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FEASIBILITY STUDY
CASTLE CLEANERS SITE
221 HOFFMAN STREET
ELMIRA, NEW YORK
NYSDEC SITE NO. 808034

Prepared For:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Prepared By:

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221 Hoffman Street
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Certification

I, Kenneth Teter, P.E. 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 Draft DER Technical Guidance for Site Investigation and Remediation dated May 2010 (DER 10).

10/7/13

Kenneth Teter, P.E. Date

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The Castle Fast Dry Cleaners, Inc. (Castle Cleaners) was listed on the registry for Inactive Hazardous Waste Sites in 2009. Castle Cleaners entered into an Order on Consent and Administrative Settlement (Order) with New York State Department of Environmental Conservation (NYSDEC), Index #B8-0779-08-04, NYSDEC Site No. 808034. This Feasibility Study (FS) has been completed pursuant to the Order.

The FS uses the information from the Remedial Investigation (RI) to develop alternative remedies that will reduce or eliminate the site's identified impact on public health and the environment.

1.2 SITE BACKGROUND

1.2.1 Site Description

Castle Cleaners (Site) is located at 221 Hoffman Street in a mixed use (residential /commercial) area of the City of Elmira, New York (see Drawing No. 1). Historically, the address of 219-225 Hoffman Street was changed as part of a re-address associated with emergency planning. The Castle Cleaners site consists of a 0.1-acre rectangular parcel located on a block with other commercial buildings. There is one 1-story masonry and metal-framed building on the Castle Cleaners site with two commercial units.

The Site is bordered by commercial properties to the north and south with common masonry walls with the two adjacent buildings. There is a paved parking area to the west of the Site with residences further west. There is a multi-unit apartment building and a professional medical office further north of the Site across West Church Street. An Exxon Mobil convenience store and fuel dispensing station and a funeral home are located east of the Site across Hoffman Street.

1.2.2 Site History

A commercial building has occupied the Site since at least 1944. Castle Cleaners first appeared in the Elmira City directories at the Site in 1958. Other occupants of the Site building in the 1940's and 1950's include the Grand Union and Saprano's Foodland Market. On the 1931 Sanborn Map, two residential dwellings are present on the Site. The Site building is currently occupied by a dry cleaning operation and a former tavern (currently vacant).

It was noted in the Elmira City directories that from at least 1935 to 1960, West Side Dyers & Cleaners, Rex Cleaners, Cash & Carry Cleaners and Holiday Hobby & Dry Cleaning Shop occupied 209 (aka 205 ½) Hoffman Street. This address, located south of the Castle Cleaner Site, was most recently occupied by The Frame Shop.

1.2.3 Site Operations

The current dry cleaner uses tetrachloroethene in its dry cleaning services and operates as a certified facility under NYSDEC. The dry cleaning machine is housed in an enclosure inside the Site building that is vented to the outside on the west side of the building. A NYSDEC registered compliance inspector completes the NYCRR Part 232 Dry Cleaning Compliance Inspection Form on a yearly basis. No violations have been noted in the inspections.

1.2.4 City of Elmira Water Supply Wells

The City of Elmira has three water supply wells located on Foster Island within the Chemung River channel known as the 'Foster Island Wellfield'. Tetrachloroethene had been detected in Well No. 42; this well was subsequently taken out-of-service. There are two other water supply wells located on Foster Island, No. 40 and No. 41, which are currently in production as a source of water for the City of Elmira.

The City of Elmira Water Board collects samples on a quarterly basis from all three Foster Island water supply wells and submits the samples for volatile organic analyses by EPA Method 524.2. The Chemung County Health Department (CCHD) provided a chart summarizing the analytical results for total tetrachloroethene concentrations for all three wells (see Figure 1). The information provided indicates that the concentrations of tetrachloroethene reported at Well No. 42 between 2002 and 2013 have been at levels below 3 ug/L. The NYSDEC Technical & Operational Guidance Series, Ambient Water Quality Standards and Guidance Values for Groundwater (SCG) for tetrachloroethene is 5 ug/L. Tetrachloroethene has also been sporadically detected in Well No. 41 at levels at 1 ug/L or less. CCHD indicated that tetrachloroethene has not been detected in Well No. 40. The CCHD indicated to GeoLogic that Well No. 42 was removed from service in 2006 due to the concentrations of tetrachloroethene in that well. The water sources currently being utilized by the City of Elmira have been sufficient to meet demand since well no. 42 was taken out of service.

Elmira Water Board 2012 Annual Drinking Water Quality Report states that all raw water from the river, wells and reservoirs are blended and then pumped to their treatment facility where it undergoes settlement, filtration and disinfection processes. The report indicates that the Foster Island Wellfield Wells, Nos. 40 and No. 41, are in use and contributed approximately 21.3% of 2012’s source water. The typical output for these two wells is reported to be 1.5 to 2 million gallons per year.

2 NATURE AND EXTENT OF CONTAMINATION

The following sections summarize and discuss the analytical results generated during the RI. Soil, groundwater and soil vapor intrusion samples were collected to characterize the nature and extent of contamination.

The contaminants of concern (COCs) are chlorinated solvents, specifically Tetrachloroethene (PCE) and its transformation products, Trichloroethene (TCE), *cis* and *trans*-1,2-Dichloroethene (DCE), 1,1-Dichloroethene (1,1-DCE), Vinyl Chloride (VC), 1,1,1-Trichloroethane (1,1,1-TCA), 1,1-Dichlorothane (1,1-DCA), 1,2-Dichloroethane (1,2-DCA), and Chloroethane (CA).

The concentrations of COCs in the groundwater at the Site exceed the SCGs values, therefore the NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (Unrestricted SCOs) for the COCs will be used. The SCOs for semi-volatile, metals and PCB will be NYCRR Part 375 Restricted Commercial Use SCOs for the Protection of Public Health (Commercial SCOs).

2.1 On-Site Soil and Groundwater

The concentrations of volatile compounds, semi-volatile compounds and PCBs reported in the soils underlying the Site building do not exceed NYCRR Part 375 Restricted Commercial Use (Commercial SCOs) or the Restricted for the Protection of Groundwater (Restricted SCOs). The concentrations of iron, magnesium and/or calcium exceed both the Commercial and Restricted SCOs in several of the soil samples. These metals are not typically associated with dry cleaning operations and are considered representative of naturally occurring (background conditions). The soils that exhibited the highest concentrations of COCs were observed at the 6 to 8 foot interval below the building.

The concentrations of COCs in soils collected at the Site are all below the SCOs for Restricted Commercial use.

The number of samples analyzed, the range in COC concentrations observed, and the number of samples that exceeded the SCG or SCOs have been summarized for the on-site evaluation on the following two tables.

