Feasibility Study for
Former Camarota Cleaners (5-46-044)
Mechanicville, New York

Prepared for

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

Prepared by

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January 2010
Revision: FINAL
EA Project No. 14368.22

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LIST OF ACRONYMS

bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminants of Concern
CVOC	Chlorinated Volatile Organic Compound
EA	EA Engineering, P.C. and its affiliate EA Science and Technology
FS	Feasibility Study
IRM	Interim Remedial Measure
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	Tetrachloroethene
RAO	Remedial Action Objective
RI	Remedial Investigation
SCG	Standards, Criteria, and Guidance
SSD	Sub-slab Depressurization System
SVI	Soil Vapor Intrusion
TCE	Trichloroethene
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1. INTRODUCTION AND PROJECT OVERVIEW

The New York State Department of Environmental Conservation (NYSDEC) tasked EA Engineering, P.C. and its affiliate EA Science and Technology (EA), to perform a Remedial Investigation (RI)/Feasibility Study (FS) at the former Camarota Cleaners located in Mechanicville, Saratoga County, New York (Figure 1).

1.1 PURPOSE AND SCOPE

This FS Report has been prepared to develop and evaluate options for remedial action to determine which option is the most appropriate, cost effective, and protective of public health and the environment for the former Camarota Cleaners site.

The FS has been conducted in accordance with the most recent versions of the 1988 United States Environmental Protection Agency (USEPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*[1] and NYSDEC *Draft DER-10, Technical Guidance for Site Investigation and Remediation*[2] and focused on a limited number of remedial alternatives proven effective at addressing remediation of former dry cleaning sites.

1.2 REPORT ORGANIZATION

The FS report has been organized as follows:

- ***Section 1***—Introduction, Site Background, and Characterization
- ***Section 2***—Nature and Extent of Contamination
- ***Section 3***—Development of Remedial Action Objectives
- ***Section 4***—Scoping and Development of Remedial Alternatives
- ***Section 5***—Detailed Analysis of Alternatives
- ***Section 6***—Recommendations.

1. USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act. l540lG-891004.
2. NYSDEC. 2002. Draft DER-10, Technical Guidance for Site Investigation and Remediation. December.

1.3 BACKGROUND

The following section provides a brief discussion of the site background for the former Camarota Cleaners site. A full description of the site is provided in the Final RI Report[3], which was submitted as a separate deliverable.

1.3.1 Site Location

The Camarota Cleaners site is a former dry cleaning facility located at 325-327 Park Avenue in the city of Mechanicville, Saratoga County, New York. The site covers 0.115 acres and is located at the southeast corner of the intersection of Park and Second avenues in a primarily residential area. The site has a single-story building situated on a soil-supported concrete slab (Figure 2).

1.3.2 Property Information

In 1892, a two-story building was constructed on the site. In 1963, a fire damaged the building, which subsequently led to it being demolished. The site was utilized as a dry cleaning and laundry facility from mid-1970 to about 1991 and was operated by Fred Camarota. Following the passing of Fred Camarota, the city of Mechanicville acquired the property through tax foreclosure in 1999. The city of Mechanicville sold the property to Royal Dyer Construction Co. Inc. on 20 October 2000. Currently the site is being remodeled. Both the on-site structure and the surrounding driveway are currently not in use.

1.3.3 Physiography

The subject site is located on the U.S. Geological Survey Mechanicville, New York 7.5-minute topographic quadrangle map, dated 1980 (Figure 3). Topography at the site is generally flat with an eastward slope toward the Hudson River. Elevation at the site is approximately 110 ft above mean sea level. The nearest surface water features, as noted on the topographic map, are the Anthony Kill (located approximately 0.2 mi northeast and east) and the Hudson River (located approximately 0.34 mi east). The Anthony Kill flows to the east-southeast into the south-flowing Hudson River.

1.3.4 Site Geology

A review of the geologic map of the New York, Hudson-Mohawk Sheet published by the University of the State of New York, the State Education Department and dated 1970, indicates that the subject site lies within the Middle Ordovician Canajoharie Shale of the Lorraine, Trenton, and Black River groups. The Canajoharie Shale consists of interbedded black shale and sandstone.

3. EA. 2009. Remedial Investigation Report. Former Camarota Cleaners Site (5-46-044), Mechanicville New York. August.

According to the Natural Resources Conservation Service Soil Survey in Saratoga County, the site is underlain by the undulating Hoosic gravelly sandy loam. This nearly level soil is described as very deep and somewhat excessively drained. The soil formed in water-sorted sand and gravel on outwash plains. This soil typically consists of an upper surface layer of gravelly sandy loam that extends to a depth of 9 in., a subsoil layer of gravelly sandy loam from 9 to 18 in. and gravelly loamy sand from 18 to 24 in., and a substratum of stratified sand and gravel extending from 24 to 72 in. Soil permeability is moderately rapid to rapid in the solum and very rapid in the substratum. Water capacity is very low and runoff is slow. Depth to water is typically greater than 6 ft, while depth to bedrock is typically greater than 60 in.

1.3.5 Site Hydrogeology

Two distinct aquifers are present at the former Camarota Cleaners site, an overburden and bedrock aquifer. The overburden consists of brown to gray medium sand with little gravel (0-3 ft below ground surface [bgs]), and gray to brown clay with some silt and little gravel beneath the sand stratum to a depth ranging from approximately 7.5 to 12 ft bgs. Underlying the clay stratum is the Canajoharie Shale with an apparent northeast dip.

2. NATURE AND EXTENT OF CONTAMINATION

The following sections briefly summarize the environmental impacts at the former Camarota Cleaners. This section is organized by areas of potential concern for the former Camarota Cleaners site. Areas of concern and the impacts associated with the environmental media are based on analytical results and their comparison with the appropriate standards, criteria, and guidance (SCGs). The areas of concern discussed are soil, groundwater, and vapor.

2.1 VOLATILE ORGANIC COMPOUNDS IN ON-SITE SOIL

No evidence of source area soil contamination has been identified on-site. Soil sampling during the 2006 Soil Vapor Intrusion Investigation and the 2008 RI have detected trace concentrations of volatile organic compounds (VOCs), but none greater than SCGs.

