of the Public Health and the Environment	**1**	**2**	**2**	**2**	**3**
Compliance with SCGs	**1**	**1**	**2**	**2**	**3**
Short-term Impacts and Effectiveness	**1**	**2**	**2**	**2**	**2**
Long-term Effectiveness and Permanence	**1**	**1**	**2**	**2**	**3**
Reduction of Toxicity, Mobility, Volume	**1**	**1**	**2**	**2**	**3**
Implementability	**3**	**3**	**3**	**2**	**1**
Relative Cost	**3**	**3**	**2**	**2**	**1**
Community/State Acceptance	**1**	**2**	**2**	**2**	**1**
Land Use	**1**	**3**	**3**	**3**	**3**
Green Remediation	**3**	**3**	**3**	**2**	**1**
Total	**16**	**21**	**23**	**21**	**21**

6.4 Recommended Remedial Alternative

Results of the SRI, presented in the March 2015 SRI Report, indicate that remediation of surface soil and groundwater are required. Monitoring for soil vapor intrusion into the on-site manufacturing building, an environmental easement requiring evaluation and, if warranted, mitigation of soil vapor intrusion for any new construction, and a vapor intrusion monitoring program for any new construction and the on-site residence are also required. In addition, an environmental easement will limit the use of the Site to industrial uses only. Alternatives 2 through 5 address soil vapor intrusion concerns utilizing the same controls, and differ with respect to soil and groundwater remediation methods.

Alternatives 2 and 3 include remediation of arsenic-impacted surface soil via cover construction, while Alternatives 4 and 5 include excavation and off-site disposal of contaminated soil. Alternative 5 includes removal of soil with contaminant concentrations above Unrestricted Use SCOs. Alternatives 2 through 5 include in-situ reduction of CVOCs in groundwater with progressively more aggressive technologies. While Alternative 5 would likely achieve chemical-specific SCGs for groundwater in a significantly shorter time period than all other alternatives, there is currently only a limited number of qualified vendors capable of successfully implementing ISTR, and due to high demand, procurement of ISTR is challenging. Therefore, Alternative 5 is not considered a viable alternative. Since Alternative 2 relies solely on natural attenuation processes for achievement of groundwater SCGs, and such processes are documented to be occurring at only limited rates, Alternative 2 is not considered optimal. Since the estimated cost for Alternative 3 is less than Alternative 4, and Alternative 4 provides for only a marginally larger treatment area with the significant challenge of injection into the bedrock aquifer beneath the footprint of the manufacturing building, Alternative 3 is the recommended remedial action for the Site.

7.0 REFERENCES

1. 6 NYCRR 375, Environmental Remedial Programs.
2. 6 NYCRR 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations.
3. Code of Federal Regulations, Title 40 Part 300.430 – National Oil and Hazardous Substances Pollution Contingency Plan, Remedial Investigation/Feasibility Study and Selection of Remedy.
4. DuPont 2001. Supplemental Remedial Investigation Report, Lyndonville West Avenue Site, September 6, 2001.
5. DuPont 2005. Post-Remediation Engineering Report – Lyndonville West Avenue Site, October 2005.
6. HRP 2014. Remedial Investigation Report, Monroe Electronics, March 2014.
7. NYSDOH 2006. Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.
8. NYSDEC 2010. Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation, May 2010.
9. NYSDEC 2010. Final Commissioner Policy CP-51/Soil Cleanup Guidance, October 21, 2010.
10. NYSDEC 2001. Site Investigation Report, July 2001
11. NYSDEC 2014. DER Bureau of Program Management Work Assignment (WA) Notice to Proceed, April 24, 2014.
12. New York State Education Department 1991. Surficial Geologic Map of New York, Niagara Sheet, New York State Museum, 1991.
13. TRC 2014. Standby Engineering Contract Work Assignment (WA) No. D007620-19, Scope of Work, July 16, 2014.
14. TRC 2015. Supplemental Remedial Investigation Report, May 2015.

Tables

Table 1
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Soil Contaminants of Concern and Chemical-Specific SCGs

Constituents of Concern for Soil	NYSDEC Part 375 Protection of Public Health Residential / Industrial Soil Cleanup Objective[1] (ppm)
Metals	
Arsenic	16

Notes

ppm - parts per million (or milligrams per kilogram)

1 - NYSDEC Part 375 Subpart 375-6.8

Table 2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Groundwater Contaminants of Concern and Chemical-Specific SCGs

Constituents of Concern for Groundwater	Class GA Value[1] (ppb)
Volatile Organic Compounds	
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	1
1,1-Dichloroethane	5
1,2-Dichloroethane	0.6
1,1-Dichloroethene	5
Chloroethane	5
Chloroform	7
cis-1,2-Dichloroethene	5
trans-1,2-Dichloroethene	5
Methylene chloride	5
Trichloroethane	5
Vinyl chloride	2

Notes

ppb - parts per billion (or micrograms per liter)

1 - NYSDEC Class GA Groundwater Standards and Guidance Values

Table 3
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Summary of Soil Remedial Technology Screening

☐	Retained
🟩	Screened Out on Basis of Technical Implementability
🟨	Limited Applicability

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	COMMENTS
No Action	None	Not Applicable	No action.	Fulfills requirement for consideration of no action alternative.
Institutional Control	Soil Vapor Intrusion Mitigation and Soil Cap Maintenance Requirements	Environmental	Legal restrictions requiring monitoring and future Site buildings to include vapor intrusion mitigation systems, and inspection and maintenance of soil cap.	Prevents exposure to chlorinated volatile organic compounds (CVOCs) in soil vapor. Ensures soil cap is maintained to eliminate exposure to impacted soil.
Containment	Capping	🟨 Clean Fill Cover Impermeable Cap	A clean fill layer, in conjunction with a demarcation layer, can prevent exposure to surficial contaminants. An impermeable cap would provide additional protection of groundwater from contaminant leaching.	Feasible alternative for remediating impacted soil.
Ex-Situ Management	🟩 Consolidation and Capping	🟩 On-Site Landfilling	Consolidating contaminated soils in a permitted on-Site landfill and covering excavated areas with clean fill and/or an impermeable cap.	Due to significant siting and permitting requirements, the creation of an on-Site landfill and potential active hazardous waste disposal site is not considered feasible.
	Excavation and Disposal	Off-Site Landfilling	Excavation of contaminated soils and transportation and disposal at a permitted off-Site landfill. Excavated areas backfilled with clean fill and vegetation re-established.	Feasible alternative for remediating impacted soil.

Table 4
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Summary of Groundwater Remedial Technology Screening

☐ Retained
🟩 Screened Out on Basis of Technical Implementability
🟨 Limited Applicability

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	COMMENTS
No Action	None	Not Applicable	No action.	Fulfills requirement for consideration of no action alternative.
Institutional Control	Groundwater Use Restrictions	Environmental Easement	Legal restrictions on groundwater use in the contaminated area.	Prevents exposure to groundwater contaminants.
Containment	🟩 Capping	🟩 Impermeable Cap	An impermeable cap can minimize infiltration of precipitation through contaminated soil and associated leaching of contaminants to groundwater.	Screened out since the only known potential areas of subsurface soil contamination acting as a source of groundwater contamination are already covered by the manufacturing building.
	🟩 Vertical Barriers	🟩 Slurry Wall	Impermeable barrier formed by back-filling a trench with a low permeability material.	Vertical barriers (both slurry walls and sheet piling) are not a feasible alternative for controlling migration in bedrock. Additionally, vertical barriers would have to be installed off-Site in order to encompass the extent of the groundwater plume.
		🟩 Sheet Piling	Sheet piling is driven into the ground to form a barrier to groundwater migration.	
Extraction/ Treatment/Discharge	🟩 Extraction and On-Site Treatment	🟩 Pump & Treat System	Groundwater is extracted and treated using air stripping, granular activated carbon, chemical precipitation, and/or other unit operations. Treated groundwater is discharged to the sanitary sewer or surface water.	Technical practicability limited by operating constraints including mass transfer limitations that control the transfer of contaminants from subsurface soil/bedrock to groundwater and the generally low permeability of the impacted geology.
In-Situ Treatment	Biological Treatment	Enhanced Reductive Bioremediation	Addition of nutrients, microbes or other substances to the subsurface to enhance existing bioremediation processes.	Site data confirms that biological reductive dechlorination is occurring in the groundwater; areas where degradation conditions are not optimal could be improved through the use of reductive bioremediation enhancements.
		🟩 Phytoremediation	The use of plants to remove, detoxify or immobilize environmental contaminants through the natural biological, chemical or physical activities and processes of the plants.	Limited applicability for the treatment of groundwater due to the depth of impacted groundwater. Would not be effective for bedrock aquifer.
		Natural Attenuation	Involves relying on natural volatilization, biodegradation, leaching, and adsorption to reduce contaminant concentrations over the long term.	Could be used as a polishing process after significant contaminant reductions are achieved using other remedial technologies.
		🟩 Biosparging	Injection of gas (e.g., compressed oxygen) in order to stimulate the aerobic bioremediation of VOCs; nutrients may be added to augment biodegradation.	Aerobic bioremediation is not considered effective for Site contaminants.

Table 4
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Summary of Groundwater Remedial Technology Screening

⬜ Retained
🟩 Screened Out on Basis of Technical Implementability
🟨 Limited Applicability

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	COMMENTS
In-Situ Treatment (cont.)	Physical/Chemical Treatment	🟩 Dual-Phase Extraction	Use of a high vacuum system in the subsurface to simultaneously remove various combinations of contaminated groundwater, separate-phase petroleum product, and hydrocarbon vapor from the subsurface.	Technical practicability limited by operating constraints including mass transfer limitations that constrain the transfer of contaminants from subsurface soil/bedrock to groundwater and the generally low permeability of the impacted geology.
		🟨 Air Sparging	Removes volatile groundwater contaminants through the addition of air injected into groundwater; nutrients may be added to augment biodegradation.	Effective in treating contaminants with high vapor pressures or compounds that are readily biodegraded. The generally low permeability of the impacted geology (clay and bedrock) limit the effectiveness of air sparging.
		🟨 Chemical Oxidation	Introduction of an oxidizing agent into the subsurface to chemically oxidize contaminants, breaking contaminants down into non-toxic substances.	Chemical oxidizing agents would counter the naturally occurring abiotic and biological degradation processes occurring at the Site. The generally low permeability of the impacted geology (clay and bedrock) would require close spacing of injection
		⬜ Thermal Remediation	VOC removal enhanced by the addition of heat. Can include direct heating of the subsurface or the injection of steam.	Heating of bedrock and subsurface soils to temperatures of 100°C could volatilize VOCs from bedrock and saturated soil. VOC-impacted soil vapor would be collected and treated on-Site.
		⬜ Chemical Reduction	Introduction of a reducing agent into the subsurface to chemically reduce contaminants, breaking contaminants down into non-toxic substances.	A chemical reducing agent such as zero-valent iron would increase chemical reduction rates of CVOCs in groundwater. The generally low permeability of the impacted geology (clay and bedrock) would require close spacing of injection points and wells.
		🟩 In-Well Air Stripping	Air is injected into a double-screened well, lifting the water in the well and forcing it out an upper screen. Simultaneously, additional water is drawn in the lower screen. Once in the well, VOCs in the contaminated groundwater are transferred from the dissolved phase to the vapor phase by air bubbles. The contaminated air rises in the well to the water surface where vapors are drawn off and treated by a vapor extraction system.	The generally low permeability of the impacted geology (clay and bedrock) would result in zones where treatment would not occur.
	Enhancements	🟨 Directional Wells	Use of wells drilled at a direction other than vertical to better intersect target subsurface formations or to access areas where vertical wells are not feasible.	Horizontal drilling is not typically viable for drilling in bedrock. However, angled drilling could be utilized to install borings under the manufacturing building.
		🟨 Hydraulic-fracturing	Injection of pressurized water into wells in order to crack low permeability and over-consolidated subsurface sediments and bedrock fractures; resulting cracks are then filled with porous media that serve as substrates for remediation.	Hydraulic fracturing could be effective for increasing contact of injected reagents with contaminants adsorbed to low permeability soils and bedrock. However, it is difficult to achieve homogeneous fracturing.

Table 5
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Soil Process Option Screening

☐ Selected process option
🟩 Screened out process option

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
No Action	None	Not Applicable	Not effective in preventing exposure to surficial contamination.	No implementation required.	No significant cost.
Institutional Control	Soil Vapor Intrusion Mitigation and Soil Cover Maintenance Requirements	Environmental Easement	Prevents exposure to CVOCs in soil vapor. Ensures soil cap is maintained.	Easily implemented.	Low capital; low OM&M.
Containment	Capping	Soil Cover	Prevents exposure to soil contamination. Not effective at preventing contaminant leaching.	Easily implementable.	Low capital; low OM&M.
		🟩 Impermeable Capping	Prevents exposure to soil contamination and leaching of contaminants.	Easily implemented, but would require significant alteration of the Site drainage features.	Low capital; low OM&M.
Ex-Situ Management	Excavation and Disposal	Off-Site Landfilling	Effective in removing the contaminants of concern from the Site.	Readily implementable.	High capital; low OM&M.

Table 6
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Groundwater Process Option Screening

☐ Selected process option
🟩 Screened out process option

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
No Action	None	Not Applicable	Not effective in controlling contaminant migration.	No implementation required.	No cost.
Institutional Control	Groundwater Use Restriction	Environmental Easement	Prevents exposure to CVOCs in groundwater. Not effective in controlling contaminant migration.	Easily implemented.	Low capital; no OM&M.
In-Situ Treatment	Biological Treatment	Enhanced Reductive Bioremediation	Reductive dechlorination is already occurring naturally; use of enhancements could be effective in areas where existing conditions are not conducive to microbial degradation.	Readily implementable, generally low permeability geology would require dense spacing of injection points.	Moderate capital; high OM&M.
		Natural Attenuation	Existing data indicates natural attenuation is already occurring; could be effective in addressing low-level residual contaminant levels; would not be effective in treating high contaminant levels.	Easily implemented.	No capital; low OM&M.