Table 2-1
Soil Contaminant Summary
On-Site Borings

Contaminant	Concentration Range *[ppm]*	Commercial SCO[1] *[ppm]*	Restricted SCO[2] *[ppm]*	No. of Excursions	No. Exceeding Restricted SCO[2]
COCs					
Tetrachloroethene	0.004J to 1.900	150	1.3	39	2
Trichloroethene	0.0054U to 0.014	200	0.470	39	0
cis-1,2-Dichloroethene	0.0053U to 0.010J	500	0.250	39	0

1 - SCO – Part 375-6.8 (b) Restricted Soil Cleanup Objective for Commercial Use
2 -SCO – Part 375-6.8 (b) Restricted Soil Cleanup Objective for the Protection of Groundwater

Groundwater at the Site has been impacted by COCs that exceed SCGs

Table 2-2
Groundwater Contaminant Summary
On-Site Borings

Contaminant	Concentration Range *[ppb]*	SCG *[ppb]*	No. of Excursions	No. Exceeding SCG
COCs				
Tetrachloroethene	25D to 3,800	5	7	7
Trichloroethene	2J to 680D	5	7	3
cis-1,2-Dichloroethene	1J to 2,300D	5	7	3
trans-1,2-Dichloroethene	5.0U to 20 JD	5	7	1
Vinyl Chloride	5.0U to 24JD	2	7	1

2.2 Off-Site Groundwater

Groundwater samples collected from monitoring wells and from soil borings in November 2010, April 2011 and January 2012 indicated the presence of COCs extending from the Site south to Winsor Street. Other volatile compounds associated with petroleum fuels were also detected in groundwater from the Exxon Mobil Gas Station south to West Water Street. The petroleum-related compounds are likely associated with a past petroleum release(s) at the Exxon Mobil Gas Station (NYSDEC Spill #95-08867) located on the southeast corner of Hoffman and W. Church Streets.

The City of Elmira has three water supply wells located on Foster Island within the Chemung River channel known as the 'Foster Island Wellfield'. Tetrachloroethene has been detected in Well No. 42 at concentration of less than 3 ug/L, and was subsequently taken out-of-service to prevent potential exposure. There are two other water supply wells located on Foster Island, No. 40, and No. (41 with tetrachloroethene concentration less than 1 ug/L,) which are currently in production as a source of water for the City of Elmira.

A summary of COCs in groundwater at locations hydraulically upgradient and downgradient of the Site are summarized on the following tables.

The following is a general summary of total contaminant concentrations for both COCs and other VOCs for work completed in November 2010 and April 2011, and January 2012.

Table No. 2-3
Off-Site Groundwater Contaminant Concentration Data at Borings

LOCATION	COCs	Other VOCs
	November 2010/April 2011	November 2010/April 2011
Boring		
GW-1 (40-44 ft)	ND	ND
OFDP-10.1 (25-28 ft)	ND	ND
OFDP-10.1 (46-50 ft)	ND	7
OFDP-10.2 (37-41 ft)	3	ND
OFDP-10.3 (14-18 ft)	89	19
OFDP-10.3 (24-28 ft)	629	89
OFDP-10.3 (36-40 ft)	7	ND
OFDP-10.4 (11-15 ft)	12	6
OFDP-10.4 (26-30 ft)	135	28
OFDP-10.5 (46-50 ft)	ND	ND
OFDP-10.6 (11.5-15.5 ft)	8	ND
OFDP-10.6 (37-41 ft)	ND	6
OFDP-10.7 (43-47 ft)	ND	ND
OFDP-10.8 (20-24 ft)	20	3,699
OFDP-10.8 (44-48 ft)	ND	2,513
OFDP-10.9 (12-16 ft)	18	ND
OFDP-10.9 (45-49 ft)	3	ND
OFDP-10.10 (12-16 ft)	ND	22
OFDP-10.10 (44-48 ft)	ND	ND
OFDP-10.11 (12-16 ft)	154	32
OFDP-10.11 (36-40 ft)	ND	ND
OFDP-10.12 (15-19 ft)	120	ND
OFDP-10.12 (40-44 ft)	ND	ND
OFDP-10.13 (15-19 ft)	15	10
OFDP-10.13 (26-30 ft)	46	ND
OFDP-10.14 (15-19 ft)	108	12
OFDP-10.14 (45-49 ft)	ND	ND
OFDP-10.15 (13-17 ft)	32	10
OFDP-10.15 (32-36 ft)	10	20
OFDP-10.16 (15-19 ft)	20	ND
OFDP-10.16 (45-49 ft)	3	ND
OFDP-10.17 (12-16 ft)	46	ND
OFDP-10.17 (28-32 ft)	3	ND
OFDP-10.18 (12-16 ft)	47	ND
OFDP-10.18 (17-21 ft)	35	ND
OFDP-10.19 (12-14 ft)	7	2
OFDP-10.19 (46-48 ft)	4	ND

LOCATION	*COCs*	*Other VOCs*
	November 2010/April 2011	*November 2010/April 2011*
OFDP-10.20 (14-16 ft)	5	2
OFDP-10.20 (38-40 ft)	ND	ND
OFDP-10.21(12-16 ft)	ND	ND
OFDP-10.21 (24-28 ft)	2	ND
OFDP-10.22 (12-16 ft)	5	2
OFDP-10.22 (26-30 ft)	27	ND

Table No. 2-4
Off-Site Groundwater Contaminant Concentration Data at Monitoring Wells

Location	*COCs [ppb]*		*Other VOCs [ppb]*	
	November 2010/ April 2011	*January 2012*	*November 2010/ April 2011*	*January 2012*
Monitoring Well				
OFDP-10.1 (5-15 ft)	6	29	ND	ND
OFDP-10.2 (7-17 ft)	153	41	ND	ND
OFDP-10.5 (8-18 ft)	ND	ND	ND	51
OFDP-10.7 (7-17 ft)	ND	ND	21	61
OFDP-10.8 (8-18 ft)	ND	ND	8,640	4,277
GW-1S (8-18 ft)	ND	ND	ND	ND
GW-1D (22-27 ft)	NS	ND	NS	ND
GW-2 (6.3-16.3 ft)	ND	ND	ND	ND
GW-4 (5.9-15.9 ft)	223	41	ND	ND
GW-8S (9.8-19.8 ft)	465	986	ND	ND
GW-8D (34-39 ft)	NS	ND	NS	ND
GW-11 (9.8-19.8 ft)	90	94	11	14
GW-12S (5-15 ft)	NS	ND	NS	ND
GW-12D (35-40 ft)	NS	ND	NS	ND
GW-13S (5-15 ft)	NS	164	NS	ND
GW-14S (7-17 ft)	NS	194	NS	ND
GW-15S (8-18 ft)	NS	9	NS	ND
GW-15D 67-72 ft)	NS	ND	NS	ND
GW-16S (9.5-19.5 ft)	NS	129	NS	ND
GW-17S (12-22 ft)	NS	ND	NS	ND
GW-17D (29-34 ft)	NS	24	NS	ND
GW-18S (5-15 ft)	NS	27	NS	ND
GW-18D (20-25 ft)	NS	25	NS	ND
GW-19S (8-18 ft)	NS	68	NS	ND

Location	COCs [ppb]		Other VOCs [ppb]	
	November 2010/ April 2011	January 2012	November 2010/ April 2011	January 2012
PS-1	4	27	ND	ND
GW-20S (7-17 ft)	NS	3	NS	3
GW-20D (24-29 ft)	NS	4	NS	ND

Contaminants of Concern – PCE, TCE, DCE, VC, 1,1,1-TCA, 1,1-DCE, 1,1-DCA, 1,2-DCA and CA
Other VOC consist of petroleum-related compounds
ND – Not detected at the reporting limits
NS – Not sampled

A summary of COCs in groundwater at the Site and at locations hydraulically upgradient and downgradient of the Site are summarized on the following tables.