2.2 CHLORINATED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Groundwater has been impacted by chlorinated volatile organic compounds (CVOCs). The following table summarizes the degree of impacts of the contaminants of concern (COCs) and compares the data with the SCGs for the site. As previously stated, this FS is focused on groundwater defined as the on-site source area.

SUMMARY OF DEGREE OF IMPACT FROM CHEMICALS OF CONCERN IDENTIFIED DURING THE REMEDIAL INVESTIGATION

Groundwater	Chemical of Potential Concern	Concentration Range Detected (µg/L)	SCG (µg/L)	Frequency of Exceeding SCG
CVOCs	*cis*-1,2-Dichloroethene	ND-180	5	15/45
	trans-1,2-Dichloroethene	ND-7.4	5	2/45
	Tetrachloroethene (PCE)	ND-130	5	19/45
	Trichloroethene (TCE)	ND-39	5	15/45
	Vinyl Chloride	ND-62	2	11/45

NOTE: µg/L = micro grams per liter
NYSDEC Ambient Water Quality Standards Class GA (µg/L)

- Shallow overburden groundwater on-site has been contaminated by VOCs, specifically CVOCs, due to the former operational history of the site as a dry cleaner. PCE and its common degradation compounds have been detected in on-site groundwater above the site SCGs.

- Bedrock groundwater on-site does not appear to be contaminated with CVOCs; however, a groundwater sample collected from monitoring well MW-09 in September 2008

detected an estimated vinyl chloride concentration (2.4 J µg/L) slightly above the SCG. No other VOCs have been detected in the bedrock monitoring wells on-site.

- Based on the geometry and areal distribution of the dissolved-phase CVOC plume, impacted groundwater has migrated off-site and a single off-site estimated concentration of PCE was detected in MW-06, an off-site benchmark monitoring well located approximately 120 ft east and hydraulically downgradient of the site. Off-site migration has occurred, but remains within close proximity to the site and concentrations from the off-site monitoring wells remain below applicable SCGs.

- Groundwater water quality parameters and analytes, monitored natural attenuation data, and the results of the biotrap CENSUS analysis performed under the RI activities indicate that while groundwater conditions exhibit an anaerobic state favorable for reductive dechlorination, the process will be slow and is currently being limited by deficiencies in available electron donors in the substrate and methanogen bacteria out competing more favorable reductive dechlorination microbial communities, specifically *dehalococodies*.

- Historical groundwater analytical data dating back to 1992, reveal a reduction in the groundwater concentrations of PCE to the south of the building. Concentrations of PCE in groundwater in the area to the south of the on-site structure have decreased from 1,100 µg/L in 1992 to a high of 36 µg/L (MW-02) in April 2009.

2.3 CHLORINATED VOLATILE ORGANIC COMPOUNDS AND VAPOR INTRUSION EVALUATION

A vapor intrusion evaluation was completed as part of the RI activities in accordance with the New York State Department of Health (NYSDOH) Soil Vapor Intrusion (SVI) Guidance document[4]. Based on an evaluation of the SVI data collected during the RI, the NYSDEC and NYSDOH recommended that no further action is required.

2.4 CURRENT REMEDIATION ACTIVITIES

The following remediation systems are in place at the site to address vapor intrusion on-site and groundwater contamination.

2.4.1 Sub-slab Depressurization System

A sub-slab depressurization system (SSD) was installed by Alpine Environmental Services, Inc. in May 2007. The SSD was installed as an interim remedial measure (IRM) due to the continued detection of elevated concentrations of PCE in sub-slab vapor beneath the on-site structure. The on-site SSD system consists of 4 in. polyvinyl chloride piping, eight subslab suction points, three

4. NYSDOH, October 2006. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

ball valves and dampers for system balancing, and a RadonAway GP501 fan and exhaust system mounted to the rear (south) of the structure.

Upon completion of the RI, the on-site SSD was determined to be operating in accordance with NYSDOH SVI Guidance and American Society for Testing and Materials E2121.

2.4.2 Phytoremediation

The CVOCs in the groundwater on-site are currently being addressed by phytoremediation. Phytoremediation is a process where interactions between vegetation, associated microorganisms, and the host substrate combine to effectively degrade contaminated soils, sediments, and groundwater. Six specific processes are commonly associated with the phytoremediation process. These processes and methods for quantifying their contributions are:

- ***Phytoextraction***—The uptake and translocation of dissolved-phase contaminants from groundwater to plant tissue.

- ***Phytocontainment***—Transpiration from trees induces a cone of depression to contain contaminated groundwater. (Native or planted vegetation must transpire enough water from the groundwater containing the contaminant to control transport or decrease contaminant mass).

- ***Phytostimulation***—Plant roots excrete compounds containing organic carbon, which serve as a food source for microorganisms (e.g., sugars, alcohols, and acids).

- ***Phytodegradation***—Natural substances in a tree's roots, stems, and leaves aid in degrading organics (e.g., PCE).

- ***Phytovolatilization***—Multimedia transfer of contaminants from water or soil to the atmosphere (i.e., the plant's ability to remove organic compounds like PCE from the roots, bark, and leaf surface occurs as it moves through the plant).

- ***Phytostabilization***—Plants bind contaminated soils in place, resulting in immobilization of toxic contaminants.

In April 2007, 27 poplar trees were planted on the site to act as an IRM for groundwater through uptake via the trees.

3. DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

Goals for the remedial program have been established through the remedy selection process stated in 6 New York Code of Rules and Regulations (NYCRR) Part 375. The remedial goal for all remedial actions is considered to be the restoration of the site to the pre-disposal/pre-release conditions to the extent practicable and legal. Remedial action objectives (RAOs) are defined as the medium specific or operable-unit specific cleanup objectives to provide protection of public health and the environment. The RAOs are based on contaminant specific SCGs defined in the RI.

3.1 CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

Cleanup standards for groundwater are presented in the following table.