Table 6
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Groundwater Process Option Screening

☐ Selected process option
🟩 Screened out process option

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
~	Physical/ Chemical Treatment	🟩 Air Sparging	Effective in stripping the contaminants of concern from groundwater. Low permeability geology limits effectiveness.	Readily implementable, generally low permeability geology would require dense spacing of air injection points and soil vapor extraction wells.	High capital; moderate OM&M.
		🟩 Chemical Oxidation	Impacted areas of groundwater exhibit reducing conditions. Achievement of oxidizing conditions would require significant volumes of reagent and would disturb natural abiotic degradation.	Readily implementable, generally low permeability geology would require dense spacing of injection points and wells.	Moderate capital; moderate OM&M.
		☐ Chemical Reduction	Impacted areas of groundwater exhibit reducing conditions. Injection of reducing agents would accelerate natural degradation.	Readily implementable, generally low permeability geology would require dense spacing of injection points and wells.	Moderate capital; moderate OM&M.
		☐ Electrical Resistance Heating	Effective in treating CVOCs in clay and bedrock.	Implementable, but limited number of qualified bidders.	High capital; high OM&M.
	Enhancements	🟩 Directional Drilling	Effective in accessing groundwater below the manufacturing building.	Implementable, but limited applicability to bedrock.	High capital; low OM&M.
		🟩 Hydraulic-fracturing	Effective in increasing the permeability of impacted geology. Difficult to achieve homogeneous fracturing.	Implementable, but limited effectiveness.	Moderate capital; low OM&M.

Table 7
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 1 Cost Estimate
No Action

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
FUTURE ACTIONS						
Five Year Reviews ($5,000 each, annualized basis)	1	l.s.	$1,000	$1,000	30	$12,409
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$12,409
CONTINGENCY (20%)						$2,482
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 1						$14,891

Notes

1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.

Table 8
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 2 Cost Estimate
Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Indoor Air Monitoring						
Indoor Air Sampling and Analysis	1	l.s.	$5,000	$5,000	NA	$5,000
Soil Cover						
Pre-Design Investigation	1	l.s.	$5,000	$5,000	NA	$5,000
Mobilization and Site Preparation	1	l.s.	$10,000	$10,000	NA	$10,000
Erosion and Sediment Control	1	l.s.	$3,000	$3,000	NA	$3,000
Geotextile, Soil Cover, and Hydroseeding	80,000	sf	$1.85	$148,000	NA	$148,000
TOTAL DIRECT COSTS						$171,000
CAPITAL COST - INDIRECT						
Engineering and Design (10%)						$17,100
Construction Phase Engineering Services (20%)						$34,200
Permits and Plans (5%)						$8,550
TOTAL INDIRECT COSTS						$59,850
TOTAL CAPITAL COSTS						$230,850

Table 8
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 2 Cost Estimate
Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
FUTURE ACTIONS						
Quarterly Groundwater Sampling/Reporting (Years 1 and 2)	1	l.s. (per year)	$40,000	$40,000	2	$72,320
Annual Groundwater Sampling/Reporting (Years 3 through 30)	1	l.s. (per year)	$10,000	$10,000	28	$99,074
Annual Indoor Air Monitoring (Years 2 through 30)	1	l.s. (per year)	$5,000	$5,000	29	$53,593
Five Year Reviews ($5,000 each, annualized basis)	1	l.s. (per year)	$1,000	$1,000	30	$12,409
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$237,397
CONTINGENCY (20%)						$93,649
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 2						$561,896

Notes

1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs, such as costs for implementing Institutional Controls, are not included in cost estimate.

Table 9
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 3 Cost Estimate
EISB and ISCR, Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

Item	Quantity	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT					
Indoor Air Monitoring					
Indoor Air Sampling and Analysis	1	$5,000	$5,000	NA	$5,000
Soil Cover					
Pre-Design Investigation	1	$5,000	$5,000	NA	$5,000
Mobilization and Site Preparation	1	$10,000	$10,000	NA	$10,000
Erosion and Sediment Control	1	$3,000	$3,000	NA	$3,000
Geotextile, Soil Cover, and Hydroseeding	80,000	$1.85	$148,000	NA	$148,000
EISB and ISCR Injections					
Mobilization and Site Preparation	1	$10,000	$10,000	NA	$10,000
Pre-Design Investigation	1	$250,000	$250,000	NA	$250,000
Bedrock Injection Wells	26	$4,000	$104,000	NA	$104,000
Bedrock Injection	1	$100,000	$100,000	NA	$100,000
Post-Injection Groundwater Sampling	1	$15,000	$15,000	NA	$15,000
Site Restoration (Landscaping, etc.)	1	$4,000	$4,000	NA	$4,000
Waste Characterization and Disposal	5	$100	$500	NA	$500
TOTAL DIRECT COSTS					$654,500
CAPITAL COST - INDIRECT					
Engineering and Design (10%)					$65,450
Construction Phase Engineering Services (20%)					$130,900
Permits and Plans (5%)					$32,725
TOTAL INDIRECT COSTS					$229,075
TOTAL CAPITAL COSTS					$883,575

Table 9
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 3 Cost Estimate
EISB and ISCR, Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs

Item	Quantity	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
FUTURE ACTIONS					
Quarterly Groundwater Sampling/Reporting (Years 1 and 2)	1	$40,000	$40,000	2	$72,320
Annual Groundwater Sampling/Reporting (Years 3 through 30)	1	$10,000	$10,000	28	$99,074
Annual Indoor Air Monitoring (Years 2 through 30)	1	$5,000	$5,000	29	$53,593
Five Year Reviews ($5,000 each, annualized basis)	1	$1,000	$1,000	30	$12,409
EISB and ISCR Injections - Years 3, 6, and 9					
Mob/Demob	1	$3,000	$3,000	3	$6,080
Bedrock Injection	1	$100,000	$100,000	3	$202,650
Post-Injection Groundwater Sampling	1	$15,000	$15,000	3	$30,398
Injection Well Abandonment (Year 30)	1	$30,000	$30,000	1	$3,942
Construction Phase Engineering Services (20%)					$48,614
TOTAL PRESENT VALUE OF FUTURE ACTIONS					$529,080
CONTINGENCY (20%)					$282,531
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 3					$1,695,186

Notes

1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs, such as costs for implementing Institutional Controls, are not included in cost estimate.

Table 10
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 4 Cost Estimate
Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Indoor Air Monitoring						
Indoor Air Sampling and Analysis	1	l.s.	$5,000	$5,000	NA	$5,000
Shallow Soil Excavation (Industrial SCOs)						
Pre-Design Investigation	1	l.s.	$5,000	$5,000	NA	$5,000
Mobilization and Site Preparation	1	l.s.	$10,000	$10,000	NA	$10,000
Erosion and Sediment Control	1	l.s.	$3,000	$3,000	NA	$3,000
Excavation, Transportation and Disposal	2,400	ton	$100	$240,000	NA	$240,000
Confirmatory Sampling	1	l.s.	$5,000	$5,000	NA	$5,000
Site Restoration (Including backfill)	1	l.s.	$75,000	$75,000	NA	$75,000
Expanded In-Situ Chemical Reduction and Enhanced In-Situ Bioremediation Injections						
Mobilization and Site Preparation	1	l.s.	$10,000	$10,000	NA	$10,000
Pre-Design Investigation	1	ea.	$250,000	$250,000	NA	$250,000
Bedrock Injection Wells	42	ea.	$4,000	$168,000	NA	$168,000
Bedrock Injection	1	l.s.	$200,000	$200,000	NA	$200,000
Post-Injection Groundwater Sampling	1	l.s.	$15,000	$15,000	NA	$15,000
Site Restoration (Landscaping, etc.)	1	l.s.	$6,000	$6,000	NA	$6,000
Waste Characterization and Disposal	10	tons	$100	$1,000	NA	$1,000
TOTAL DIRECT COSTS						$993,000
CAPITAL COST - INDIRECT						
Engineering and Design (10%)						$99,300
Construction Phase Engineering Services (20%)						$198,600
Permits and Plans (5%)						$49,650
TOTAL INDIRECT COSTS						$347,550
TOTAL CAPITAL COSTS						$1,340,550

Table 10
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 4 Cost Estimate
Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
FUTURE ACTIONS						
Quarterly Groundwater Sampling/Reporting (Years 1 and 2)	1	l.s. (per year)	$40,000	$40,000	2	$72,320
Annual Groundwater Sampling/Reporting (Years 3 through 30)	1	l.s. (per year)	$10,000	$10,000	28	$99,074
Annual Indoor Air Monitoring (Years 2 through 30)	1	l.s. (per year)	$5,000	$5,000	29	$53,593
Five Year Reviews ($5,000 each, annualized basis)	1	l.s. (per year)	$1,000	$1,000	30	$12,409
In-Situ Chemical Reduction and Enhanced In-Situ Bioremediation Injection - Years 3, 6, and 9						
Mob/Demob	1	l.s.	$5,000	$5,000	3	$10,133
Bedrock Injection	1	l.s.	$200,000	$200,000	3	$405,300
Post-Injection Groundwater Sampling	1	l.s.	$15,000	$15,000	3	$30,398
Injection Well Abandonment (Year 20)	1	l.s.	$50,000	$50,000	1	$6,570
Construction Phase Engineering Services (20%)						$90,480
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$780,277
CONTINGENCY (20%)						$424,165
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 4						$2,544,992

Notes

1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs, such as costs for implementing Institutional Controls, are not included in cost estimate.
4. Partial demolition of building may be required. Related costs have not been estimated.

Table 11
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 5 Cost Estimate
ISTR, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Indoor Air Monitoring						
Indoor Air Sampling and Analysis	1	l.s.	$5,000	$5,000	NA	$5,000
Soil Excavation (Unrestricted Use SCOs)						
Pre-Design Investigation	1	l.s.	$5,000	$5,000	NA	$5,000
Mobilization and Site Preparation	1	l.s.	$10,000	$10,000	NA	$10,000
Erosion and Sediment Control	1	l.s.	$3,000	$3,000	NA	$3,000
Excavation, Transportation and Disposal	34,000	ton	$100	$3,400,000	NA	$3,400,000
Confirmatory Sampling	1	l.s.	$5,000	$5,000	NA	$5,000
Site Restoration (Including backfill)	1	l.s.	$925,000	$925,000	NA	$925,000
Electric Resistance Heating System						
Pre-Design Investigation	1	l.s.	$250,000	$250,000	NA	$250,000
Abandonment of Existing Monitoring Wells	1	l.s.	$50,000	$50,000	NA	$50,000
Mob/Demob/Purchase & Delivery of Materials and Equipment	1	l.s.	$830,000	$830,000	NA	$830,000
Site Preparation and Drilling	1	l.s.	$500,000	$500,000	NA	$500,000
Surface and Subsurface Installation and Start-Up	1	l.s.	$810,000	$810,000	NA	$810,000
Electrical Permitting and Utility Connection	1	l.s.	$52,000	$52,000	NA	$52,000
Electrical Energy Consumption	4,000	MWh	$120	$480,000	NA	$480,000
ERH System OM&M	1	l.s.	$790,000	$790,000	NA	$790,000
Waste Characterization and Disposal	1	l.s.	$33,000	$33,000	NA	$33,000
Site Restoration (Landscaping, etc.)	1	l.s.	$25,000	$25,000	NA	$25,000
Replacement Groundwater Monitoring Wells	1	l.s.	$50,000	$50,000	NA	$50,000
TOTAL DIRECT COSTS						$8,223,000
CAPITAL COST - INDIRECT						
Engineering and Design (10%)						$822,300
Construction Phase Engineering Services (20%)						$1,644,600
Permits and Plans (5%)						$411,150
TOTAL INDIRECT COSTS						$2,878,050
TOTAL CAPITAL COSTS						$11,101,050

Table 11
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Alternative 5 Cost Estimate
ISTR, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
FUTURE ACTIONS						
Quarterly Groundwater Sampling/Reporting (Quarterly First Year)	1	l.s. (per year)	$40,000	$40,000	1	$40,000
Annual Groundwater Sampling/Reporting (Years 2 through 5)	1	l.s. (per year)	$10,000	$10,000	4	$31,697
Annual Indoor Air Monitoring (Years 2 through 5)	1	l.s. (per year)	$5,000	$5,000	4	$15,834
Five Year Review	1	l.s. (per year)	$5,000	$5,000	1	$3,565
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$91,096
CONTINGENCY (20%)						$2,238,429
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 5						$13,430,575

Notes

1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs are not included in cost estimate.
4. Partial demolition of building may be required. Related costs have not been estimated.