Table 2-5
Off-Site Groundwater Contaminant Summary

Off-Site Borings/Monitoring Wells – Upgradient:

Contaminant	Concentration Range *[ppb]*	SCG *[ppb]*	No. of Excursions	No. Exceeding SCG
COCs				
Tetrachloroethene	5.0 UJ	5	9	0
Trichloroethene	5.0 UJ	5	9	0
cis-1,2-Dichloroethene	5.0 UJ	5	9	0
trans-1,2-Dichloroethene	5.0 UJ	5	9	0
Vinyl Chloride	5.0 UJ	2	9	0

Off-Site Borings/Monitoring Wells – Downgradient:

Contaminant	Concentration Range *[ppb]*	SCG *[ppb]*	No. of Excursions	No. Exceeding SCG
COCs				
Tetrachloroethene	5.0U to 310	5	101	36
Trichloroethene	5.0U to 55	5	101	14
cis-1,2-Dichloroethene	4.5J to 400	5	101	24
trans-1,2-Dichloroethene	5.0U	5	101	0
Vinyl Chloride	5.0U	2	101	0

The extent of the groundwater contamination has not been fully defined. Further groundwater monitoring may result in a plume configuration that differs from that presented in the RI.

2.3 Soil Vapor and Air

When considering vapor intrusion into residential and commercial properties as a result of migrating soil vapors, the NYSDOH has established decision-based matrices and air guideline values in its Soil Vapor Intrusion Guidance (NYSDOH 2006) that apply to specific chemicals. These matrices are used to determine if taking reasonable measures to reduce exposure, further monitoring, or mitigation are required based on the action level of 5.0 ug/m^3 for trichloroethene and 100 ug/m^3 for tetrachloroethene in indoor air, as well as taking into account sub-slab soil vapor concentrations. COCs were observed in soil vapor at downgradient properties that exceed NYSDOH Soil Vapor Intrusion guidelines.

The evaluation of the potential for soil vapor intrusion resulting from the presence of site-related COCs in groundwater was investigated by sampling sub-slab soil vapor under structures, air inside the structures, and ambient outdoor air.

The soil vapor intrusion sampling was conducted during the 2011 and 2012 heating seasons and included 16 structures. For each structure, sub-slab soil vapor (if a concrete floor was present in the lowest portion of the structure) and indoor air samples were collected to assess the potential for exposure via soil vapor intrusion. Outdoor air samples were collected concurrently to evaluate outdoor air quality in the vicinity of the study area. The results of the soil vapor intrusion primarily indicated tetrachloroethene were found in sub-slab vapors and indoor air at structures both on-site and off-site.

The potential exposure via soil vapor intrusion has yet to be completely evaluated. NYSDOH has recommended further soil vapor intrusion investigation of the area encompassed by the dissolved chlorinated contaminant groundwater plume.

3 POST ROD REMEDIAL DESIGN INVESTIGATION

3.1 Groundwater Evaluation

Prior to completion of the remedial design and after issuance of the Record of Decision (ROD), additional monitoring wells will be installed to further delineate the areal extent of the tetrachloroethene plume. The proposed monitoring wells are depicted on Drawing No. 2 (Proposed Monitoring Well Location and Soil Vapor Target Area). These locations may be modified in the field dependent upon utility locations. These wells will be installed in accordance to the RI Work Plan dated April 2010.

Following the completion of the installation of the additional monitoring wells, water samples from all existing monitoring wells will be collected and analyzed in accordance with the RI Work Plan methodologies. Results will be evaluated as part of the final remedial design.

3.2 Soil Vapor Intrusion Evaluation

Vapor intrusion (VI) sampling has been conducted at properties overlying PCE contaminated groundwater with concentrations in excess of 5 ppb. The highest concentrations that were observed in indoor air during the 2011 and 2012 VI sampling were within the commercial block area along Hoffman Street between West Church Street and West Grey Street. According to NYSDOH, all properties evaluated within this area warranted the installation of vapor mitigation systems.

Properties evaluated south of this commercial block area overlie groundwater with contaminant concentration ranging between 50 and 800 ppb. Of the nine properties evaluated within this contaminant zone, one property warranted additional sampling, and another warranted mitigation. These two properties overlie contaminated groundwater with concentrations in excess of 500 ppb.

Excluding the commercial block area, the data obtained to date indicates that those properties overlying the contaminant plume where the contaminant concentrations are less than 500 ppb are not being impacted. To confirm this association, additional VI sampling will be performed following issuance of the ROD along the north side of West Water Street, both to the east and west of Hoffman Street, and along both sides of Hoffman Street between West Water Street and Winsor Street. It is estimated that 13 additional properties will be evaluated. This additional soil vapor target area is depicted on Drawing No. 2. All sampling will be done in accordance with NYSDEC Soil Vapor Intrusion guidelines.

4 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

A qualitative human health exposure assessment (QHHEA) was completed as part of the

Remedial Investigation. The QHHEA was completed in general accordance with the guidance presented in DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010 (NYSDEC 2010). Castle Cleaners uses tetrachloroethene as its dry cleaning solvent; therefore, COCs exposure to Castle Cleaners' workers and customers is not part of this QHHEA.

A summary of the QHHEA is presented in the following summary table.

Table 3-1
QHHEA Summary

Receptor Group	Medium	Exposure Route/Pathway	Comment
On-Site Municipal Workers, Utility Workers, Environmental Contractors, Construction Contractors – current and future	Soil	Ingestion Dermal	Soil may be accidently ingested or come in contact with skin
	Groundwater	Ingestion Dermal	Groundwater may be accidently ingested or come in contact with skin
	Vapor	Inhalation	COCs may volatilize from subsurface soils or groundwater in trench and enter breathing zone
On-Site Occupant – current and future	Soil	None	
	Groundwater	Ingestion	Municipal Water Supply wells have been impacted by COCs
	Vapor	Inhalation	COCs may volatilize from subsurface soils or groundwater into buildings
Off-Site Utility Worker – current and future	Soil	Ingestion Dermal	Soil may be accidently ingested or come in contact with skin
	Groundwater	Ingestion Dermal	Combination storm water and sanitary sewer system may intercept water table; groundwater may be accidently ingested or come in contact with skin
	Vapor	Inhalation	COCs may volatilize from subsurface soils or groundwater in trench and enter breathing zone
Off-Site Community	Soil	None	
	Groundwater/ Drinking Water	Ingestion	Municipal Water Supply wells have been impacted by COCs
	Vapor	Inhalation	COCs may volatilize from subsurface soils or groundwater into buildings

5 FEASIBILITY STUDY

The purpose of a Feasibility Study (FS) is to use information collected during the RI to develop alternative remedies that will eliminate or reduce the Site's significant threat to public health or the environment.