CLEANUP STANDARDS, CRITERIA, AND GUIDANCE		
Chemical of Potential Concern	Concentration Range Detected (µg/L)	SCG (µg/L)
cis-1,2-Dichloroethene	ND-180	5
trans-1,2-Dichloroethene	ND-7.4	5
PCE	ND-130	5
TCE	ND-39	5
Vinyl Chloride	ND-62	2
NYSDEC Ambient Water Quality Standards Class GA (µg/L)		

The SSD is being operated in accordance with the NYSDOH SVI guidance document. This guidance is not a regulation or requirement, but it is recommended by the NYSDEC for use as the methodology for the evaluation and mitigation of SVI.

3.2 OTHER POTENTIALLY APPLICABLE REQUIREMENTS

The NYSDEC Environmental Remediation Programs guidance (6 NYCRR Part 375) requires that site remedies "*conform to standards and criteria that are generally applicable, consistently applied, and officially promulgated, that are either directly applicable, or that are not directly applicable but are relevant and appropriate, unless good cause exists why conformity should be dispensed with* [6 NYCRR Part 75, 375-1.8(f)(2)]". The primary requirements are presented in the following table.

SCGS FOR THE FORMER CAMAROTA CLEANERS REMEDY	
Requirement	Rationale
FEDERAL	
Clean Water Act **National Pollution Discharge Elimination System 40 CFR Part 122** The National Pollution Discharge Elimination System establishes permitting requirements, technology-based limitations and standards, control of toxic pollutants, and monitoring of effluents to assure discharge permit conditions and limits are not exceeded.	Applicable if groundwater will be extracted from ground and discharged.
Safe Drinking Water Act (National Primary and Secondary Drinking Water Regulations) (42 U.S.C. 300f, 40 CFR Part 141, 40 CFR Part 143) The Safe Drinking Water Act provides a national framework to ensure the quality and safety of drinking water. The primary standards establish maximum contaminant levels and maximum contaminant level goals for chemical constituents in drinking water. Secondary standards pertain primarily to the aesthetic qualities of drinking water.	The removal action is being conducted to reduce chemical concentrations in soil and groundwater, with a goal of meeting cleanup levels at the property boundary.
Clean Air Act, as Amended (42 U.S.C. 7401) The Clean Air Act is a comprehensive law which is designed to regulate any activities that affect air quality, and provides the national framework for controlling air pollution. The National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) set standards for ambient pollutants which are regulated within a region. The National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61) establishes numerical standards for hazardous air pollutants.	The Clean Air Act will be required if any remediation alternatives produce air emissions.
Resource Conservation and Recovery Act Provides the governing regulations for owners and operators of hazardous waste treatment, storage, and disposal facilities; and for the generators and transporters of hazardous waste.	All waste generated during the removal action will be characterized and handled per Resource Conservation and Recovery Act regulations, as implemented by WAC 173-303.
Occupational Safety and Health Act (29 CFR 1910) Establishes the worker health and safety requirements for operations at hazardous waste sites.	Site activities will be conducted under appropriate Occupational Safety and Health Act standards.
Rules for Transport of Hazardous Waste (49 CFR 107, 171) The U.S. Department of Transportation establishes requirements for packaging, handling, and manifesting hazardous waste.	Any hazardous waste generated during site activities will be characterized as needed to determine packaging, handling, and transport requirements.
STATE	
New York State Department of Environmental Conservation Environmental Remediation Programs. 6 NYCRR Part 375 This program applies to the development and implementation of remedial programs for environmental restoration sites.	Site cleanup will be conducted in accordance with 6 NYCRR Part 375.
Solid Waste Management Facilities. 6 NYCRR Part 360 Provides standards and regulations for permitting and operating solid waste management facilities.	These regulations will be followed for off-site generation, treatment, and disposal of hazardous waste (if generated during the removal action).
Waste Transporter Permits. NYCRR Part 364 Provides standards and regulations for waste transporters.	
Land Disposal Restrictions. 6 NYCRR Part 376	
Hazardous Waste Management System. 6 NYCRR Part 370, 371, 372, 373, 375 Provides standards and regulations for the state hazardous waste management system, identification and listing of hazardous wastes, and provides standards, regulations, and guidelines for the manifest system, as well as additional standards for generators, transporters, and facilities.	

SCGS FOR THE FORMER CAMAROTA CLEANERS REMEDY	
Requirement	Rationale
New York State Department of Transportation Rules for Hazardous Materials Transport. 49 CFR, Parts 107, 171.1-500. Addresses requirements for marking, manifesting, handling, and transport of hazardous materials; applicable if offsite treatment or disposal of wastes is required.	
Water Quality Regulations for Surface Waters and Groundwater. 6 NYCRR Part 700-705 Provides standards, regulations, and guidelines for the protection of waters within the state.	Water discharged from the site will comply with this guidance.
Air Quality Standards. 6 NYCRR Part 257 Air quality standards are designed to provide protection from the adverse health effects of air contamination; and they are intended further to protect and conserve the natural resources and environment.	All substantive requirements of the State air pollution control regulations will be followed during implementation of the remedial action.
Guidance for Evaluating Soil Vapor Intrusion in the State of New York Provides guidance for evaluating soil vapor intrusion.	These guidelines will be used to evaluate SVI at the site.
LOCAL	
Land development standards, storm water and surface water regulations, and clearing and grading requirements.	Local permits are required depending on the selected remedial action.
Building permits and building codes.	Local permits are required depending on the selected remedial action.

4. SCOPING AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

A screening review of remedial technologies was submitted to the NYSDEC in a letter dated 7 October 2009. The screening was completed based on discussions between EA and the NYSDEC upon completion and approval of the RI report. EA has completed the technology screening in accordance with DER-10 and the 1988 USEPA publication *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA l540lG-891004). The screening was designed to provide a basis for an overall assessment of applicable technologies based on impacted media identified at the site during the RI. The list of alternatives was limited to three to focus the FS on known and frequently implemented alternatives used for remediation of CVOCs in the environment.

The RI report concluded that no contamination was identified in on-site soil and that shallow overburden groundwater contamination would be addressed in this FS. Currently, two IRM have been implemented at the site: an active SSD system at the on-site structure, and phytoremediation of shallow groundwater along the south and east sides of the on-site structure.