Table 12
New York State Department of Environmental Conservation
Feasibility Study Report
Monroe Electronics Site
Comparison of Remedial Alternative Costs

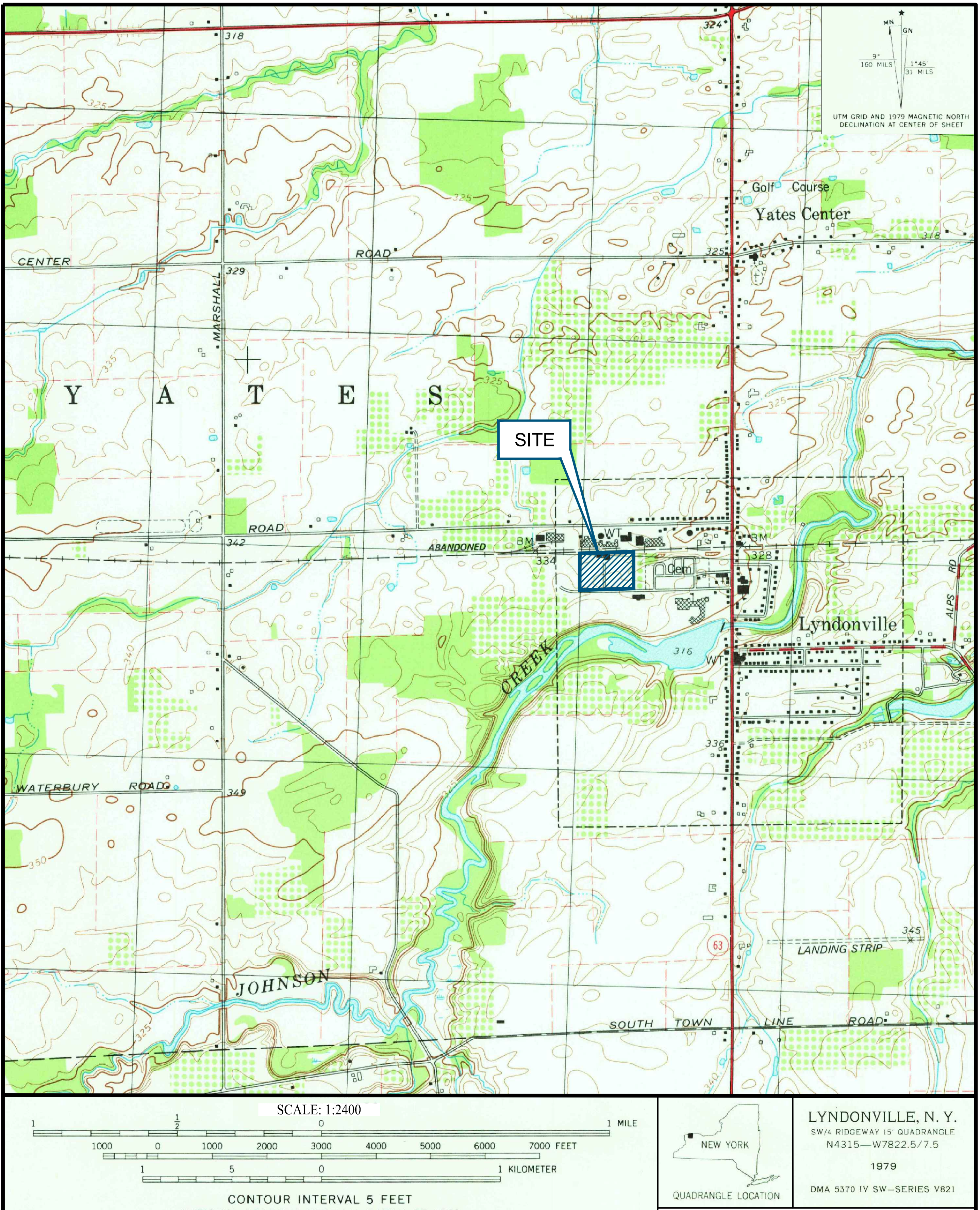
ALTERNATIVE	TOTAL CAPITAL COST	PRESENT WORTH OF FUTURE ACTIONS COST	TOTAL PRESENT WORTH[1]
Alternative 1 - No Action	$0	$12,000	$15,000
Alternative 2 – Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs	$230,000	$240,000	$560,000
Alternative 3 – EISB and ISCR, Soil Cover, Groundwater MNA, Indoor Air Monitoring, and ICs	$880,000	$530,000	$1,700,000
Alternative 4 – Expanded EISB and ISCR, Shallow Soil Excavation, Groundwater MNA, Indoor Air Monitoring, and ICs	$1,340,000	$780,000	$2,540,000
Alternative 5 – ISTR, Soil Excavation, Groundwater MNA, and Indoor Air Monitoring	$11,100,000	$91,000	$13,430,000

Notes:

Estimated costs are rounded.

[1] Includes contingency.

Figures



MAP OBTAINED THROUGH USE OF THE NATIONAL MAP ONLINE VIEWER FROM USGS

TRC
1430 BROADWAY, 10TH FLOOR
NEW YORK, NEW YORK 10018
212-221-7822

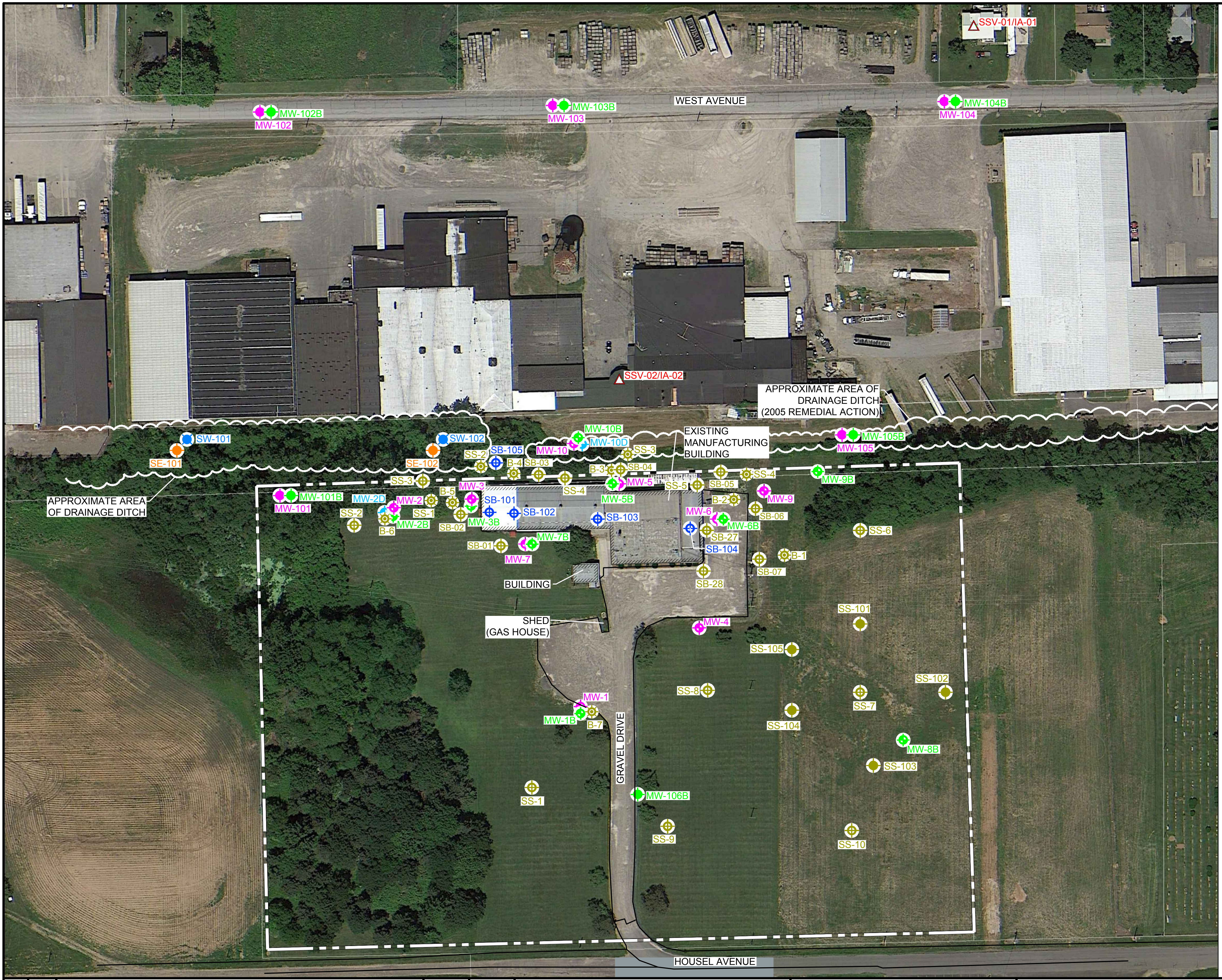
DESIGNED BY: JM
DRAWN BY: HD
CHECKED BY: DSG/LM
DATE: OCTOBER 2015
SCALE: AS SHOWN
PROJECT NUMBER: 219075.0000.0000

PROJECT NAME:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FEASIBILITY STUDY
MONROE ELECTRONICS - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
SITE LOCATION MAP

FIGURE
1

Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 – Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 1 – Site Location Map R1.dwg – Date\Time: Mon, 05 Oct 2015 – 3:01pm – User Name: hdelgado – Layout Tab: 8.5X11



LEGEND (SYMBOLS NOT TO SCALE):

— ▫ —	SITE BOUNDARY
▨	BUILDING FOOTPRINT
MW-XXXB	BEDROCK MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
MW-XXX	SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
SB-XXX	DIRECT PUSH SOIL BORING / GROUNDWATER GRAB SAMPLE LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
△ SSV-X/IA-X	SUB-SLAB VAPOR / INDOOR AIR SAMPLING LOCATION AND IDENTIFICATION NUMBER (DECEMBER 2014)
SS-XXX	SURFACE SOIL SAMPLING LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
SE-XXX	SEDIMENT SAMPLING LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
SW-XXX	SURFACE WATER SAMPLING LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
MW-XXB	BEDROCK MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRE-2014)
MW-XXD	DEEP MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRE-2014)
MW-XX	SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRE-2014)
SS-XX, SB-XX	HISTORIC SURFACE SOIL SAMPLING LOCATION AND IDENTIFICATION NUMBER (SS-XX = AUGUST 2011) (SB-XX = 1997)
B-X, SS-X	HISTORIC SURFACE SOIL SAMPLING LOCATION AND IDENTIFICATION NUMBER (2001)

NOTES:

1. NOT ALL HISTORIC SURFACE SOIL SAMPLING LOCATIONS ARE SHOWN.
2. BASE AERIAL PHOTOGRAPH FROM GOOGLE EARTH 2015.
3. SURFACE SOIL SAMPLE LOCATIONS OBTAINED FROM SCANNED IMAGES AND MAPS PREPARED BY PRIOR CONSULTANTS. LOCATIONS ARE APPROXIMATE.

REVISIONS

NO.	DESCRIPTION	BY	DATE

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APPROXIMATE SCALE: 1"=120'

PAPER SIZE: 11" x 17"

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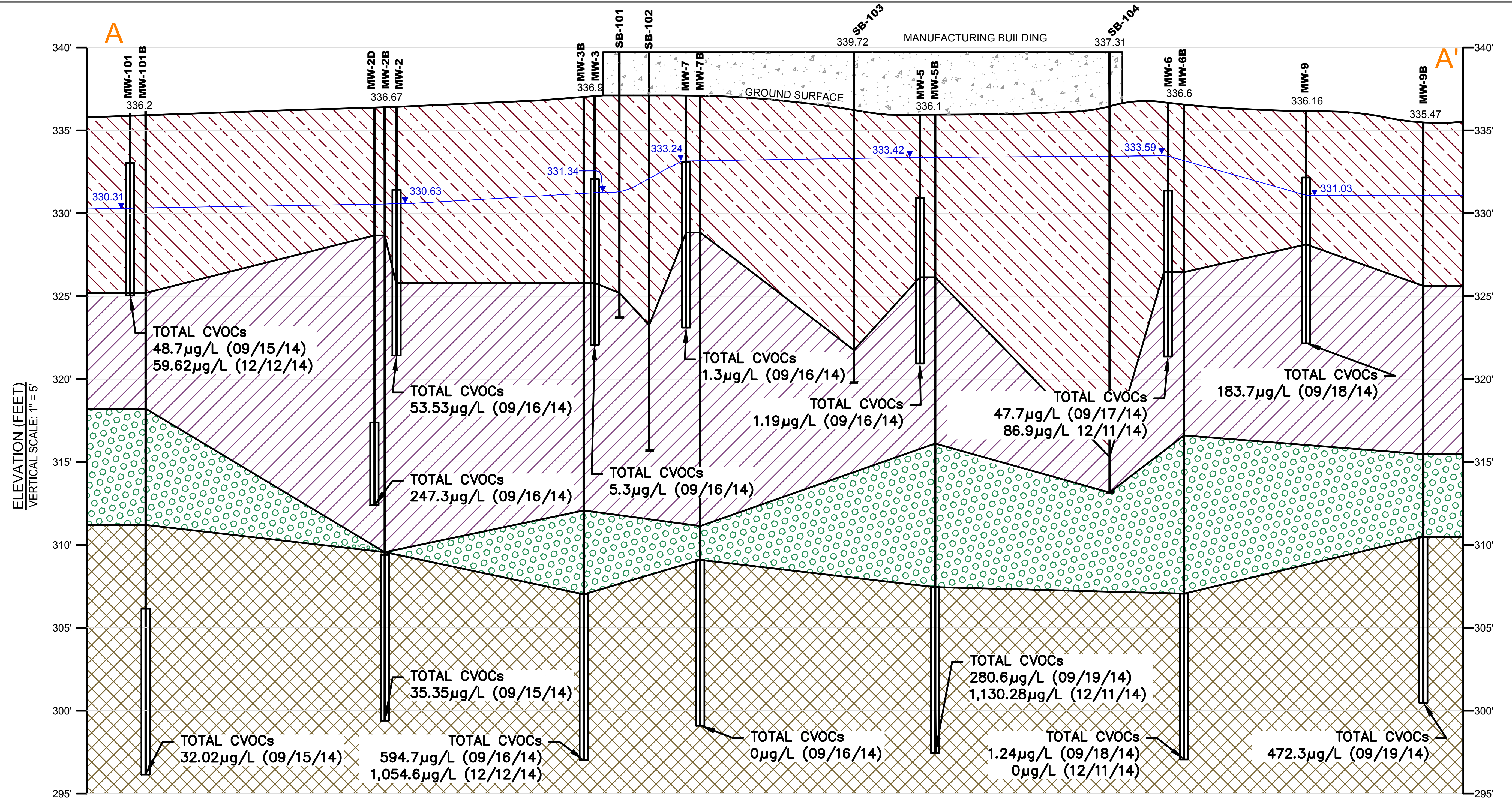
PROJECT NAME:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FEASIBILITY STUDY
MONROE ELECTRONICS - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