This FS is not an all-inclusive study of *all* potentially feasible remedies, but is an evaluation of select Presumptive/Proven Remedial Technologies presented in NYSDEC DER-15 for volatile organic compounds in soil, groundwater and soil vapor. The potential remedial technologies that will be evaluated are those that allow the use of site-specific SCO's that are protective of public health and the environment established in 6 NYCRR Part 375-3.8(e) and to the NYSDEC TOGS 1.1.1 Water Quality standards, criteria and guidance values (SCG).

As discussed above, the potential complete exposure pathway is soil vapor affected by COCs. Exposure to indoor air impacted by COCs in commercial and residential properties is the primary exposure route and occupants of impacted properties are the primary receptors. There is also some potential for inhalation or dermal exposure to COCs when intrusive work is done on the Castle Cleaner Site as well as off-site. This may include subsurface utility workers, construction contractors and environmental contractors.

The public water supply uses groundwater in the area of the Castle Cleaners Site as one of its sources. Well No. 42 was taken out-of-service due to the detection of tetrachloroethene at concentrations less than 3 ug/L in the periodic samples collected for analysis. Direct ingestion of impacted groundwater is considered a complete exposure pathway for the community. Properties located within the vicinity of the Site, including the Site, are connected to the municipal water supply system completing the exposure pathway to impacted drinking water. The observed COCs concentrations at Well No. 42 have not exceeded SCGs, to date (see attached Figure 1).

This Feasibility Study recognizes that the Site and the adjacent populated study area present numerous logistical constraints that eliminate several presumptive remedies.

Those technologies that are retained for further consideration will be evaluated by the following criteria:

- Overall Protection of Public Health and the Environment
- Reduction of Toxicity, Mobility or Volume of Contaminant
- Long-term Effectiveness and Permanence
- Short-term Impact and Effectiveness
- Implementability
- Compliance with Standards, Criteria and Guidance (SCGs)
- Cost

5.1 Description of Evaluation Criteria

5.1.1 Overall Protection of Human Health and the Environment

This criterion assesses the ability of each remedial alternative to protect human health and the environment. The assessment draws on the analyses of other criteria evaluated for each alternative, and considers the degree to which site risks would be reduced.

5.1.2 Reduction of Toxicity, Mobility or Volume of Contaminant

This evaluation criterion addresses the ability of the remedial alternative to reduce the toxicity, mobility or volume of the impacts present in the site media. Preference should be given to remedies that permanently or significantly reduce the toxicity, mobility or volume of contaminants at the site

5.1.3 Long-term Effectiveness and Permanence

This criterion evaluates the remedial alternative in terms of the potential risks remaining at the site after remedial activities have been completed, and the ability of the alternative to meet Remedial Action Objectives (RAOs) established for the site.

5.1.4 Short-term Impact and Effectiveness

This criterion is an evaluation of the potential short-term adverse environmental impacts and human health exposure (including community and remediation workers) during the construction and implementation of the remedy.

5.1.5 Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing the remedial alternative.

5.1.6 Compliance with Standards, Criteria and Guidances (SCGs)

This evaluation criterion evaluates each remedial alternative with respect to New York State SCGs.

5.1.7 Cost

This criterion refers to the total cost to implement the remedial alternative on the basis of present worth analysis including direct capital costs (material, labor, equipment), indirect capital costs (engineering licenses, permits, contingency allowances) and operation and maintenance costs (operating labor, energy, sampling and laboratory fees).

5.2 Remedial Action Objectives

This section presents the RAOs that have been developed for the Site. Based on considerations specific to the Site (e.g. site use, detected constituents and potential exposure pathways), RAOs are identified to maintain and/or achieve conditions that are protective of public health and the environment. The RAOs that have been developed for the Site are consistent with the remedy selection process described in *Technical Guidance for Site Investigation and Remediation*, NYSDEC Program Policy DER-10 (DER-10, May 2010).

The RAOs were developed based on the results of the completed Remedial Investigation (RI), the present and anticipated use of the Site and the properties within the areas that exceed SCGs, and the actual or potential public health and/or environmental exposures.

The RAOs were used to identify the remedial alternatives presented in the following sections. The RAOs developed for the Site are presented in the following table.

Table 4.1
Remedial Action Objectives

Media	Remedial Action Objective
Soil	RAOs for Public Protection: • Prevent ingestion/direct contact with impacted subsurface soils. • Prevent inhalation of or exposure to persons to COCs volatilizing from soil. RAOs for Environmental Protection: • Prevent further impact of COCs to groundwater.
Groundwater	RAOs for Public Health Protection: • Prevent ingestion of groundwater with COCs levels exceeding SGCs. • Prevent ingestion of municipal drinking water with COCs. • Prevent contact with or inhalation of COCs from impacted groundwater. RAO for Environmental Protection: • Prevent on-going impact to groundwater by removing the source. • Reduce contaminant concentrations within the plume.
Soil Vapor	RAO for Public Health Protection: • Prevent migration of COCs from soil or groundwater via soil vapor to indoor air.

5.3 Development of Remedial Alternative

This section presents a description and analysis of remedial alternatives, or combinations thereof, to address the RAOs established for the Site.

The remedial alternatives evaluated in this section were identified considering site-specific conditions and the four different cleanup “tracks” established in 6 NYCRR Part 375-3.8(e). These include one track that allows for unrestricted site use (Track 1) and three tracks that differ in approach, but each allow for restricted site use – whether residential, restricted-residential, commercial, or industrial. Track 2 involves use of generic SCOs, Track 3 involves use of “modified” SCOs (one or more of the generic SCOs may be modified), and Track 4 involves use of site-specific SCOs that are protective of public health and the environment. Tracks 2 and 3 do not allow use of long-term institutional or engineering controls to address impacted soil. However, such controls can be used to address impacts to certain other media (e.g., groundwater and soil vapor). Track 4 can include the use of long-term institutional and/or engineering controls to address any impacted media (soil, groundwater, and soil vapor, etc.).

According to the USEPAs *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a), each technology type and associated processes are briefly described and evaluated against preliminary and secondary screening criteria. This approach was used to determine if the application of a particular technology type or process option is applicable given the site-specific conditions for remediation of the impacted media. Based on this screening, remedial technology types and process options were eliminated or retained, and subsequently combined, into potential remedial alternatives for further, more detailed evaluation.