The screening assessed seven different technologies (including the no action alternative) for applicability of the site. The technology screening compared no action, natural attenuation, no further action with site management, *in-situ* enhanced bioremediation, *in-situ* thermal treatment, *in-situ* chemical reduction, and *ex-situ* groundwater pump and treat, according to applicable guidance using the following five categories:

- Compliance with RAOs
- Effectiveness
- Implementability
- Reduction of toxicity, mobility, and volume
- Cost.

The screening matrix is presented in Table 1. Of the technologies screened, three were retained for further analysis. The three remedial alternatives that will be retained for evaluation through this FS are: No Action, no further action with site management, and Enhanced Bioremediation or Bioaugmentation.

4.1 ALTERNATIVE 1: NO FURTHER ACTION

The No Further Action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the site in its present condition, meaning that the SSD system would no longer be maintained, and would not provide any additional protection to human health or the environment.

4.2 ALTERNATIVE 2: NO FURTHER ACTION WITH SITE MANAGEMENT

The second potential remediation alternative to be evaluated for the site is no further action with site management. Site Management consists of monitoring groundwater COCs to ensure the contamination footprint and contaminant concentrations are stable or decreasing. Evidence of decreased oxygen content in groundwater, and byproducts of degradation of CVOCs, indicate that natural attenuation may already be ongoing at the site. This alternative includes:

- Continued operation and maintenance of the IRM SSD system.
- Long-term groundwater monitoring for VOCs.
- Implementation of environmental easement to include a Site Management Plan.

4.3 ALTERNATIVE 3: *IN-SITU* ENHANCED BIOREMEDIATION OR BIOAUGMENTATION ALTERNATIVE

In-situ enhanced bioremediation or bioaugmentation is the third potential remediation alternative that will be evaluated for the site. Enhanced bioremediation is when carbon and/or nutrients are added to contaminated areas to stimulate existing microbes that feed off of the contaminants. Bioaugmentation is a process where specific microbes are added to the contaminated areas to breakdown COCs into non-toxic by-products. Since aquifers vary in chemical content, physical properties, and availability of naturally occurring microbes capable of breaking down the COCs, it is necessary to evaluate the site to determine the best means to enhance or augment the bioremediation of the COCs. For costing purposes, enhanced bioremediation was evaluated.

This alternative includes:

- Bench scale study to evaluate the effectiveness of enhanced bioremediation versus bioaugmentation
- Installation of injection well(s)
- Continued operation and maintenance of the IRM SSD system
- Long-term groundwater monitoring for VOCs
- Implementation of environmental easement to include a Site Management Plan.

A preliminary design layout for this alternative is presented in Figure 4.

5. DETAILED ANALYSIS OF ALTERNATIVES

This section describes the process for the detailed analysis of remedial alternatives for the Camarota Cleaners site and presents the FS level cost estimates also used as part of the analysis.

The detailed analysis of the remedial alternatives is presented in Table 2.

5.1 CRITERIA USED FOR ANALYSIS OF ALTERNATIVES

The criteria to which potential remedial alternatives are compared (and used during this detailed analysis) are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York, and are listed below:

- Overall protectiveness of the public health and the environment
- SCGs
- Long-term effectiveness and permanence
- Reduction in Toxicity, mobility, or volume of contamination through treatment
- Short-term impacts and effectiveness
- Implementability
- Cost-effectiveness
- Land use.

A description of the criteria and how alternatives are evaluated against them follows.

Overall Protectiveness of the Public Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Standards, Criteria, and Guidance. Compliance with SCGs addresses whether a remedy would meet environmental laws, regulations, and other standards and criteria. The SCGs are presented in Section 3.

Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

Reduction of Toxicity, Mobility, or Volume of Contamination Through Treatment. The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of

treatment residuals generated. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

Short-term Impacts and Effectiveness. Evaluation of the short-term effectiveness for an alternative includes consideration of the risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Impacts from remedial action implementation include vehicle traffic; temporary relocation of residences/buildings; temporary closure of public facilities; odor; open excavations; and noise, dust, and safety concerns associated with extensive heavy equipment activity. The greatest short-term risk to human health is related to safety and general construction activity.

Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria it can be used as the basis for the final decision.

Land Use. The current and anticipated future use of the site will be considered. Land use must comply with applicable zoning laws and maps.

5.2 COST ASSUMPTIONS

Costs for each remedial alternative were developed as part of the FS process. Cost assumptions were prepared for each alternative using USEPA's *Guide to Developing and Documenting Cost Estimates during the Feasibility Study*[5]. Net present value of the project costs were estimated using an interest rate of 5 percent. The cost assumptions were calculated using the most common products and application methods available for a remedial alternative. The USEPA guidance was used with modifications as directed by NYSDEC.

Cost Assumptions

There are many different means and methods that could be used to accomplish the alternatives being compared for the former Camarota Cleaners site. To prepare the cost assumptions for this FS, the following assumptions were made for each alternative. These assumptions used standard

5. USEPA. 1996. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*. USEPA 542-F-96-007. USEPA Office of Solid Waste and Emergency Response. April.

means and methods, and made assumptions using data available from the RI. These methods and assumptions will be refined during subsequent design activities, following alternative selection.

Alternative 2: No Further Action With Site Management

This alternative would be implemented as follows:

- Baseline samples would be collected from nine monitoring wells (MW-01, MW-02, MW-03, MW-04, MW-05, MW-06, MW-07, MW-08, and MW-09). Each of the samples will be analyzed for VOCs.

- Groundwater samples would be collected semi-annually to measure the concentration of VOCs in groundwater (anticipated to be 10 years).

- IRM SSD system would require maintenance. System will be checked during each sampling event to confirm it is operating properly. Fan will be replaced as needed, which is anticipated to be replaced once every 10 years.

- Preparation of easement and Site Management Plan are limited in scope and estimated to cost no more than $25,000 to prepare and file.

Alternative 3: In-Situ Enhanced Bioremediation or Bioaugmentation

This alternative would be implemented as follows (note, with the exception of the bioenhancement/augmentation component, this alternative is very similar to Alternative 2):

- Soil and groundwater samples would be collected and used for bench scale tests to determine the most effective additives to encourage bioremediation at the site.

- Baseline samples would be collected from nine monitoring wells. Each of the samples would be analyzed for natural attenuation parameters: VOCs, chloride, nitrate/nitrite, methane, ethane/ethane, alkalinity, total organic carbon, sulfate, and sulfide.