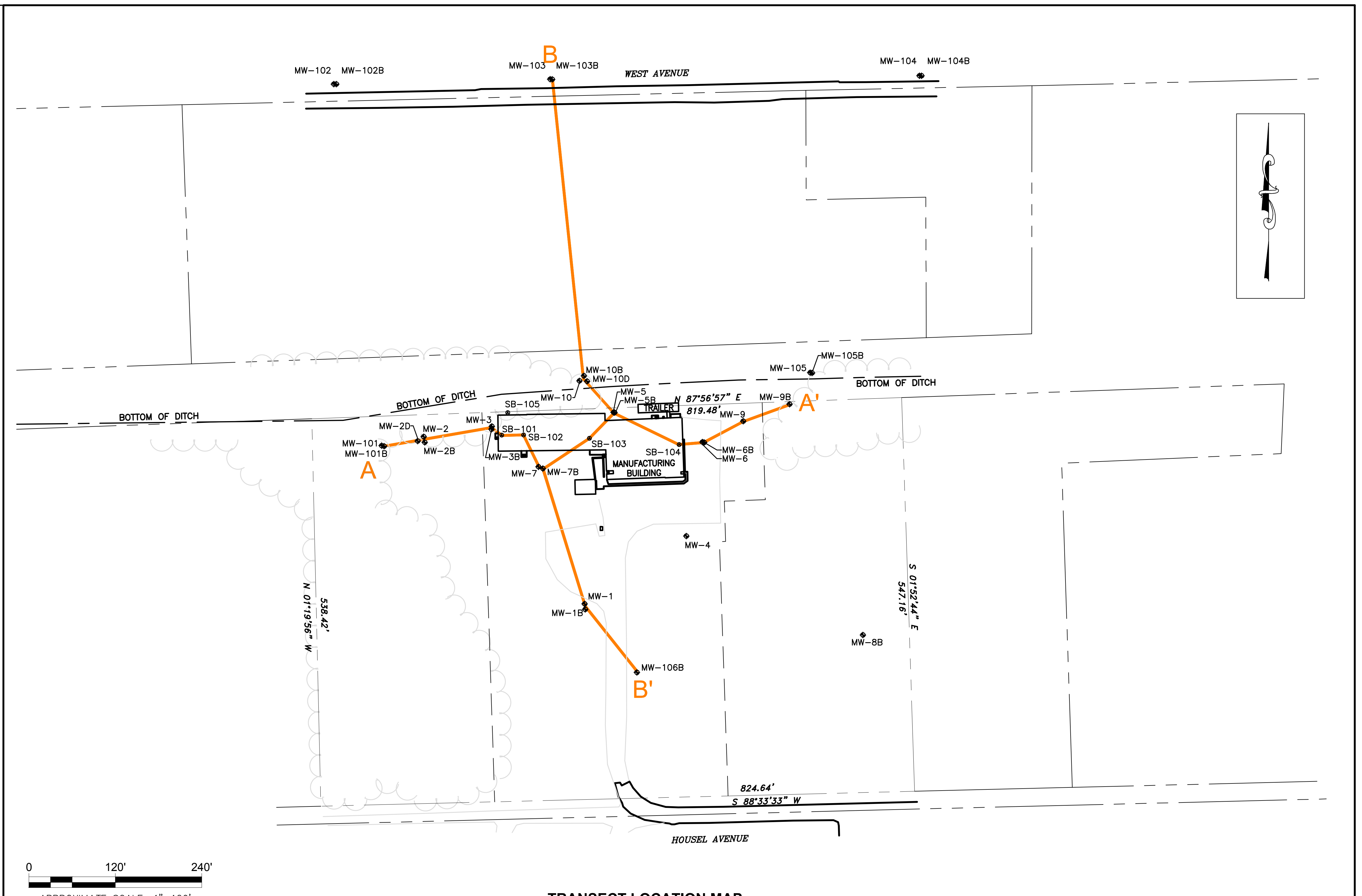
DRAWING TITLE:
SITE PLAN AND INVESTIGATION LOCATIONS

FIGURE
2

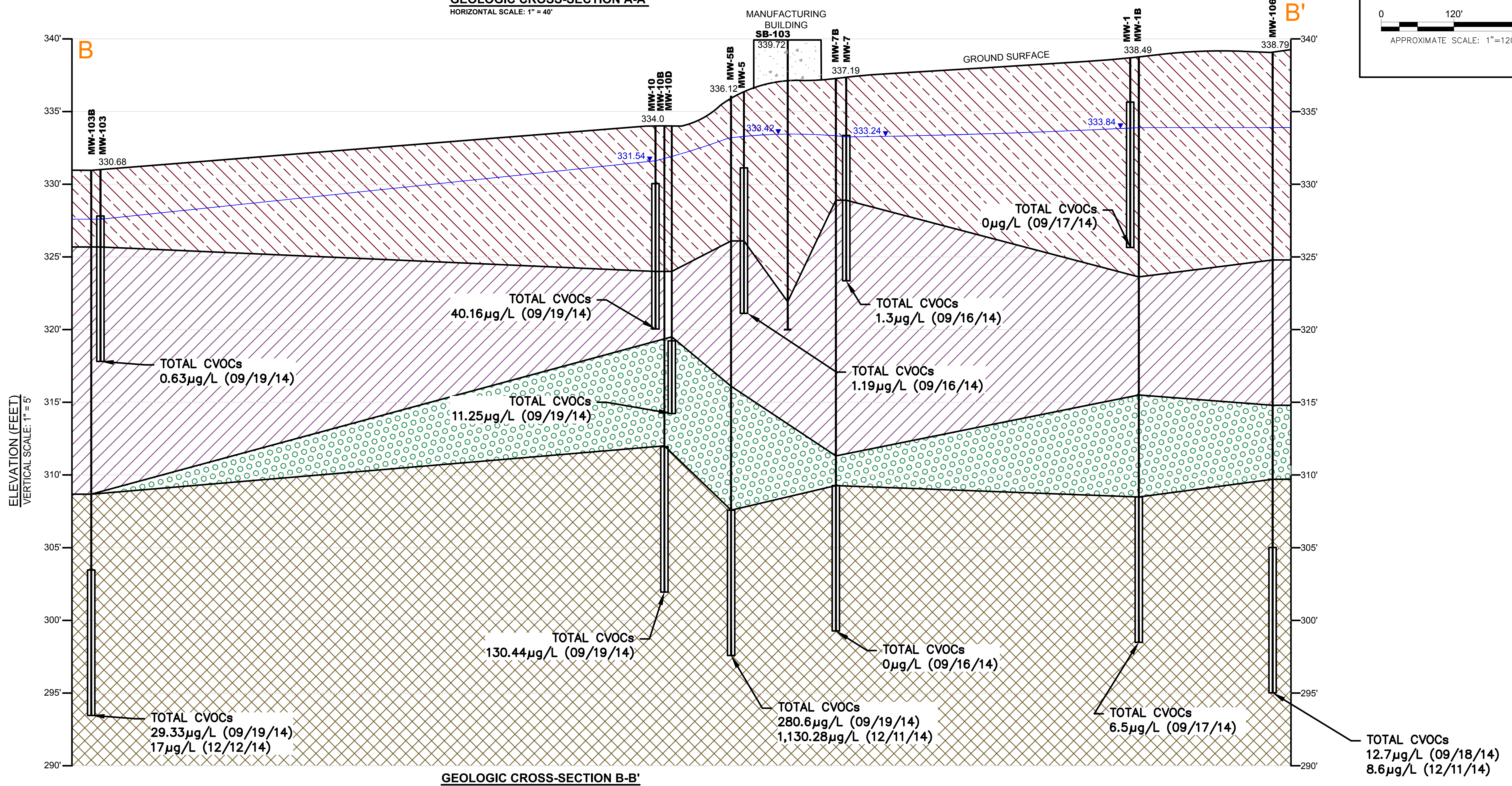
Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 - Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 2 - Site Plan and Invest. Locations (05.01.15).dwg - Date\Time: Mon, 05 Oct 2015 - 3:03pm - User Name: hdelgado - Layout Tab: 11X17



GEOLOGIC CROSS-SECTION A-A'
HORIZONTAL SCALE: 1" = 40'



TRANSECT LOCATION MAP
SCALE: 1" = 120'



GEOLOGIC CROSS-SECTION B-B'
HORIZONTAL SCALE: 1" = 50'

LEGEND:

—	GEOLOGIC CROSS-SECTION TRANSECT
▼ 327.75	INFERRED GROUNDWATER SURFACE ELEVATION AND ELEVATION MEASUREMENT (SHALLOW WELLS – DECEMBER 2014)
▯	MONITORING WELL SCREEN
▨	CONCRETE BUILDING SLAB
▨	MOSTLY SAND
▨	MOSTLY CLAY
▨	WEATHERED SHALE
▨	BEDROCK
CVOCs	= TOTAL CHLORINATED VOLATILE ORGANIC COMPOUNDS
µg/L	= MICROGRAMS PER LITER

NOTES:

1. VERTICAL DATUM IS NAVD '88
2. GRID NORTH ESTABLISHED FROM THE NEW YORK STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83, FEET

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PROJECT NAME:
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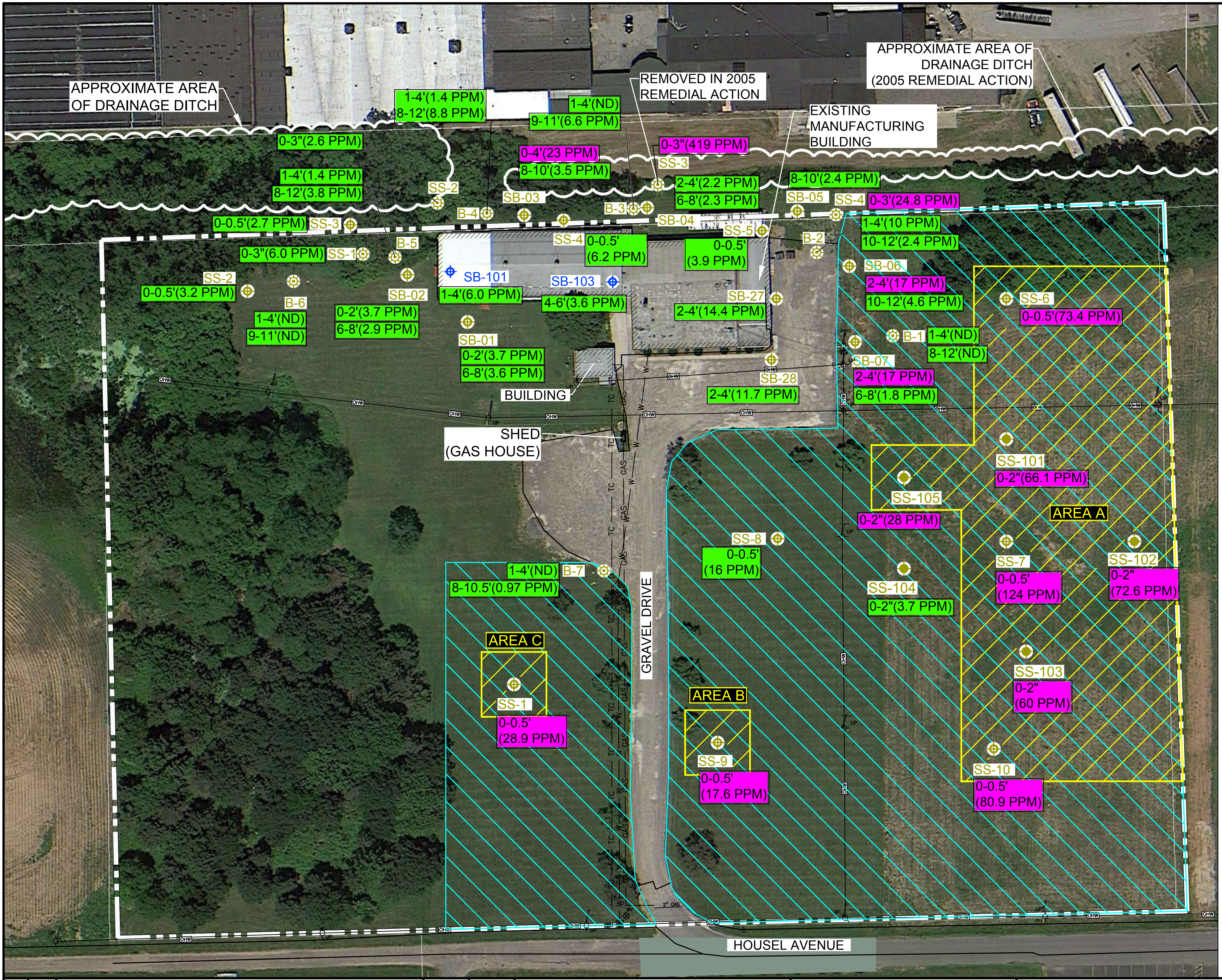
FEASIBILITY STUDY- MONROE ELECTRONICS SITE - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
GEOLOGIC CROSS-SECTIONS
WITH TOTAL CHLORINATED VOLATILE ORGANIC COMPOUNDS (CVOCs)
DETECTED IN SHALLOW AND BEDROCK MONITORING WELLS

FIGURE
3



N
W E
S

LEGEND (SYMBOLS NOT TO SCALE):

▭ ▭ ▭	SITE BOUNDARY
▨	BUILDING FOOTPRINT
— GAS —	GAS LINE
— OHW —	OVERHEAD WIRES
— TC —	TELECOMMUNICATIONS
— W —	WATER LINE
HYD	HYDRANT
UP	UTILITY POLE
⊕ SB-XXX	DIRECT PUSH SOIL BORING / GROUNDWATER GRAB SAMPLE LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
● SS-XXX	SURFACE SOIL SAMPLING LOCATION AND IDENTIFICATION NUMBER (AUGUST 2014)
⊕ SS-XX, SB-X	HISTORIC SURFACE SOIL SAMPLING LOCATION AND IDENTIFICATION NUMBER (SS-XX = AUGUST 2011) (SB-X = 1997)
⊕ B-X, SS-X	HISTORIC SURFACE SOIL SAMPLING LOCATION AND IDENTIFICATION NUMBER (2001)
AREA X	AREA TARGETED FOR SHALLOW SOIL EXCAVATION OR COVER (PRELIMINARY)
▨	AREA TARGETED FOR UNRESTRICTED SOIL REMEDIATION (PRELIMINARY)
0-2'(73 PPM)	DEPTH IN FEET OR INCHES CONCENTRATION OF ARSENIC IN PARTS PER MILLION (PPM)
🟩	CONCENTRATION LESS THAN OR EQUAL TO 16 PPM ARSENIC
🟪	CONCENTRATION GREATER THAN 16 PPM ARSENIC

NOTES:

1. BASE AERIAL PHOTOGRAPH FROM GOOGLE EARTH 2015.
2. 1997 TO 2011 SAMPLE LOCATIONS OBTAINED FROM SCANNED IMAGES AND MAPS PREPARED BY PRIOR CONSULTANTS. LOCATIONS ARE APPROXIMATE.
3. ONLY SAMPLING LOCATIONS WHERE ARSENIC ANALYSIS WAS PERFORMED ARE SHOWN.
4. AREAS TARGETED FOR SHALLOW SOIL REMEDIATION ARE PRELIMINARY. FINAL EXTENTS OF REMEDIATION WOULD BE DETERMINED BY PRE-DESIGN INVESTIGATION AND POST-EXCAVATION SAMPLING RESULTS.