This approach is consistent with the screening and selection process provided in the NYSDECs DER-10 Technical Guidance for Site Investigation and Remediation. The NYSDEC Division of Environmental Remediation (DER) *Presumptive/Proven Remedial Technologies* (DER-15) allows for use of industry experience related to remedial cleanups to focus the evaluation of technologies to those that have been proven to be both feasible and cost effective for specific site types or constituents. The objective of DER-15 is to use experience gained at remediation sites and scientific and engineering evaluation of performance data to make remedy selection quicker and consistent.

5.3.1 Remedial Alternative for COCs in Soil

5.3.1.1 Alternative 1 – No Further Action

Under the No Further Action Alternative, no active remediation would be implemented to reduce or eliminate contaminants in soil. No complete exposure pathway has been identified for the community, or Site building occupants to soils impacted by COCs that exceed the SCO's under current site conditions. Exposure to utility, construction, and environmental workers to elevated COCs in soils that currently underlie impermeable covers (asphalt and the building) can be addressed through institutional controls and the proper use of personal protective equipment. This alternative is feasible and is retained for further consideration.

5.3.1.2 Alternative 2 – Excavation and Off-Site Disposal

While the excavation of soils of impacted near-surface soils observed along the west side of the Site building is feasible, excavation would not achieve complete source removal of the deeper soils. The highest concentrations of COC in soils at the Site were observed within the capillary fringed zone or within the upper saturated zone. Additionally, COCs in soils were observed underlying the Site building. Due to the presence of the Site building and foundation, excavation at the necessary depths is not feasible under current Site conditions. This alternative is not retained for further consideration.

5.3.1.3 Alternative 3 - Soil Vapor Extraction

The objective of this presumptive remedy is to reduce the concentrations of COCs in soil at the Site. While soil vapor extraction is not applicable to the saturated zone, it can be effective in reducing contaminant levels in the vadose and capillary fringe. Soil vapor extraction may also influence contaminant concentrations under the Site building. This alternative is feasible and is retained for further consideration.

5.3.2 Remedial Alternative for COCs in Groundwater

5.3.2.1 Alternative 1 – No Further Action

Under the No Further Action Alternative, no groundwater remediation would be implemented. No complete exposure pathway has been identified for the community, or Site building occupants to groundwater impacted by COCs that exceed the SCGs. Groundwater at the Site and downgradient of the Site has been impacted with COCs at levels that exceed SCGs. Tetrachloroethene has been detected in the Foster Island municipal water supply wells at levels below SCGs. The presence of the site-related tetrachloroethene at Well No. 42 is considered a complete exposure pathway. This alternative is not feasible and is not retained for further consideration.

5.3.2.2 Alternative 2 – Extraction and Treatment/Air Stripping

The objective of this presumptive remedy is to reduce COC concentrations in groundwater as well as provide hydraulic control in reducing or preventing contaminant migration.

The contaminant distribution observed in groundwater at the Site and hydraulically downgradient of the Site depicts a contaminant plume extending several hundred feet in a north-south and east-west direction at concentrations generally 50 ug/L or less. The highest contaminant levels were most recently observed about 250 feet south of the Site at a concentration of approximately 900 ug/L. This remedy generally does not achieve SCGs.

Groundwater extraction and treatment require space for the infrastructure; there are space limitations associated with the Site and within the study area. These systems require secure power supplies, and have noise nuisance and water discharge issues associated with them. Additionally, a petroleum-contaminant plume is present east of the Site, which could influence the treatment technology required to address both the chlorinated COCs and the petroleum hydrocarbons. This alternative is not feasible under current Site conditions and is not retained for further consideration.

5.3.2.3 Alternative 3 – In-Situ Chemical Oxidation (ISCO)

The objective of this presumptive remedy is in-situ mineralization of COCs to carbon dioxide, hydrogen and water as the endpoint of ISCO. ISCO involves introducing a strong oxidant into a subsurface aquifer, typically via an injection well, to transform COCs and reduce their mass, mobility and/or toxicity. There are several types of commercially available oxidants available to address the COCs, including hydrogen peroxide, potassium or sodium permanganate and sodium persulfate.

While sodium and potassium permanganate are recognized oxidizing agents capable of destroying the double-bonded chlorinated ‘ethene’ compounds that make up part of the list of COCs, there are many logistical, safety and geological factors that can influence the applicability of ISCO and its effectiveness for this project.

The feasibility of this alternative is questionable due to the proximity of buried utilities in the study area, the presence of residential and commercial buildings with basements, the variability in the geology, and the close presence of water supply wells. Although the feasibility of the alternative is in question and typically does not meet the RAO for groundwater, it has been retained for further discussion under the selection criteria.

5.3.2.4 Alternative 4 – In-Situ Reductive Biostimulation

The objective of enhanced *in-situ* biostimulation is to increase activity of a targeted biological biomass throughout the contaminated aquifer, thereby achieving effective biodegradation of contaminants.

Tetrachloroethene requires the addition of an electron donor to stimulate reductive dechlorination. The biostimulation of anaerobic activity is facilitated through the introduction of an electron donor. There are several types of commercially available electron donors that produce molecular hydrogen (H2) through a fermentation process. These include, but are not limited to, HRC®, food grade molasses and vegetable oil. These products are released into the aquifer to stimulate the growth of targeted indigenous bacteria that are efficient in degrading a particular contaminant. In-situ dechlorination of COCs is dependent upon logistical, geological and geochemical factors, as well as competing biological reactions within the groundwater system that can influence the applicability of any biostimulation substrate.

Although the feasibility of this alternative may be limited due to the restrictive developed nature of the impacted area, and typically does not meet the RAO for groundwater, it has been retained for further discussion under the selection criteria.

5.3.3 Remedial Alternatives for COCs in Drinking Water

5.3.3.1 Alternative 1 – No Further Action

Under the No Further Action Alternative, no drinking water remediation would be implemented. Tetrachloroethene has been detected in the Foster Island municipal water supply wells at levels below SCGs. The presence of the site-related tetrachloroethene at Well No. 42 is considered a complete exposure pathway. This alternative is not feasible and is not retained for further consideration.

5.3.3.2 Alternative 2 – Blending with Enhanced Monitoring of Well No. 42

Well No. 42 has been out of service since 2006. In the event the City of Elmira determines it is necessary to return Well No. 42 to service, a blending program with enhanced monitoring can be developed to allow the use of the well under controlled conditions.

The objective of this alternative would provide the Elmira City Water Board with a decision-making process to place Well No. 42 back into production. Enhanced monitoring would provide frequent analytical data from Well No. 42 that can be used in projecting contaminant concentrations in total raw water entering the filtration plant and in determining the pumping rate at Well No. 42.