- Injection wells and/or direct-push injection would be used to deliver the selected additives to the contaminated zones of groundwater. Wells would be screened from approximately 4 to 11 ft bgs. If direct push is the selected delivery method, injections would occur every foot from 4 to 11 ft bgs. For 25 injection wells and/or direct-push injections, it is assumed that 4 days of drilling or direct-push injections would be sufficient.

- Groundwater samples would be collected semi-annually to measure the concentration of VOCs in groundwater (anticipated to be 4 years).

- Semi-annual samples would be collected for a 4-year period to measure the parameters described above, which could be used to evaluate the effectiveness of the bioenhancement/bioaugmentation process.

- IRM SSD system would require minimal maintenance. System would be checked during each sampling event to confirm it is operating properly. Fan would be replaced as needed, which is anticipated to be replaced once every 10 years.

- Preparation of easement and Site Management Plan are limited in scope and estimated to cost no more than $25,000 to prepare and file.

5.2.1 Costs

Based on the results of the remedial technology screening in Table 1, the following cost estimates were prepared for Alternatives 1, 2, and 3.

Alternative 1: **No Further Action**

Present Worth: ..... *{$0}*
Capital Cost: ..... *{$0}*
Annual Costs:
(Years 0): ..... *{$0}*

Alternative 2: No Further Action with Site Management

Present Worth: ..... *{$75,000}*
Capital Cost: ..... *{$28,000}*
Annual Costs:
(Years 2-10): ..... *{$6,000}*

Alternative 3: ***In-Situ*** **Enhanced Bioremediation or Bioaugmentation Alternative**

Present Worth: ..... *{$149,000}*
Capital Cost: ..... *{$91,000}*
Annual Costs:
(Years 2-5): ..... *{$16,000}*

6. RECOMMENDATIONS

The purpose of this FS was to develop, screen, and evaluate potential remedial alternatives for the former Camarota Cleaners. Remedies were identified and screened in accordance with USEPA and NYSDEC guidance.

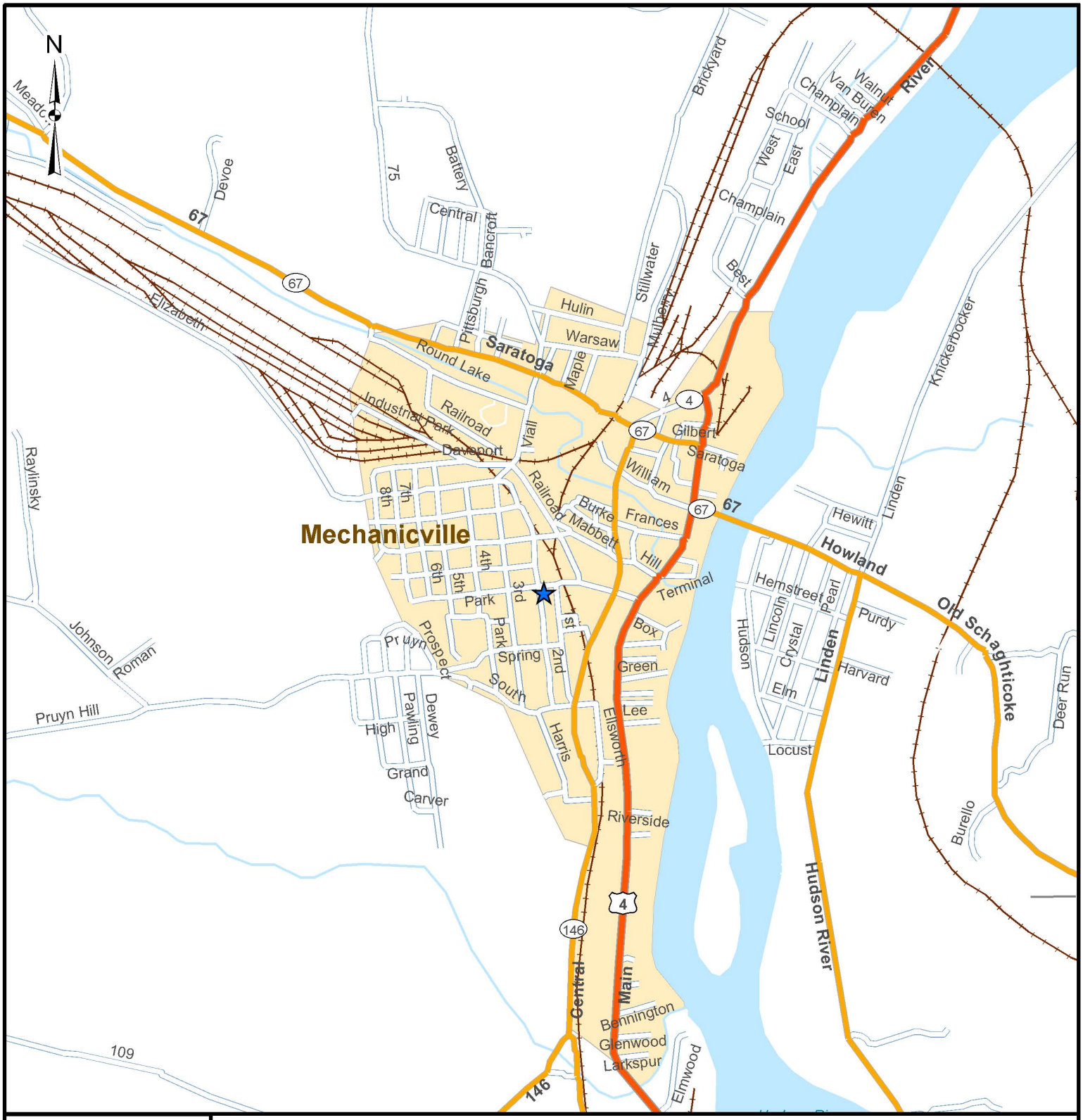
Three remedial alternatives were developed in this FS, as identified below.