REVISIONS

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APPROXIMATE SCALE: 1"=80'
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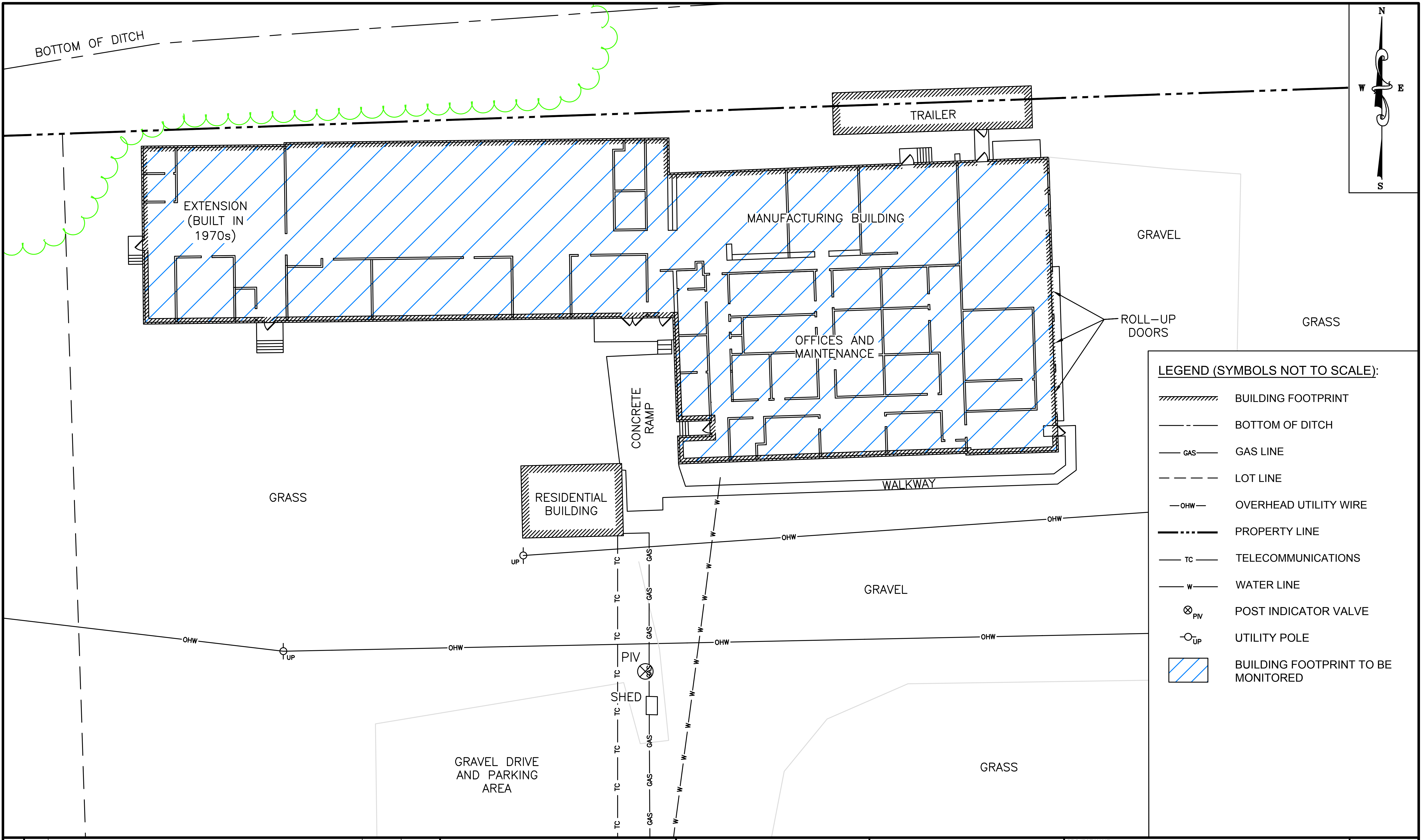
FEASIBILITY STUDY
MONROE ELECTRONICS - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
AREAS TARGETED FOR SOIL REMEDIATION

FIGURE
4

Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 – Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 4 – Areas Targeted for Soil Remediation.dwg – Date\Time: Fri, 30 Oct 2015 – 3:35pm – User Name: hdelgado – Layout Tab: 11X17



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APPROXIMATE SCALE: 1"=25'

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FEASIBILITY STUDY - MONROE ELECTRONICS - SITE NO. 837013
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LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
MANUFACTURING BUILDING FLOOR PLAN

FIGURE
5

Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 – Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 5 – Manufacturing Building Floor Plan.dwg – Date\Time: Fri, 30 Oct 2015 – 3:39pm – User Name: hdelgado – Layout Tab: 11X17

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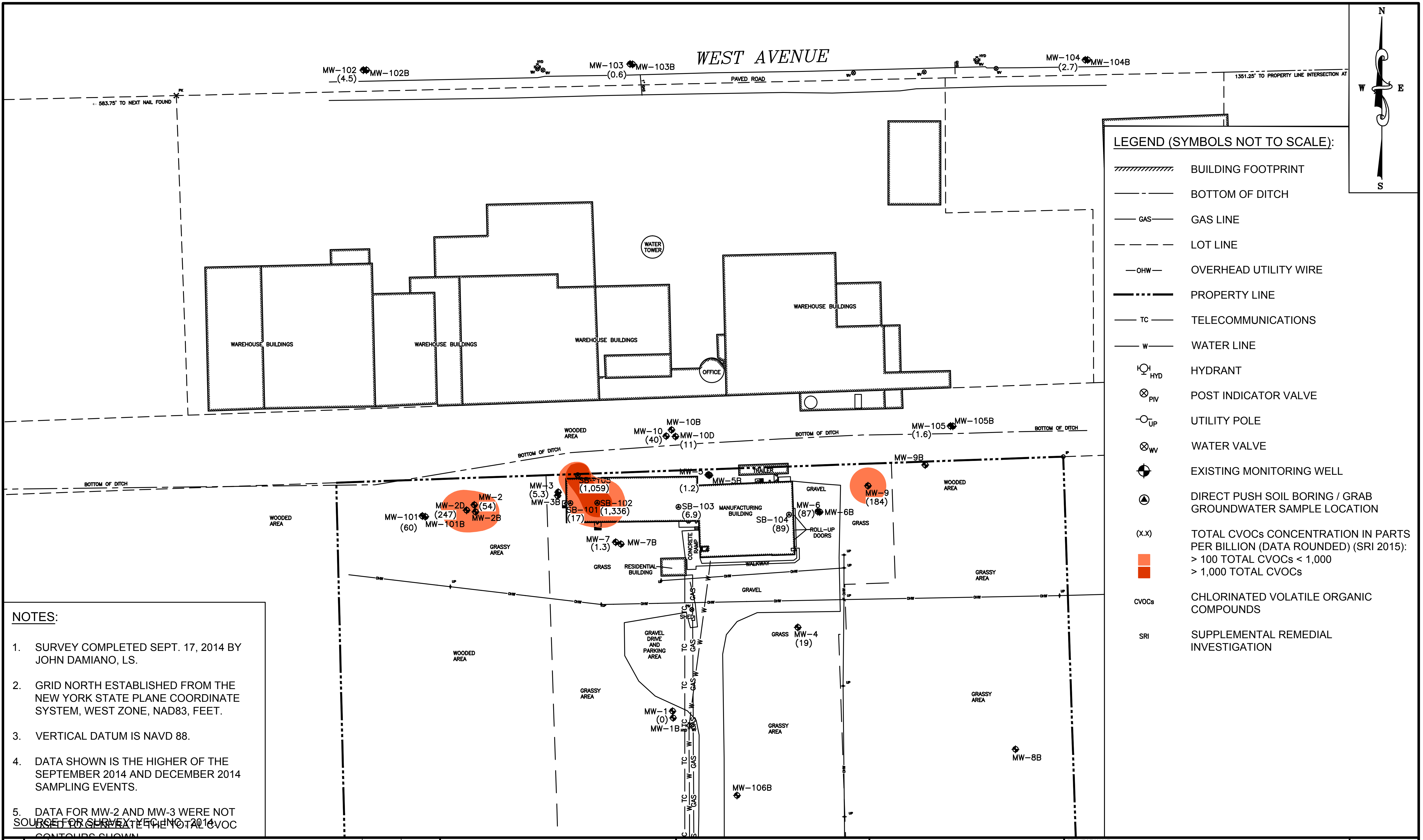

LEGEND (SYMBOLS NOT TO SCALE):

▨	BUILDING FOOTPRINT
— · —	BOTTOM OF DITCH
—GAS—	GAS LINE
— — —	LOT LINE
—OHW—	OVERHEAD UTILITY WIRE
—··—	PROPERTY LINE
—TC—	TELECOMMUNICATIONS
—W—	WATER LINE
HYD	HYDRANT
⊗ PIV	POST INDICATOR VALVE
UP	UTILITY POLE
⊗ WV	WATER VALVE
⊕	EXISTING MONITORING WELL
⊙	DIRECT PUSH SOIL BORING / GRAB GROUNDWATER SAMPLE LOCATION
(X.X)	TOTAL CVOCs CONCENTRATION IN PARTS PER BILLION (DATA ROUNDED) (SRI 2015):
🟧	> 100 TOTAL CVOCs < 1,000
🟥	> 1,000 TOTAL CVOCs
CVOCs	CHLORINATED VOLATILE ORGANIC COMPOUNDS
SRI	SUPPLEMENTAL REMEDIAL INVESTIGATION

NOTES:

1. SURVEY COMPLETED SEPT. 17, 2014 BY JOHN DAMIANO, LS.
2. GRID NORTH ESTABLISHED FROM THE NEW YORK STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83, FEET.
3. VERTICAL DATUM IS NAVD 88.
4. DATA SHOWN IS THE HIGHER OF THE SEPTEMBER 2014 AND DECEMBER 2014 SAMPLING EVENTS.
5. DATA FOR MW-2 AND MW-3 WERE NOT USED TO GENERATE THE TOTAL CVOC CONTOURS SHOWN.

SOURCE FOR SURVEY: YEC, INC., 2014.

REVISIONS

NO.	DESCRIPTION	BY	DATE

0 100' 200'

APPROXIMATE SCALE: 1"=100'

PAPER SIZE: 11" x 17"

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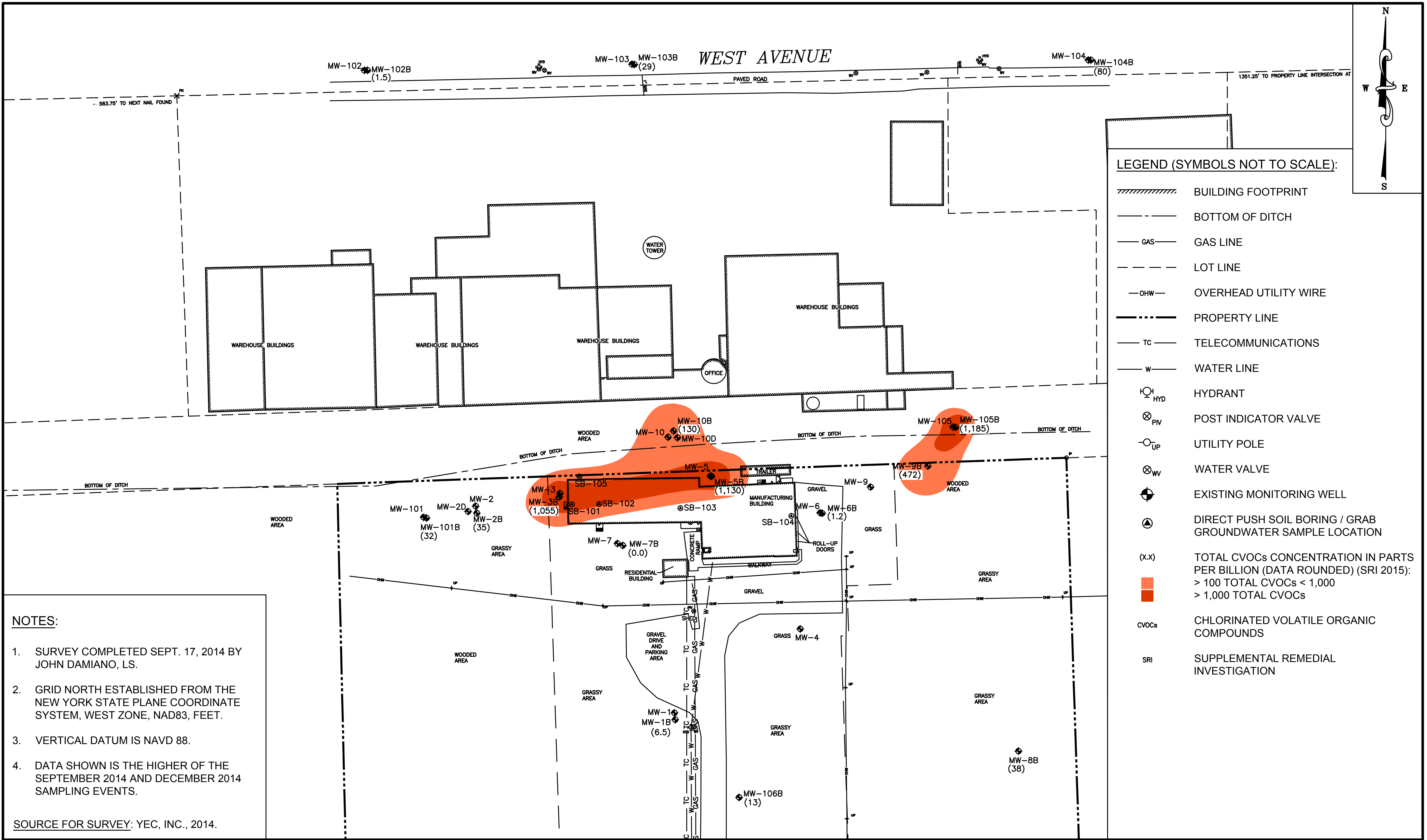
SCALE: AS SHOWN
PROJECT NUMBER: 219075.0000.0000