5.3.3.3 Alternative 3 – Treatment at Municipal Well No. 42

The objective of this alternative would be to provide treatment of impacted water at Well No. 42. An aeration tower would be installed at the Foster Island Wellfield. This alternative would allow the City of Elmira to place Well No. 42 back into production, mitigating the complete exposure pathway to the community to contaminated drinking water at the Foster Island Wellfield. This alternative is retained for further consideration under the selection criteria.

5.3.4 Remedial Alternative for COCs in Soil Vapor

When considering vapor intrusion into residential and commercial properties as a result of migrating soil vapors, the NYSDOH has established decision-based matrices and air guideline values in its Soil Vapor Intrusion Guidance (see Section 2.3) These matrices are applicable when considering the alternatives of reducing inhalation pathway in residential and commercial properties.

5.3.4.1 Alternative 1 - No Further Action

Under the No Further Action Alternative, no remediation would be implemented to reduce or prevent migration of COCs from soil or groundwater via soil vapor to indoor air. Tetrachloroethene has been detected in soil vapor that has warranted the installation of vapor mitigation systems within the study area. The presence of the site-related tetrachloroethene in soil vapor is considered a complete exposure pathway. This alternative is not feasible and is not retained for further consideration.

5.3.4.2 Alternative 2 – Soil Vapor Extraction

Soil vapor extraction (SVE) is a technology that reduces contaminants in soils as well as mitigates the potential for vapor intrusion. The technology of soil vapor extraction to reduce COCs in soil vapor is feasible and is retained for further consideration.

5.3.4.3 Alternative 3 – Vapor Mitigation System

The purpose of a vapor mitigation system is to reduce contaminants in soil vapor from migrating into indoor air. A vapor mitigation system is generally a less aggressive vapor collection system generating a smaller pressure difference than those generated by a SVE system. A vapor mitigation system is not designed to directly influence contaminants in soils. Vapor mitigation is a feasible alternative for reducing or eliminating the potential for exposure of COCs through inhalation to building occupants, and is retained for further consideration.

6 SCREENING OF REMEDIAL ALTERNATIVES

The process used in the screening of feasible remedial options for soil, groundwater, drinking water and soil vapor takes into consideration those remedies whose goals are aimed at protecting public health and the environment. Protection may be achieved by minimizing exposure and reducing contaminant levels in an effort to restore groundwater and soils to SCGs/SCOs.

Each remedial alternative has been evaluated individually during the screening process except for the two alternatives for remediation of COCs in soil vapor. These two alternatives are discussed jointly since the alternatives share a common vapor mitigation component.

6.1 Alternative 1 – No Further Action for Soil, Groundwater, Drinking Water and Soil Vapor

No Further Action indicates that no remedial action will be conducted at the Site or off-site. This option entails no future activities to contain or remediate COCs, provides no treatment of COCs, and provides no institutional or engineering protection to human health or the environment. This option assumes that physical conditions at the Site remain unchanged, with no increase in the introduction of COCs into groundwater, and existing COCs in soil and groundwater would naturally attenuate.

6.1.1 Overall Protection of Human Health and the Environment

The no action alternative does not reduce, control or eliminate the COCs present in soil, groundwater, drinking water and soil vapor in excess of SCGs or provide data to measure future protection of human health and the environment.

There is no current complete exposure pathway to the residences or commercial building occupants to soils impacted by COCs. Soils that have been impacted by COCs lie below the Site building or the Site asphalt pavement.

6.1.2 Reduction of Toxicity, Mobility, and Volume

Under the no action alternative, the impacted soil, groundwater, drinking water and soil vapor would not be treated, recycled or destroyed through active treatment. The no action alternative is not effective in reducing the contaminants in soils, groundwater, drinking water and soil vapor and meeting the SCOs/SCGs.

6.1.3 Long-term Effectiveness and Permanance

Based on current Site conditions, utility workers exposure to subsurface soils impacted by COCs during future intrusive activities on the Site may occur. Such exposure could occur during excavation to remove or replace existing utilities.

The no further action alternative does not include actions or measures to address potential human exposure to Site-related contaminants. Therefore, the no further action alternative is not considered to be effective at addressing RAO related to potential direct contact, ingestion, or inhalation human health exposure pathways. The alternative would not meet the RAOs related to removing the source of groundwater impacts.

6.1.4 Short-term Impact and Effectiveness

No remedial action would be performed under the no further action alternative. Therefore, there would be no short-term environmental impacts or risks to the community or individual occupants of the Site. In addition, there would be no short-term environmental impact or risk to environmental contractors because there would not be any workers performing remedial activities.

6.1.5 Implementability

There are no technical or administrative issues associated with implementing the no further action alternative.

6.1.6 Compliance with SCGs

The no further action alternative does not totally negate the ability to achieve compliance with SCGs. Compliance may be achieved through natural attenuation processes in soil, groundwater and drinking water.

6.1.7 Cost

There are no costs associated with the no further action alternative.

6.2 Alternative 2 – In-Situ Chemical Oxidation (ISCO) & Groundwater Monitoring

Alternative 2 would address impacted soil and groundwater at the Site and off-site, and provide a mechanism to evaluate both short-term and long-term effectiveness of the remedy. ISCO would be performed to reduce COC concentrations in saturated soil and groundwater with the potential of reducing long-term COC impact to water quality at the municipal water supply well. Resulting reduction of COCs in groundwater may reduce or eliminate impact to indoor air quality.

6.2.1 Overall Protection of Human Health and the Environment

ISCO can provide some protectiveness by reducing the amount of contaminant mass at the residual source area(s) and by reducing ongoing contribution of COCs to groundwater. The alternative does not directly address impacted soil vapor, and therefore does not eliminate the potential inhalation exposure to soil vapor migration into indoor air or potential ingestion exposure to impacted drinking water. However, this alternative can be combined with other alternatives, which can meet the protectiveness criterion.

6.2.2 Reduction of Toxicity, Mobility, and Volume

ISCO can reduce the toxicity and volume of COCs in the groundwater, if the chemical reaction is complete. Some transformation products of tetrachloroethene have a higher toxicity (ex. vinyl chloride) than tetrachloroethene. The solubilities and vapor pressures of the transformation products are greater than tetrachloroethene, potentially influencing the mobility of the COCs.

Certain oxidants contain salts and metal impurities that may generate concerns especially with the presence of the nearby Foster Island Wellfield. This class of oxidants can also temporarily mobilize naturally occurring metals in soils. For example, chromium in soils may be oxidized to hexavalent chromium, which can persist for some time. This may generate concern since the aquifer is being used for drinking water.

Oxidants may also significantly alter aquifer geochemistry that can cause clogging through precipitation of minerals in pore space with the potential of altering the contaminant plume configuration.