- Alternative 1—No Further Action
- Alternative 2—No Further Action with Site Management
- Alternative 3—*In-Situ* Enhanced Bioremediation or Bioaugmentation Alternative

Alternative 1 does not meet any of the RAOs. Alternative 2 may meet RAOs over time through naturally occurring degradation and influences of the IRMs, but needs to be proven through long-term monitoring. Alternative 3 actively addresses COCs and most RAOs will be met through this alternative.

Alternative 2 is recommended over Alternative 3 for the following reasons.

- With low COC concentrations and minimal impacts to public health and the environment, an active remediation alternative is unnecessary. Groundwater monitoring can be used to monitor concentrations and plume areas to identify potential problems, such as a spike in COC concentrations or plume migration.
- Natural attenuation appears to be ongoing; therefore, COC concentrations will continue to decrease without the implementation of a remedial technology.
- The cost of Alternative 2 is less than Alternative 3.



LEGEND

★ Site Location

Miles

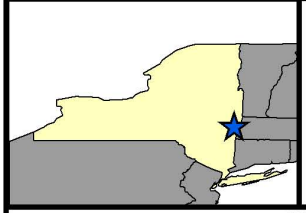
0 0.25 0.5 1

Source: NYSDEC, USGS Seamless Data Distribution

CAMAROTA CLEANERS (Site No. 5-46-044)
MECHANICVILLE, NEW YORK

FIGURE 1
SITE LOCATION

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	MJS	FDJR	JAV	AS SHOWN	JANUARY 2010	14368.22	GIS/PROJECTS/ FIGURE1_1.MXD



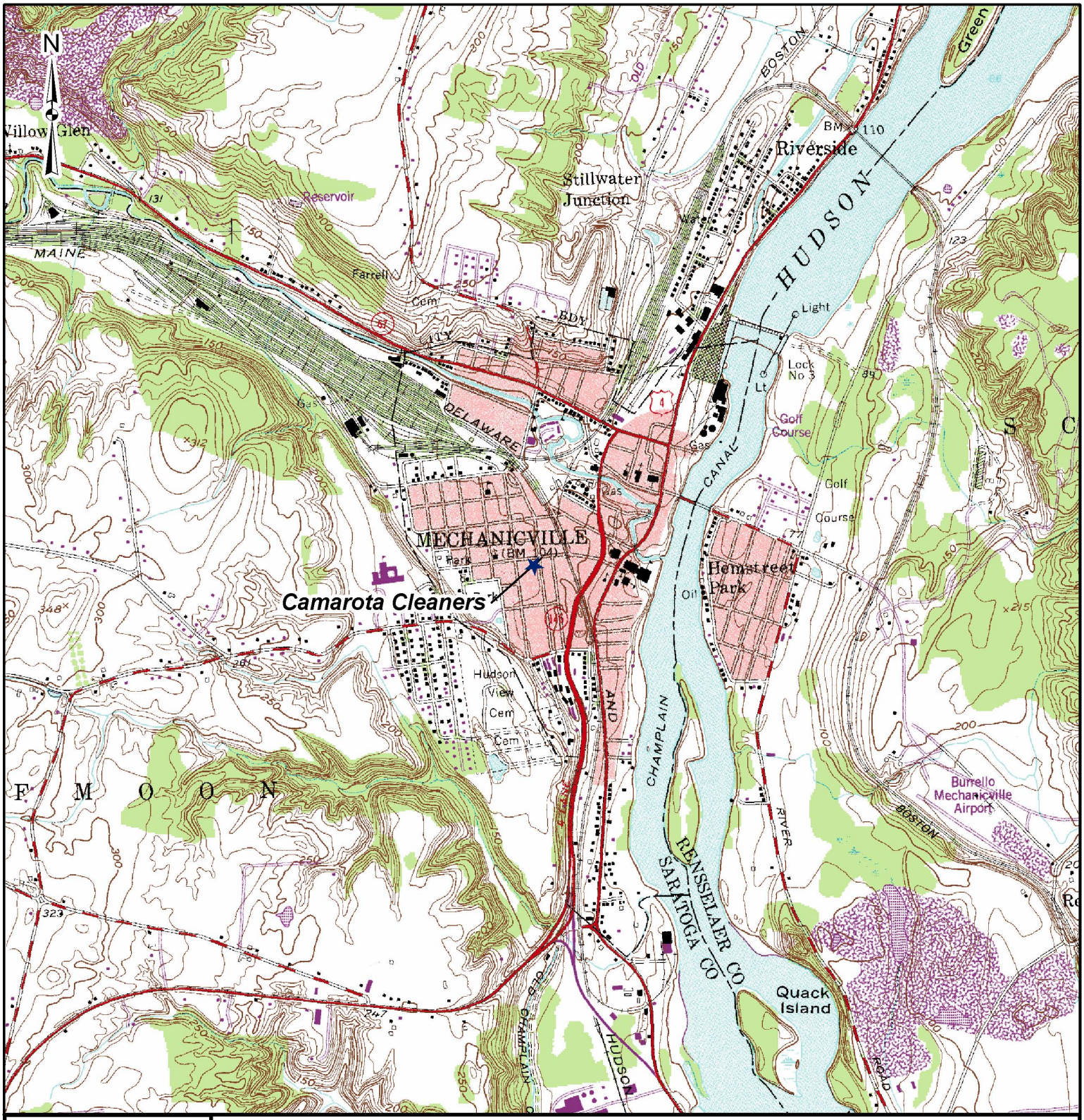
Feet
0 25 50 100

Source: NYS Office of Cyber Security and Critical Infrastructure Coordination (CSCIC)