PROJECT NAME:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FEASIBILITY STUDY - MONROE ELECTRONICS - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
SHALLOW AQUIFER: CONCENTRATIONS OF TOTAL CVOCs

FIGURE
6

Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 – Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 7 – Bedrock Aquifer – Concent. of Total CVOCs R1.dwg – Date\Time: Mon, 05 Oct 2015 – 3:37pm – User Name: hdelgado – Layout Tab: 11X17 (B)



LEGEND (SYMBOLS NOT TO SCALE):

▨	BUILDING FOOTPRINT
— · —	BOTTOM OF DITCH
—GAS—	GAS LINE
— — —	LOT LINE
—OHW—	OVERHEAD UTILITY WIRE
—··—	PROPERTY LINE
— TC —	TELECOMMUNICATIONS
— W —	WATER LINE
HYD	HYDRANT
⊗ PIV	POST INDICATOR VALVE
—○ UP	UTILITY POLE
⊗ WV	WATER VALVE
⊕	EXISTING MONITORING WELL
⊙	DIRECT PUSH SOIL BORING / GRAB GROUNDWATER SAMPLE LOCATION
(x.x)	TOTAL CVOCs CONCENTRATION IN PARTS PER BILLION (DATA ROUNDED) (SRI 2015):
🟧	> 100 TOTAL CVOCs < 1,000
🟥	> 1,000 TOTAL CVOCs
CVOCs	CHLORINATED VOLATILE ORGANIC COMPOUNDS
SRI	SUPPLEMENTAL REMEDIAL INVESTIGATION

NOTES:

1. SURVEY COMPLETED SEPT. 17, 2014 BY JOHN DAMIANO, LS.
2. GRID NORTH ESTABLISHED FROM THE NEW YORK STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83, FEET.
3. VERTICAL DATUM IS NAVD 88.
4. DATA SHOWN IS THE HIGHER OF THE SEPTEMBER 2014 AND DECEMBER 2014 SAMPLING EVENTS.

SOURCE FOR SURVEY: YEC, INC., 2014.

REVISIONS

NO.	DESCRIPTION	BY	DATE

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APPROXIMATE SCALE: 1"=100'
PAPER SIZE: 11" x 17"

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1430 BROADWAY, 10TH FLOOR
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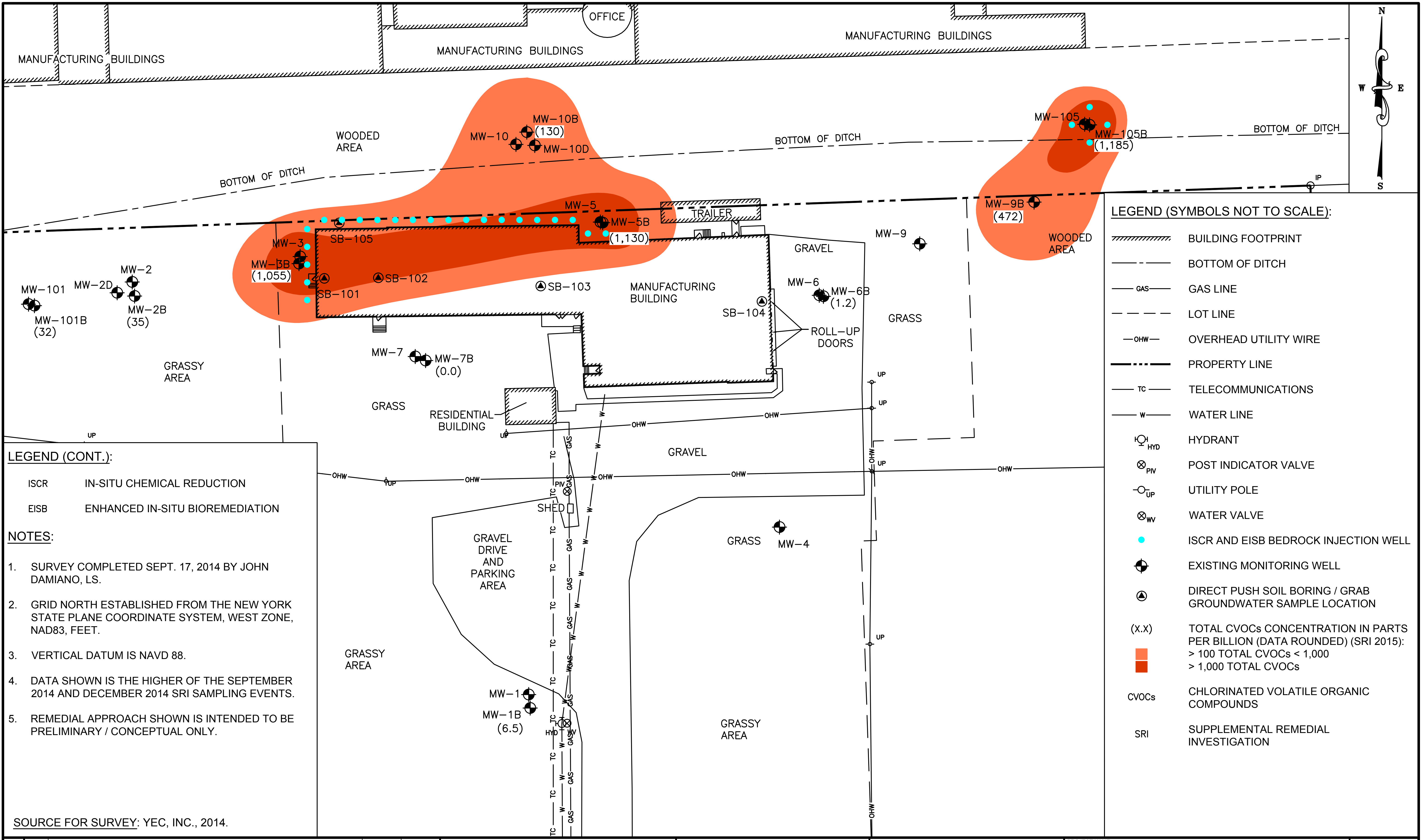
212-221-7822

DESIGNED BY: JM / LM
DRAWN BY: HD
CHECKED BY: DSG
DATE: OCTOBER 2015
SCALE: AS SHOWN
PROJECT NUMBER: 219075.0000.0000

PROJECT NAME:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FEASIBILITY STUDY - MONROE ELECTRONICS - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
BEDROCK AQUIFER: CONCENTRATIONS OF TOTAL CVOCs

FIGURE
7



LEGEND (SYMBOLS NOT TO SCALE):

▨▨▨▨	BUILDING FOOTPRINT
—— - ——	BOTTOM OF DITCH
—GAS—	GAS LINE
— — — —	LOT LINE
—OHW—	OVERHEAD UTILITY WIRE
—··—	PROPERTY LINE
— TC —	TELECOMMUNICATIONS
— W —	WATER LINE
HYD	HYDRANT
⊗PIV	POST INDICATOR VALVE
-OUP	UTILITY POLE
⊗WV	WATER VALVE
●	ISCR AND EISB BEDROCK INJECTION WELL
⊕	EXISTING MONITORING WELL
ⓐ	DIRECT PUSH SOIL BORING / GRAB GROUNDWATER SAMPLE LOCATION
(X.X)	TOTAL CVOCs CONCENTRATION IN PARTS PER BILLION (DATA ROUNDED) (SRI 2015):
🟧	> 100 TOTAL CVOCs < 1,000
🟥	> 1,000 TOTAL CVOCs
CVOCs	CHLORINATED VOLATILE ORGANIC COMPOUNDS
SRI	SUPPLEMENTAL REMEDIAL INVESTIGATION

LEGEND (CONT.):

ISCR	IN-SITU CHEMICAL REDUCTION
EISB	ENHANCED IN-SITU BIOREMEDIATION

NOTES:

1. SURVEY COMPLETED SEPT. 17, 2014 BY JOHN DAMIANO, LS.
2. GRID NORTH ESTABLISHED FROM THE NEW YORK STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83, FEET.
3. VERTICAL DATUM IS NAVD 88.
4. DATA SHOWN IS THE HIGHER OF THE SEPTEMBER 2014 AND DECEMBER 2014 SRI SAMPLING EVENTS.
5. REMEDIAL APPROACH SHOWN IS INTENDED TO BE PRELIMINARY / CONCEPTUAL ONLY.

SOURCE FOR SURVEY: YEC, INC., 2014.

REVISIONS

NO.	DESCRIPTION	BY	DATE

0 50' 100'

APPROXIMATE SCALE: 1"=50'

PAPER SIZE: 11" x 17"

TRC

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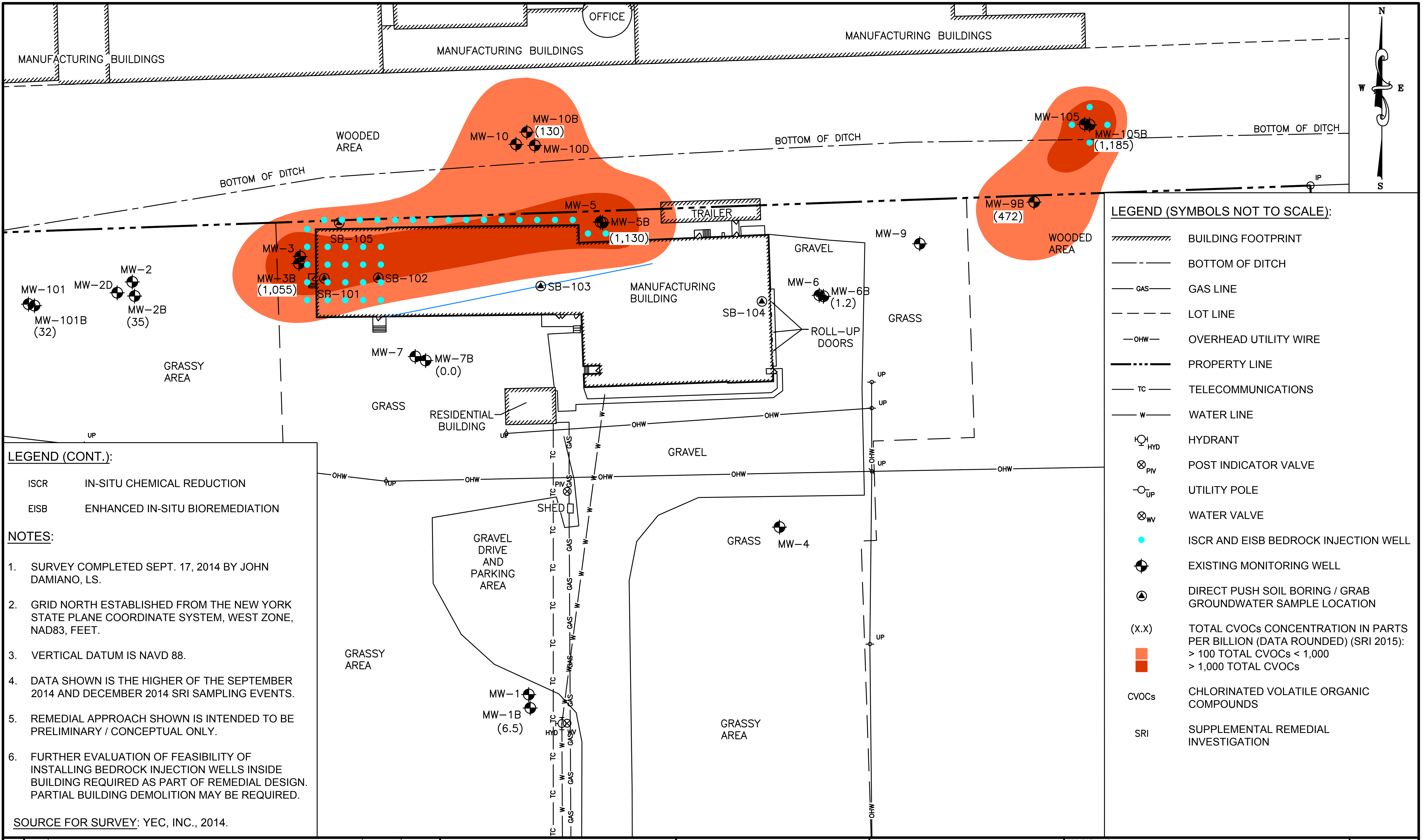
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:

ALTERNATIVE 3: BEDROCK AQUIFER
EISB AND ISCR INJECTION POINTS

FIGURE
8

Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 - Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 8 - Alt. 3 Bedrock Aquifer EISB and ISCR Inj. Pts..dwg - Date\Time: Fri, 06 Nov 2015 - 12:12pm - User Name: hdelgado - Layout Tab: 11X17



LEGEND (SYMBOLS NOT TO SCALE):

▨	BUILDING FOOTPRINT
— · —	BOTTOM OF DITCH
—GAS—	GAS LINE
— — —	LOT LINE
—OHW—	OVERHEAD UTILITY WIRE
—··—··—	PROPERTY LINE
— TC —	TELECOMMUNICATIONS
— W —	WATER LINE
HYD	HYDRANT
⊗PIV	POST INDICATOR VALVE
UP	UTILITY POLE
⊗WV	WATER VALVE
●	ISCR AND EISB BEDROCK INJECTION WELL
⊕	EXISTING MONITORING WELL
◉	DIRECT PUSH SOIL BORING / GRAB GROUNDWATER SAMPLE LOCATION
(X.X)	TOTAL CVOCs CONCENTRATION IN PARTS PER BILLION (DATA ROUNDED) (SRI 2015):
🟧	> 100 TOTAL CVOCs < 1,000
🟥	> 1,000 TOTAL CVOCs
CVOCs	CHLORINATED VOLATILE ORGANIC COMPOUNDS
SRI	SUPPLEMENTAL REMEDIAL INVESTIGATION

LEGEND (CONT.):

ISCR	IN-SITU CHEMICAL REDUCTION
EISB	ENHANCED IN-SITU BIOREMEDIATION

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5. REMEDIAL APPROACH SHOWN IS INTENDED TO BE PRELIMINARY / CONCEPTUAL ONLY.
6. FURTHER EVALUATION OF FEASIBILITY OF INSTALLING BEDROCK INJECTION WELLS INSIDE BUILDING REQUIRED AS PART OF REMEDIAL DESIGN. PARTIAL BUILDING DEMOLITION MAY BE REQUIRED.

SOURCE FOR SURVEY: YEC, INC., 2014.

REVISIONS			
NO.	DESCRIPTION	BY	DATE

0 50' 100'

APPROXIMATE SCALE: 1"=50'
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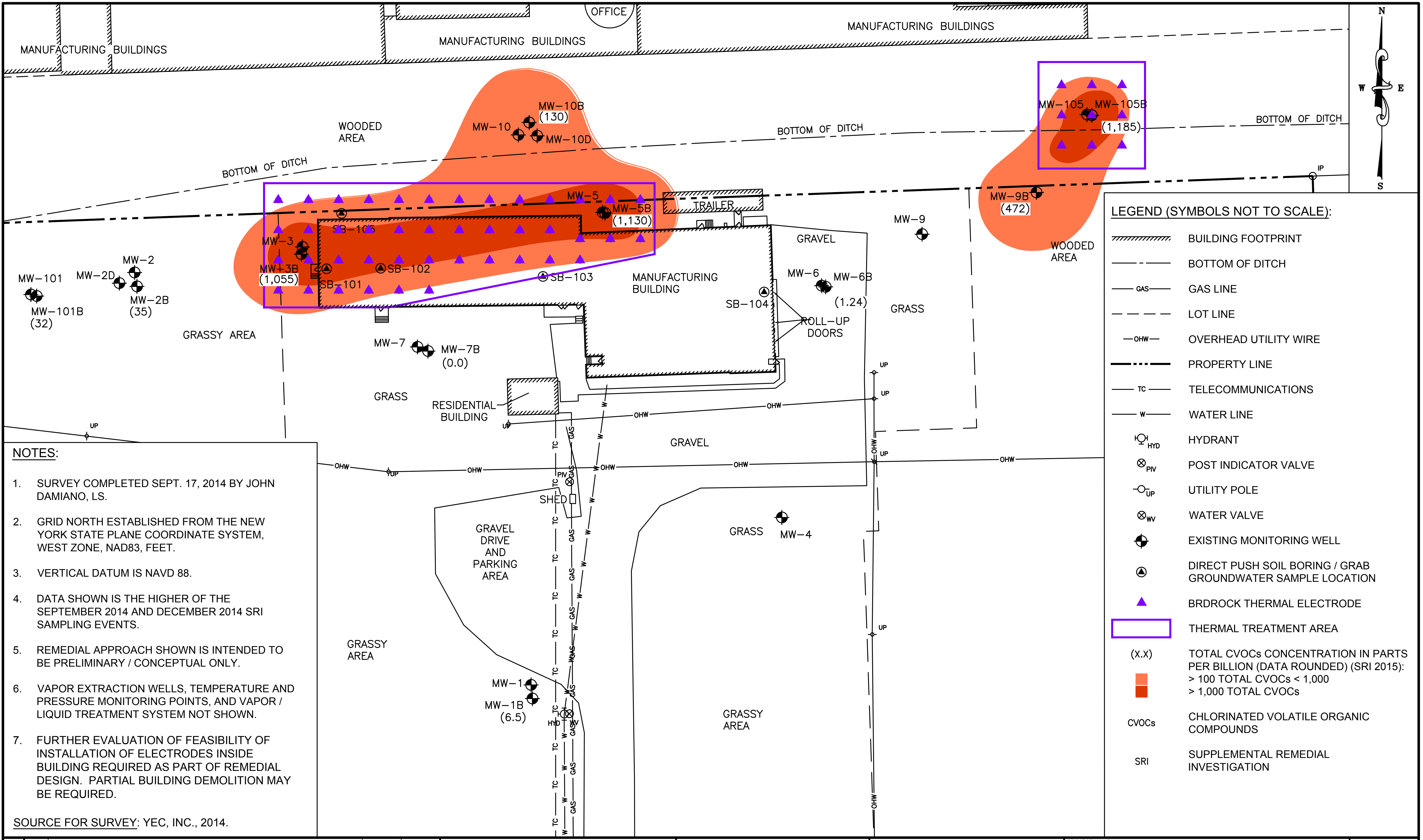
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
ALTERNATIVE 4: EXPANDED BEDROCK AQUIFER
EISB AND ISCR INJECTION POINTS

FIGURE
9

Path\Name: I:\Projects\NYSDEC\Assignments\WA #19 – Monroe Electronics\Feasibility Study\TRC Working Drawings\Figure 9 – Alt. 4 Expanded Bedrock Aquifer EISB and ISCR Injection Points.dwg – Date\Time: Fri, 06 Nov 2015 – 12:15pm – User Name: hdelgado – Layout Tab: 11X17



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1. SURVEY COMPLETED SEPT. 17, 2014 BY JOHN DAMIANO, LS.
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3. VERTICAL DATUM IS NAVD 88.
4. DATA SHOWN IS THE HIGHER OF THE SEPTEMBER 2014 AND DECEMBER 2014 SRI SAMPLING EVENTS.
5. REMEDIAL APPROACH SHOWN IS INTENDED TO BE PRELIMINARY / CONCEPTUAL ONLY.
6. VAPOR EXTRACTION WELLS, TEMPERATURE AND PRESSURE MONITORING POINTS, AND VAPOR / LIQUID TREATMENT SYSTEM NOT SHOWN.
7. FURTHER EVALUATION OF FEASIBILITY OF INSTALLATION OF ELECTRODES INSIDE BUILDING REQUIRED AS PART OF REMEDIAL DESIGN. PARTIAL BUILDING DEMOLITION MAY BE REQUIRED.

SOURCE FOR SURVEY: YEC, INC., 2014.

LEGEND (SYMBOLS NOT TO SCALE):

▨	BUILDING FOOTPRINT
	BOTTOM OF DITCH
GAS	GAS LINE
	LOT LINE
OHW	OVERHEAD UTILITY WIRE
	PROPERTY LINE
TC	TELECOMMUNICATIONS
W	WATER LINE
HYD	HYDRANT
⊗ PIV	POST INDICATOR VALVE
UP	UTILITY POLE
⊗ WV	WATER VALVE
⊕	EXISTING MONITORING WELL
◉	DIRECT PUSH SOIL BORING / GRAB GROUNDWATER SAMPLE LOCATION
▲	BRDROCK THERMAL ELECTRODE
☐	THERMAL TREATMENT AREA
(X.X)	TOTAL CVOCs CONCENTRATION IN PARTS PER BILLION (DATA ROUNDED) (SRI 2015):
🟧	> 100 TOTAL CVOCs < 1,000
🟥	> 1,000 TOTAL CVOCs
CVOCs	CHLORINATED VOLATILE ORGANIC COMPOUNDS
SRI	SUPPLEMENTAL REMEDIAL INVESTIGATION

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REVISIONS

NO.	DESCRIPTION	BY	DATE

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APPROXIMATE SCALE: 1"=50'
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PROJECT NAME:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FEASIBILITY STUDY - MONROE ELECTRONICS - SITE NO. 837013
100 HOUSEL AVENUE
LYNDONVILLE, NEW YORK 14098

DRAWING TITLE:
ALTERNATIVE 5:
IN-SITU THERMAL REMEDIATION ELECTRODE ARRAY

FIGURE
10

Appendix A

Standards, Criteria and Guidance Analysis

SCGs Analysis

Standards, Criteria and Guidelines (SCGs) are defined as follows:

> "Standards and criteria are cleanup standards, standards of control, and other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance."
>
> "Guidelines are non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as standards and criteria; however, remedial alternatives should consider guidance documents that, based on professional judgment, may be applicable to the project."

SCGs may include Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Criteria (TBCs) where:

1. Applicable requirements are those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site;

2. Relevant and appropriate requirements are those federal and state requirements that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site; and

3. To be considered (TBC) material are non-promulgated advisories or guidance issued by federal or state agencies that, although not legally binding, can be used in determining the level of clean up for protection of health or the environment.

There are three types of SCGs: chemical-specific (i.e., that pertain to the management of certain chemicals); location-specific (i.e., that restrict activities at a given location); and action-specific (i.e., that control specific actions). Chemical-specific SCGs are usually health- or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. Location-specific SCGs prevent damage to unique or sensitive areas, such as floodplains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they take place. Action-specific SCGs are activity or technology based. These SCGs control remedial activities involving the design or use of certain equipment, or regulate discrete actions.

A discussion of chemical-specific SCGs that are applicable to the COCs detected in the environmental media at the Site is presented in Section 2.3 of this Feasibility Study (FS). Location-specific and action-specific SCGs are more relevant to the evaluation of remedial alternatives in the later stages of the FS process. This appendix provides the initial identification and evaluation of location-specific and action-specific SCGs.

Location-Specific SCGs

An area's location is a fundamental determinant of its impact on human health and the environment. Location-specific SCGs are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they are in a specific location (USEPA, 1988b). Some examples of these unique locations include floodplains, wetlands, coastal areas, historic places and sensitive ecosystems or habitats.

The location-specific SCGs analysis revealed the Monroe Electronics Site is not located in, and does not exhibit the features of, any of the following designated areas:

- A USEPA-designated Sole-Source Aquifer;
- A coastal zone as designated by the State of New York;
- An area of prime farmland or additional farmland of statewide importance;
- An area affecting national wild, scenic, or recreational rivers; or
- Property included in or eligible for the National Register of Historic Places.

Accordingly, the Safe Drinking Water Act, New York State Coastal Management Program, Farmland Protection Policy Act, the Wild and Scenic Rivers Act, and the National Historic Preservation Act are not considered SCGs for the Site. Similarly, New York State regulations and acts regarding farmland protection (Article 25-AA of New York State's Agriculture and Markets Law), wild and scenic rivers (NYCRR Part 666), and historic and cultural resources (Section 14.09 of the State Historic Preservation Act) are not location-specific SCGs for the Site.

New York State's Environmental Resource Mapper[1] and Nature Explorer[2] were checked for the presence of rare plants and animals or significant natural communities in the vicinity of the Site. The Site is located within an area designated as a habitat for Rare Plants and Rare Animals. Therefore, the federal Endangered Species Act and state regulations relative to endangered and threatened species (6 NYCRR Part 182) are potentially applicable to remedial actions at the Site. Prior to selecting a remedy, a request for determination whether activity is subject to regulation under 6 NYCRR Part 182 would be made to NYSDEC.

National Wetland Inventory (NWI) mapping and New York State's Environmental Resource Mapper were checked to determine if any new wetlands have been mapped at or in the vicinity of the Site. The nearest wetland area identified in the NWI mapping, Johnson Creek, is located approximately 500 feet south of the Site. A freshwater emergent wetland is located approximately 1,800 feet southwest of the Site. Remedial alternatives evaluated in this FS Report would not impact the wetland areas. Therefore, related federal Executive Orders 11988 and 11990 and New York regulations (NYCRR Part 661 and the Freshwater Wetlands Act) do not apply to the Site.

The Flood Insurance Rate Map (FIRM) that covers the Site (FEMA, Map Number 3614590001B, Panel 0107G, September 16, 1981) was reviewed to determine if the floodplain designation for the Site has changed since 1981. The floodplain map indicates that the Site is located in Zone A, which is defined as an area of minimal flood hazard, usually above the 500-year flood level. Therefore, federal location-specific regulations applicable to floodplains do not apply to the Site. There are no New York State

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[1] http://www.dec.ny.gov/imsmaps/ERM/viewer.htm

[2] http://www.dec.ny.gov/natureexplorer/app/

floodplain regulations; local communities that participate in the National Flood Insurance Program regulate development in Special Flood Hazard Areas.

The location-specific federal ARARs that are potentially applicable to the Site are listed in Table A-1.

Action-Specific SCGs

Based on the identification of COCs in surface soil, soil vapor, and groundwater remediation activities may be required and numerous state and federal requirements could apply to the implementation of these activities. Potential action-specific ARARs cannot be well-defined until response actions are defined and remedial alternatives developed. A preliminary identification of potential action-specific SCGs is presented in Table A-2.