6.2.3 Long-term Effectiveness and Permanence

After ISCO has reached its effectiveness in reducing COCs in groundwater, elevated concentrations of metals in groundwater may persist, and with time may impact groundwater quality further downgradient of the area of ISCO treatment. Reduction of COCs in groundwater will likely not achieve the RAO for the protection of public health associated with exposure to groundwater and soil vapor.

6.2.4 Short-term Impact and Effectiveness

The short-term impact of this remedial alternative has the potential of impacting human health and the environment during the implementation phase. There are risks to the storage, staging and injection of hazardous chemical oxidants in the community. Potential risks associated with the use of chemical oxidation in the presence of buried utilities include corrosion, elevated oxygen levels in manways, explosion, combustion and vapor intrusion into buildings.

6.2.5 Implementability

The implementability of ISCO is influenced by numerous factors including site geology, soil and groundwater chemistry, the distribution of contaminants in the groundwater and the proximity of targeted source areas to buildings, below-grade structures, and community residences.

The depth of the combined sanitary and storm sewer system and associated trenching along Hoffman Street between W. Church Street to W. Water Street ranges in depth of approximately 8 to 10 feet bgs. This utility as well as other public and private utilities trenches could act as a conduit for the injected oxidant to migrate to the Chemung River or toward the Foster Island Wellfield.

Elevated levels of iron were observed in groundwater samples collected at the Site. Elevated levels of iron can influence the efficacy of certain oxidants.

6.2.6 Compliance with SCGs

This alternative generally does not achieve SCGs. ISCOs are known to be more effective at treating higher concentrations of contaminants than what is present in the study area. The natural oxidant demand of the groundwater system will be difficult to overcome when lower contaminant concentrations are present. The contaminant distribution observed in groundwater at the Site and hydraulically downgradient of the Site depicts a contaminant plume extending several hundred feet in a north-south, and east-west direction at concentrations generally 100 ug/L or less. The highest contaminant levels were most recently observed about 250 feet south of the Site at a concentration approximately 900 ug/L.

6.2.7 Cost

The cost development assumes the following:

- Performance confirmed by a Pilot Study
- Installation of Injection Wells and additional Monitoring Wells
- Implementing ISCO within the source area of the +500 ug/L plume
- Groundwater Monitoring on a quarterly basis for 5-years

Capital Costs:	$795,000
Annual Monitoring Costs:	$28,000

6.3 Alternative 3 – In-Situ Biostimulation & Groundwater Monitoring

Alternative 3 would address impacted saturated soil and groundwater within the contaminant plume generally defined within the 500 ug/L concentration contour interval. The injection of a hydrogen producing substrate would be performed to reduce COC concentrations in saturated soil and groundwater by enhancing the reductive dehalogenation and methanogenesis processes with the potential of reducing long-term COC impact to water quality at the municipal water supply well. Reduction of COCs in groundwater may also reduce or eliminate impact to indoor air quality.

6.3.1 Overall Protection of Human Health and the Environment

In-situ biostimulation can provide some protectiveness by reducing the amount of contaminant mass within the groundwater plume.

As with Alternative 2, In-Situ Chemical Oxidation (ISCO), this alternative does not directly address impacted soil vapor, and therefore does not eliminate the potential inhalation exposure to soil vapor migration into indoor air, or the potential ingestion exposure to impacted drinking water. However, this alternative can be combined with other alternatives, which can meet the protectiveness criterion.

6.3.2 Reduction of Toxicity, Mobility, and Volume

In-situ biostimulation can reduce the toxicity and volume of COCs in the groundwater, if biodegradation is complete. Some transformation products of tetrachloroethene have a higher toxicity than tetrachloroethene. The dechlorination of tetrachloroethene tends to be incomplete or can stall through the reductive dehalogenation process. The anaerobic process becomes slower as the number of chlorines decreases. However, trichloroethene, dichloroethene and vinyl chloride are also degradable aerobically via co-metabolic activities, and the efficiency of aerobic treatment generally increases with a decreased number of chlorines. The solubilities and vapor pressures of the transformation products are greater than tetrachloroethene, potentially influencing the mobility of the COCs.

6.3.3 Long-term Effectiveness and Permanence

Reduction of COCs in groundwater will likely not achieve the RAO for the protection of public health associated with exposure to groundwater and soil vapor. If dechlorination can be pushed to vinyl chloride (VC) in the anaerobic zone, then the residual VC is readily degraded as the plume converts to aerobic conditions. If however, DCE is the final product of the anaerobic zone, it may persist in an aerobic environment.

6.3.4 Short-term Impact and Effectiveness

The short-term impact of this remedial alternative has little potential of impacting human health and the environment during the implementation phase. There are little to no identified risks to the community from the storage, staging and injection of hydrogen-producing substrates.

6.3.5 Implementability

The implementability of in-situ biostimulation is influenced by numerous factors including site geology, soil and groundwater chemistry, the distribution of contaminants in the groundwater and the proximity of targeted source areas to buildings and below-grade structures. The natural oxidant demand of the existing groundwater system will be difficult to overcome throughout the contaminant plume area. The implementation of an in-situ reactive zone (IRZ) within the plume will be highly impeded by above-grade and below-grade structures. Incomplete or sporadic IRZs will influence the effectiveness of the biostimulation process. Since the points of injection will be limited along accessible areas within the right-of-ways, developing an anaerobic biostimulation environment encompassing the entire contaminant plume is considered unfeasible; however, the implementation of biostimulation within the limits of the +500 ug/L contaminant plume is feasible.

6.3.6 Compliance with SCGs

This alternative generally does not achieve SCGs.

6.3.7 Cost

The cost development for in-situ biostimulation assumes the following:

- Performance of an in-situ biostimulation injection event within the +500 ug/L contaminant plume
- Post-injection monitoring to evaluate the impact of this alternative
- Groundwater Monitoring on a quarterly basis for 5-years

Capital Costs:	$150,000
Annual Monitoring Costs:	$28,000

6.4 Alternative 4–Soil Vapor Extraction at the Site, Vapor Mitigation of Residential Structures & Groundwater Monitoring

Alternative 3 involves the installation of an SVE system at the Site with the goal of: 1.) reducing COC concentrations that were observed in the subsurface soils at the Site, 2.) removing accumulated vapors within the subsurface soils at the Site; 3.) mitigating the potential of vapor intrusion into residential structures, and 4.) monitoring groundwater quality.

The community groundwater monitoring component would provide data on the effectiveness of the SVE in reducing or eliminating further impact to groundwater quality from the Site, as well as provide the information needed to evaluate the natural attenuation process. The RI data suggest that attenuation is occurring in the groundwater system with the presence of tetrachloroethene's transformations products, most notably at those wells that exhibited the higher COC concentrations.

6.4.1 Overall Protection of Human Health and the Environment

This alternative would reduce remaining residual COCs at the Site, further reducing any on-going source of COCs that may be impacting groundwater quality and prevent the migration of COCs from soil or groundwater via soil vapor to indoor air.