CAMAROTA CLEANERS (Site No. 5-46-044)
FEASIBILITY STUDY
MECHANICVILLE, NEW YORK

FIGURE 2
SITE MAP

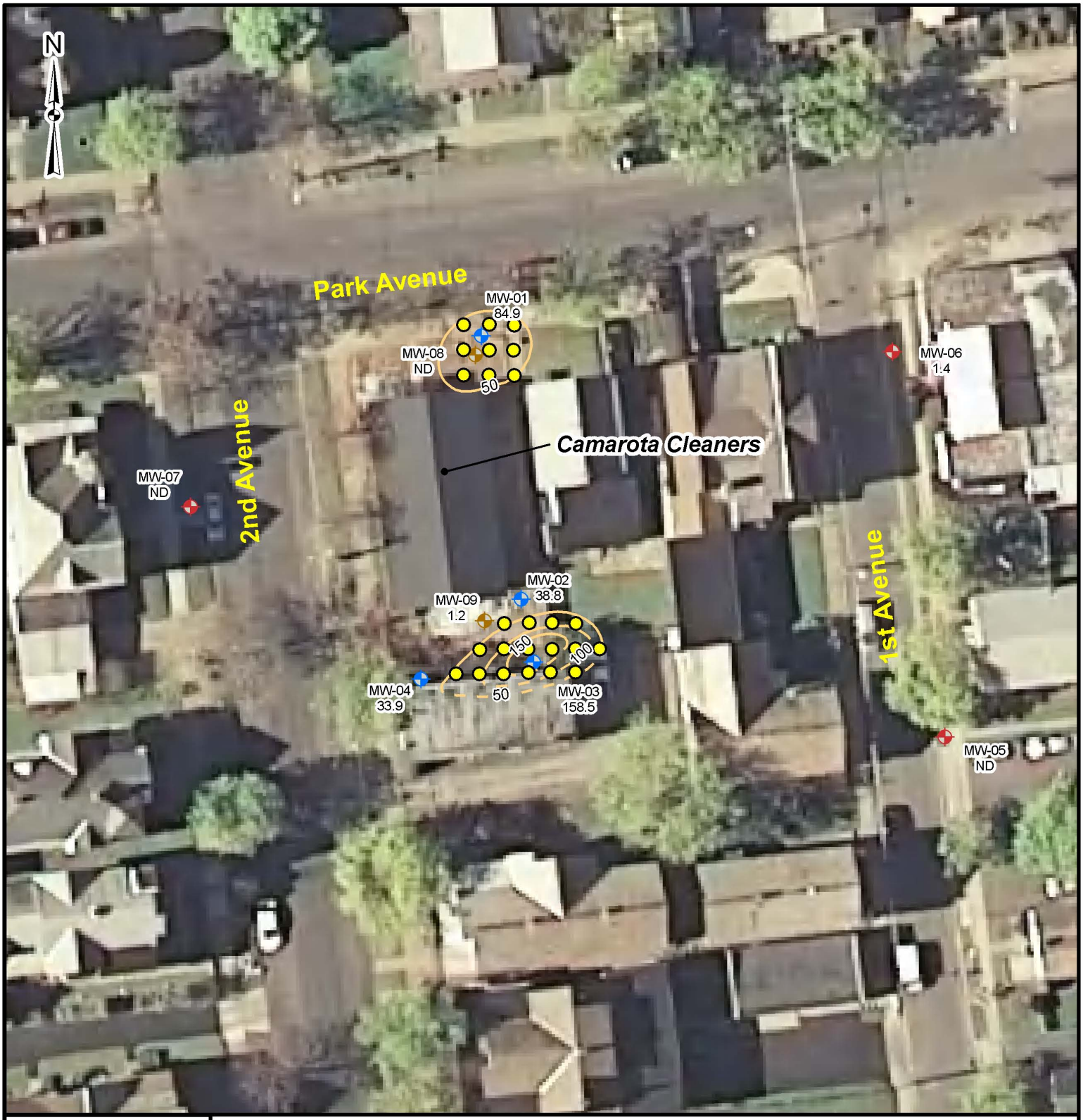
PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	MJS	MJS	JAV	AS SHOWN	JANUARY 2010	14368.22	GIS/PROJECTS/ FIGURE1_2.MXD

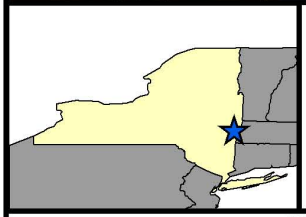


CAMAROTA CLEANERS (Site No. 5-46-044)
MECHANICVILLE, NEW YORK

FIGURE 3
TOPOGRAPHIC QUADRANGLE MAP

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	MJS	FDJR	JAV	AS SHOWN	JANUARY 2010	14368.22	GIS/PROJECTS/ FIGURE1_3.MXD





Legend

- Existing Monitoring Well
- New Overburden Monitoring Well
- New Bedrock Monitoring Well (Analytical data not used to develop isopleth)
- InjectionPoints

Total CVOC Contour

- Data Supported
- Interpolated

0 25 50

Feet

Source: NYS Office of Cyber Security and Critical Infrastructure Coordination (CSCIC)

CAMAROTA CLEANERS
(Site No. 5-46-044)
FEASIBILITY STUDY
MECHANICVILLE, NEW YORK

FIGURE 4
ALTERNATIVE 3
ENHANCED BIOREMEDIATION/BIOAUGMENTATION
PROPOSED INJECTION LOCATIONS

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	MJS	MJS	JAV	AS SHOWN	JANUARY 2010	14368.22	GIS/PROJECTS/ FIGURE3_21.MXD