Numerous state and federally-promulgated action-specific ARARs and TBC criteria could potentially affect the implementation of remedial measures. In accordance with NYSDEC DER-10, the primary administrative requirements that will guide remediation of the Site are those established under CERCLA and SARA. In addition, NYSDEC has promulgated many regulations that are similar to those of the federal government.

The revised NCP (40 CFR Part 300) incorporates SARA Title III requirements that alternatives satisfy ARARs, and utilize technologies that will provide a permanent reduction in the toxicity, volume and mobility of contamination, to the extent practicable.

Additional potential requirements include those pertaining to worker health and safety, as established under the Occupational Safety and Health Act. ARARs associated with treatment, storage and disposal actions include RCRA requirements governing administrative (permitting, manifesting, etc.) and substantive (design) issues. The federal Clean Air Act (CAA) and Clean Water Act (CWA) are also potentially applicable to the evaluation of remedial activities which result in discharges to water bodies or ambient air. Rules concerning the transportation of hazardous materials are promulgated under the Hazardous Materials Transportation Act (49 CFR 170, 171) and are potential ARARs for remedial actions involving the off-Site shipment of hazardous materials or waste. Requirements pertinent to land disposal, in the Hazardous and Solid Waste Amendments of 1984 (HSWA), are potential ARARs which may limit the use of land disposal in connection with certain hazardous waste. New York State regulations pertaining to Waste Transporter Permits (6 NYCRR 364) and Solid Waste Management Facilities (6 NYCRR 360) are also potential ARARs for remedial actions involving off-Site transportation and disposal of waste.

Federal Underground Injection Control Program regulations (40 CFR Parts 144 through 148) are potential ARARs for remedial actions involving the subsurface injection of chemical and biological reagents.

The New York State Pollution Discharge Elimination System (SPDES) regulations (6 NYCRR 750) govern discharges of wastewater to waters of the State. These regulations are applicable to discharges to the sanitary sewer system and surface water.

The New York Chemical Bulk Storage Regulations (6 NYCRR Parts 595-599) establish requirements for bulk storage of hazardous substance or mixtures in aboveground tanks. The regulations include requirements for release reporting, response and corrective action, as well as design standards, and are potentially applicable to chemical storage tanks used for remedial systems.

The New York air permitting regulations (6 NYCRR Part 201) establish requirements for permitting of air pollution sources. The requirements may be applicable to the management of air emission sources such as VOCs and/or hazardous air pollutants (HAPs) from remedial systems.

In addition to the State regulations, there are also local action-specific regulations, in the form of county ordinances that must be considered. *Article II, Environmental Health Services* of the Orleans County Department of Health Sanitary Code addresses the storage, handling and control of offensive materials.

Table A-1
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Location-Specific SCGs

REGULATION	CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Rare Plants and Animals --			
Endangered and Threatened Species of Fish and Wildlife	6 NYCRR Part 182	Lists endangered and threatened fish and wildlife species, establishes requirements for take permits, and outlines recovery and restoration plans.	ARAR as the Site is located in a state-designated rare plants and animals zone.
Rare Plants	New York State Conservation Law 9-1503	Lists endangered and threatened plant species and regulates takings.	ARAR as the Site is located in a state-designated rare plants and animals zone.
Endangered and Threatened Plants, Fish, and Wildlife	50 CFR - Part	Lists endangered and threatened plant, fish, and wildlife species and regulates takings.	ARAR as the Site is located in a state-designated rare plants and animals zone.

Table A-2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Action-Specific SCGs

STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Comprehensive Environmental Response, Compensation, and Liability Act of 1980	42 U.S.C. 9605 and 40 CFR 300 (National Contingency Plan)	Establishes funding and provisions for the clean-up of Superfund sites.	ARARs as the Site is on the NYSDEC "Superfund List" (Register of Inactive Hazardous Waste Disposal Sites).
Superfund Amendments and Reauthorization Act	42 U.S.C. 9601	Treatments must provide permanent reductions in volume, toxicity and mobility of wastes and satisfy ARARs.	ARARs as the Site is on the NYSDEC Superfund List.
Hazardous and Solid Waste Amendments of 1984 (HSWA)	42 U.S.C. 6924, 40 CFR 260.1 et seq.	Requires the treatment of certain wastes prior to land disposal.	Potential ARARs that may limit the use of land disposal of certain wastes.
Resource Conservation and Recovery Act (RCRA)	40 CFR Parts 260 and 262	Standards for waste management shipments and treatment/disposal.	Potential ARARs for alternatives that utilize off-site treatment/disposal of hazardous waste.
RCRA	40 CFR 263	Standards for transporters of hazardous waste materials.	Potential ARARs for alternatives that utilize off-site treatment/disposal of hazardous waste.
RCRA	40 CFR 264 Subpart I	Standards for the storage of containers of hazardous wastes, including inspection, containment and closure requirements.	Potential ARARs for alternatives that involve the on-site storage of hazardous wastes within containers.

Table A-2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Action-Specific SCGs

STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
RCRA	40 CFR 264 Subpart J	Standards for the storage or treatment of hazardous wastes within tank systems.	Potential ARARs for alternatives that involve the on-site storage or treatment of hazardous wastes within tank systems.
RCRA	40 CFR 264 Subpart AA, BB, and CC	Standards for air emissions from process vents, equipment leaks, and tanks, surface impoundments, and containers used to store or treat hazardous wastes.	Potential ARARs for alternatives that store or treat hazardous wastes on the Site.
RCRA	40 CFR 268	Identifies hazardous wastes that are restricted from land disposal and sets treatment standards for restricted wastes.	Potential ARARs that may limit the use of land disposal for certain hazardous wastes.
National Contingency Plan	40 CFR 300.440	Describes procedures for managing CERCLA response action wastes at off-site facilities.	Potential ARAR for alternatives in which wastes are transferred off-site. Requires transfer to facilities that are incompliance with RCRA, TSCA, and other applicable federal and state requirements.
90-Day Accumulation Rule for Hazardous Waste	40 CFR Part 262.34	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers, and containment buildings without a RCRA hazardous waste permit.	Potentially applicable to remedial alternatives that involve the storing or treating of hazardous materials onsite.

Table A-2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Action-Specific SCGs

STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Clean Water Act (CWA) - Discharge to the Waters of the United States	40 CFR Parts 403, and 230 Section 404 (b) (1), 33 USC 1344	Establishes site-specific pollutant limitations and performance standards that are designed to protect surface water quality. Types of discharges regulated under CWA include: indirect discharge to a POTW, and discharge of dredged or fill material into U.S. waters.	Potentially applicable to remedial alternatives that involve regulated discharges.
CWA Section 401	33 U.S.C. 1341	Requires that 401 Water Quality Certificatior permit be provided to federal permitting agency (USACE) for any activity including, but not limited to, the construction or operation of facilities that may result in any discharge into jurisdictional waters of the U.S. and/or state.	Potentially applicable to remedial alternatives that involve regulated discharges.
Safe Drinking Water Act	40 CFR 144 and 146	Provides the general requirements, technical criteria and standards for underground injection wells, including prohibitions of unauthorized injection, prohibition of movement of fluid into underground sources of drinking water, and requirements for the discharge of hazardous wastes.	Potential ARAR for alternatives that utilize underground injection as a remedial method.
Clean Air Act	40 CFR 50	Establishes maximum concentrations for particulates, ozone, lead and fugitive dust emissions. Requires best available control technology (BACT) for new sources and sets emissions limitations.	Potential ARARs for alternatives involving treatment methods that impact ambient air (e.g., thermal treatment).
Prevention of Significant Deterioration of Air Quality (PSD)	40 CFR Part 51.2	New major stationary sources may be subject to PSD review (i.e., lowest achievable emission rate (LAER), and/ or emissions off-sets).	If necessary, PSD procedures will be included in the remedial design/ remedial action process. The procedures could be expanded to BACT and LAER evaluations.

Table A-2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Action-Specific SCGs

STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR 61	Establishes emissions limitations for hazardous air pollutants.	Potential ARARs for alternatives using treatment methods that result in emissions to the air.
Hazardous Materials Transportation Act	49 CFR 172 and 173	Procedures for packaging, labeling, manifesting, and off-site transport of hazardous materials.	Potential ARARs for alternatives involving the off-site shipment of hazardous materials or waste.
Occupational Safety and Health Act	29 CFR 1910.120	Establishes requirement for 40-hour training and medical surveillance of hazardous waste workers.	Potential ARAR for workers and the workplace throughout the implementation of hazardous activities.
OSHA	29 CFR 1926	Requirements for safety equipment and procedures for excavation.	Potential ARAR for workers and the workplace throughout the implementation of hazardous activities.
OSHA	29 CFR 1904	Outlines recordkeeping and reporting requirements.	Potential ARAR for all contractors/subcontractors involved in hazardous activities.
USEPA-Administered Permit Program: The Hazardous Waste Permit Programs	40 CFR Part 270	Covers the basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.	Any off-Site facility accepting hazardous waste from the Site must be properly permitted. Implementation of the Site remedy will include consideration of these requirements.
National Pollutant Discharge Elimination System (NPDES) Program, Administered Under New York State Pollution Discharge Elimination System (SPDES)	40 CFR Parts 122 Subpart B, 125, 301, 303, and 307; (Administered Under 6 NYCRR 750-758)	Establishes permitting requirements for poin source discharges; regulates discharge of water into navigable waters including the quantity and quality of discharge.	Potentially applicable to remedial activities that involve treatment/ disposal of water including injectio injection of treatment materials into the aquifer.

Table A-2
New York State Department of Environmental Conservation
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STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
General Permit for Stormwater Discharges from Construction Activity (GP-0-15-002)	Article 17, Titles 7, 8 and Article 70 of New York Environmental Conservation Law	Before commencing construction activity, the owner or operator of a construction project that will involve soil disturbance of one or more acres must obtain coverage under the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity.	Potentially applicable to remedial actions (e.g., surface soil excavation) that may result in a disturbance of one acre or more.
Not Applicable	NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy	CP-43 presents procedures for decommissioning monitoring wells at remediation sites.	This guidance will be considered if decommissioning of monitoring wells is required as part of remedial activities.
New York Air Quality Classification System	6 NYCRR Part 256	Outlines the air quality classifications for different land uses and population densities.	The air quality classification system will be considered during the treatment process design, if applicable.
New York Permits and Certificates	6 NYCRR Part 201	Provides instructions and regulations for obtaining a permit to construct and operate an air emission source.	Potentially applicable to remedial activities that involve air emissions.

Table A-2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Action-Specific SCGs

STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
New York Air Quality Standards	6 NYCRR Part 257	Provides air quality standards for different chemicals, particles, and processes	Potentially applicable to remedial systems and emissions.
Not Applicable	DAR-1 (Air Guide 1)	Provides guidance for the control of toxic ambient air contaminants in New York State and outlines the procedures for evaluating sources of air pollution.	This guidance may be considered for remedial alternatives that result in certain air emissions.
New York Uniform Procedures	6 NYCRR Part 621	NYSDEC permit application processing procedures are found in 6 NYCRR Part 621.	Potentially applicable to remedial activities that require permitting.
New York Hazardous Waste Management System - General	6 NYCRR Part 370	Provides definitions of terms and general instructions for the Part 370 series of hazardous waste management regulations.	Potentially applicable where hazardous waste is to be managed.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste subject to regulation under 6 NYCRR Parts 370 through 376.	Potentially applicable for determining if solid waste generated during implementation of remedial activities is hazardous wastes.
Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities	6 NYCRR Part 372	Provides guidelines relating to the use of the manifest system and recordkeeping requirements. Outlines procedures for the packaging, labeling, manifesting, and transporting of hazardous waste. Applies to generators, transporters, and facilities in New York State.	Potentially applicable to the treatment, transport or management of hazardous material generated at the Site.

Table A-2
New York State Department of Environmental Conservation
Monroe Electronics Site
Feasibility Study Report
Preliminary Identification of Action-Specific SCGs

STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Waste Transporter Permits	6 NYCRR Part 364	Governs the collection, transport, and delivery of regulated waste within New York State.	Potentially applicable to the transport of waste from the Site.
New York Regulations for Hazardous Waste Management Facilities	6 NYCRR Part 373	Provides requirements and procedures for obtaining a permit to operate a hazardous waste treatment, storage, and disposal facility.	Potentially applicable to any off-site facility accepting waste from the Site.
New York Regulations for Environmental Remedial Programs	6 NYCRR Part 375	Provides remediation requirements for inactive hazardous waste disposal sites.	Applicable to remedial action implemented at the site.
Land Disposal of a Hazardous Waste	6 NYCRR Part 376	Restricts land disposal of hazardous wastes that exceed specific criteria.	Potentially applicable to alternatives involving off-Site waste disposal.
Not Applicable	NYSDEC Division of Environmental Remediatio (DER) Program Policy 10 (DER-10): Technical Guidance for Site Investigation and Remediation	DER-10 provides guidance on NYSDEC-accepted site investigation and remediation processes.	Guidance would be considered during implementation of remedial activities.
Not Applicable	NYSDEC CP-51: Soil Cleanup Guidance	CP-51 provides a uniform process for the evaluation and cleanup of contaminated soil.	Guidance would be considered during implementation of remedial activities.

Table A-2
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STATUTE OR REGULATION	REGULATORY CITATION	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Chemical Bulk Storage Tanks	6NYCRR Parts 595-599	State regulations for bulk storage of hazardous substance or mixture. Includes requirements for release reporting, response and corrective action.	Potentially applicable to bulk storage of wastewater treatment chemicals in aboveground storage tanks.
Orleans County Sanitary Code: Environmental Health Service	Article II	Local regulations for the storage, handling and control of offensive materials.	Potentially applicable where hazardous waste is stored, handled, and/or controlled. Covers tank design standards, secondary containment, labeling, spill and overfill protection, and inspection and monitoring.