TABLE 1 REMEDIAL TECHNOLOGY SCREENING

General Response Action	Remedial Technology Type	Process Options	Technology Description	Effectiveness	Implementability	Relative Cost	Retained for Detailed Evaluation?	Comments
No Further Action	None	Not Applicable	No technologies are employed at the site to actively remediate contaminants of concern (COCs)	**Ineffective**	**Implementable**	**Low**	Yes	The No Further Action alternative will be carried through the evaluation for comparative purposes as required by applicable guidance.
Natural Attenuation (NA)		Not Applicable	NA with monitoring allows natural processes to achieve site-specific remedial objectives without enhancement or aggressive treatment. The "natural attenuation processes" that are at work in such a remediation approach include physical, chemical, or biological processes, that under favorable conditions, reduce the mass, toxicity, mobility, volume, or concentration of contaminants in the ground water. NA processes that could occur include biodegradation (aerobic or anaerobic), abiotic transformation (e.g., hydrolysis), adsorption, dispersion, or dilution.	**Potentially Effective-**Dependent on COC and initial contaminant source removal efficiency as well as attenuation capacity of the hydrogeologic system.	**Implementable** - Easily implemented, well documented approaches, long-term sampling programs	**Low -** No capital investment required, long-term monitoring costs and potential for additional treatment if stall occurs.	No	No Futher Action with Site Management
No Further Action with Site Management		Not Applicable	Process is identical to Natural Attenuation; however, the monitoring requirements are reduced. If continued monitoring indicates increasing or migrating contaminant concentrations, alternate remedial technologies will be required.	**Potentially Effective-**Dependent on COC and initial contaminant source removal efficiency as well as attenuation capacity of the hydrogeologic system. Process is identical to Natural Attenuation, however the monitoring requirements are reduced.	**Implementable** - Easily implemented, well documented approaches, long-term sampling programs	**Low -** No capital investment required, long-term monitoring costs and potential for additional treatment if stall occurs.	Yes	Results of the remedial investigation indicate that NA may be ongoing at the site. Due to the low concentrations of chemical contaminants at the site, groundwater monitoring of the specific COC will be used as indicateors of NA, and will be used to make sure the contaminants are not increasing or migrating to downgradient monitoring wells.
Treatment Actions	*In-Situ* Treatment	*In-situ* Enhanced Bioremediation or Bioaugmentation	Enhanced bioremediation involves adding nutrients, bacteria and/or carbon substrates to the subsurface to stimulate microbial growth and the biodegradation of contaminants.	**Effective** - proven to provide anaerobic conditions in subsurface environment. Limited effectiveness in low permeability lithology.	**Implementable** -Provides anaerobic environment for biodegradation of volaitle organic compounds (VOCs), typically initial COC spikes occur prior to degradation process	**Moderate -** Average capital investment, long-term monitoring, can require repetitive applications	Yes	Results of the remedial investigation indicate that biological breakdown of contaminants may be occurring at the site. This technology will be carried through alternative evaluation because it is relatively low cost, is implementable and effective.
		In-situ Thermal Treatment	In-situ thermal treatment uses heat to evaporate or destroy contaminants of concern in groundwater. The evaporated contaminants are then captured and treated.	**Effective** -Treats COCs. RAOs are achieved in short time frame.	**Implementable** - Technology has been demonstrated, limited case studies in bedrock application	High capital investment, reduced long-term monitoring and no O&M costs.	No	With relatively low contaminant concentrations, the high capital costs of this alternative are not justified and it will not be carried through the alternative evaluation.
		In-situ Chemical Reduction	Groundwater contamination is treated by adding reducing agents to the aquifer to reduce COCs into their non-toxic byproducts.	**Effective** -Treats COCs based on bench scale or pilot treatment study, effective in the short-term usually RAOs are achieved within 12-month period.	**Implementable** - established treatment process, intensive and intrusive installation, short duration of treatment application.	**Moderate -** Average capital investment, reduced long-term monitoring and no O&M costs.	No	Do not know impact of reducing additives to the trees and organic substrate added to the soils currently in place for phytoremediation.
	Ex-Situ Treatment	*Ex-situ* Groundwater Pump and Treat	Groundwater is pumped to the surface and treated. A variety of treatment methods can be used.	**Potentially Effective-**Uncertainty on effectiveness, can operate until RAOs are achieved, long-term operation and maintenance (O&M)	**Implementable** - Established technology, longer installation process with pilot study	**High -** high capital investment and O&M costs, monitoring would still be required.	No	With relatively low contaminant concentrations, the high capital costs of this alternative are not justified and it will not be carried through the alternative evaluation. There is limited space for treatment equipment. Long Term operation and maintenance would be required.

TABLE 2 REMEDIAL TECHNOLOGY SCREENING DETAILED ANALYSIS

Criteria	Alternative 1 No Further Action	Alternative 2 No Further Action with Site Management	Alternative 3 *In-Situ* Enhanced Bioremediation or Bioaugmentation
Overall Protectiveness of the Public Health and the Environment	Does not achieve Rememdial Action Objectives (RAOs).	May, with time, achieve RAOs. Institutional controls may be necessary. Monitoring will provide a warning system.	Most RAOs will be met.
Standards, Criteria, & Guidance (SCGs)	Does not meet SCG criterion; waiver would be required if implemented.	Will meet SCG criterion.	Will meet SCG criterion.
Long-Term Effectiveness & Permanence	Not effective in the long term. Leaves residual contamination in place. No change in current risk to the public and the environment. Remedy will not achieve long-term compliance with RAOs.	Potential for long-term compliance with RAOs; however, potential also exists for continued contamination migration due to stalled attenuation.	Contamination will be reduced permanently over the long term.
Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment	No reduction in toxicity, mobility, or volume of contamination.	Toxicity and Volume of contamination may be reduced; no reduction in mobility.	Toxicity and Volume of contamination may be reduced; no reduction in mobility.
Short-Term Impacts and Effectiveness	No short-term impacts to the community, site workers, or the environment as a result of implementation of this alternative. Does not achieve goundwater RAOs in the short-term.	No short-term impacts to the community, site workers, or the environment as a result of implementation of this alternative. Does not achieve groundwater RAOs in the short-term.	Some short-term impacts to the community, site workers, and the environment as a result of implementation of this alternative. Implementation requires injection of chemicals into the subsurface using direct push injection. Other heavy equipment will be used on site, causing potential disruption to traffic, dust and noise. Impacts will last approximately 4 days. Does not achieve RAOs in the short-term.
Implementability	Technically and administratively feasible to implement.	Technically and administratively feasible to implement.	Technically and administratively feasible to implement.
Cost Effectiveness (Present Value, including captial cost and 10 years of monitoring)	$ -	$ 75,000	$ 149,000
Land Use	Does not negatively impact current or future land use.	Implementation of this alternative is consistent with restoring site to current and potential land use scenarios, which is currently zoned residential, but has historically been zoned commerical.	Implementation of this alternative is consistent with restoring site to current and potential land use scenarios, which is currently zoned residential, but has historically been zoned commerical.
Recommended Alternative Rationale	**Pros:** Low cost **Cons:** Does not achieve RAOs, does not meet SCG criterion	**Pros:** Low cost, may achieve RAOs over time, only if RAOs met will meet SCG criterion **Cons:** Will take longer to meet RAOs and SCG criterion compared to Alternative 3	**Pros:** Most RAOs will be met, will meet SCG criterion **Cons:** Most expensive of the three alternatives. Injections will occur at adjacent off-site property.