6.4.2 Reduction of Toxicity, Mobility, and Volume

This alternative would reduce the volume of COCs present in the soils at the Site by increasing the mobility of the COCs. SVE induces the evaporation of COCs located in soils within the unsaturated zone through the use of vacuum pressure. The increased air flow through the subsurface can also stimulate biodegradation of some of the contaminants, especially those that are less volatile.

6.4.3 Long-term Effectiveness and Permanence

SVE is a remedy that transfers contamination from one media (unsaturated soil, soil vapor) to another media (atmosphere, collection system) permanently reducing COC concentrations in soils. The alternative may meet the RAOs related to removing the source of groundwater impacts and will likely achieve the SCOs for Restricted Use for the Protection of Groundwater. Current COCs concentrations in soils at the Site are below the SCO for Commercial Use for the Protection of Public Health.

6.4.4 Short-term Impact and Effectiveness

No potential risks associated with SVE, vapor mitigation and groundwater monitoring after remedial activities cease have been identified. Under this alternative, potential future vapor intrusion into the tenant portion of the Site building would be addressed by the extraction system, as well as assist in reducing COCs concentrations in soil at the Site. The vapor mitigation system would address the potential of vapor migration into structures.

An SVE system would have minimal effect on the community during its implementations. There is the potential of some disturbance to the community, mostly noise nuisance, during the installation of SVE wells, but no increase in risks associated with exposure to COCs. The performance of groundwater monitoring has minimal or no risks to the community.

6.4.5 Implementability

The installation of a SVE system on the Site could be accomplished by using conventional drilling methods and blowers or high volume fans.

6.4.6 Compliance with SCGs

Subsurface soils at the Site are already in compliance with SCOs for restricted commercial use. The implementation of an SVE system may reduce the COCs in soils for compliance for unrestricted use.

6.4.7 Cost

The cost development assumes the following:

- Installation and 3-year operation, monitoring and maintenance (OM&M) of a SVE System at the Castle Cleaners Site
- Installation of vapor mitigation systems, as warranted
- Operation, Monitoring and Maintenance (OM&M) of the SVE System for 3 years
- Groundwater Monitoring on a quarterly basis for 5-years

Capital Costs:	$105,000
OM&M Costs for 3-Years:	$12,000
Annual Monitoring Cost:	$28,000

6.5 Alternative 5 – Blending with Enhanced Monitoring at Well No. 42

Of the three water supply wells at the Foster Island Wellfield, the City of Elmira Water Board has identified that two wells have reported detectable concentrations of tetrachloroethene. Well No. 42 has been out of service since 2006. Well No. 41 with concentrations of tetrachloroethene at or below 1 ug/L has remained in use, and is blended with other raw water within the water supply system at a central filtration plant.

In the event the City of Elmira determines it is necessary to return Well No. 42 to service, a blending program with enhanced monitoring will be developed. The blending program will be incorporated into the Site Management Plan (SMP) and will include an annual review of the City of Elmira's expected water demands.

A blending program with enhanced monitoring at Well No. 42 will provide the City of Elmira Water Board with a decision-making process for using Well No. 42.

According to the Elmira Water Board's 2012 Annual Drinking Water Quality Report, Well No. 40 and No. 41 provide 21.3% of the 2.1 billion gallons per year water demand. That equates to approximately 1.23 million gallons per day (GPD) from these two wells.

Blending of the water from Well No. 42 with the remaining water supply source waters will reduce the exposure to the COC's to levels at or below the EPA Method 524.2 detection limits. For example, based on current water demand and historical tetrachloroethene concentrations reported at Well No. 42, Well No. 42 could be used at a pumping rate of approximately 600,000 GPD. This would result in the concentration of tetrachloroethene in the total raw water entering the filtration plant being less than 0.2 ug/L.

6.5.1 Overall Protection of Human Health and the Environment

This alternative would not reduce remaining residual COCs at the Site, reduce any on-going source of COCs that may be impacting groundwater quality and or prevent the migration of COCs from soil or groundwater via soil vapor to indoor air.

It would provide a mechanism for preventing the ingestion of municipal drinking water with COCs that exceed SGCs.

6.5.2 Reduction of Toxicity, Mobility, and Volume

This alternative would not reduce the volume, mobility or toxicity of COCs present in the soils or groundwater.

6.5.3 Long-term Effectiveness and Permanence

Since this alternative does not have a remedial component, it would not decrease the potential risks remaining at the Site and will not provide for other RAOs discussed in previous alternatives.

6.5.4 Short-term Impact and Effectiveness

There is no potential short-term adverse environmental impacts and human health exposure for implementing with alternative.

6.5.5 Implementability

The implementation of this alternative is technically and administratively feasible.

6.5.6 Compliance with SCGs

This alterative does not have a remedial component for achieving SCGs.

6.5.7 Cost

The cost development for blending with enhanced monitoring assumes the following:

- Developing a blending scheme with an enhanced monitoring program
- Enhanced monthly monitoring of Well No. 42 on an annual basis
- Groundwater Monitoring on a quarterly basis for 5-years

Capital Costs:	$30,000
Annual Enhanced Monitoring	$15,000
Annual Monitoring Cost:	$28,000

6.6 Alternative 6–Treatment at Municipal Well No. 42

Alternative 6 would involve the installation of an aeration tower system to remove COCs from the raw water at Well No. 42.

6.6.1 Overall Protection of Human Health and the Environment

This alternative would not reduce remaining COCs at the Site, further reduce any on-going source of COCs that may be impacting groundwater quality or prevent the migration of COCs from soil or groundwater via soil vapor to indoor air. It would reduce the contaminant concentration at Well No. 42, thereby allowing the City of Elmira Water Board to place this well back into production under a potentially less restrictive mode of operation.

Drinking water quality at Well No. 42 has been protective of human health and the environment based on the last thirteen years of monitoring data. The existing groundwater use laws under 10 NYCRR 5-1 would continue to minimize potential human exposure to constituents in groundwater at concentrations exceeding Class GA standards/guidance values.

6.6.2 Reduction of Toxicity, Mobility, and Volume

This alternative would not reduce the volume, mobility or toxicity of COCs present in the soils or groundwater. It would reduce the concentrations of COCs in production water from Well No. 42.

6.6.3 Long-term Effectiveness and Permanence

An aeration tower system transfers contamination from water to the atmosphere reducing COC concentrations at the point of treatment. The alternative would meet the RAOs for the ingestion of COCs exceeding SCGs.

An aeration tower system can be labor intensive, and could place an economical burden on the City of Elmira Water Board to operate, monitor and maintain the system. Enhanced monitoring beyond current monitoring requirements of the WSWs would likely be a requirement for the operation of an aeration tower system. There are also aesthetic consideration associates with an aeration tower system including nuisance noise and visual impact.

6.6.4 Short-term Impact and Effectiveness

A water treatment system would have minimal effect on the community during its implementations; there would be no increase in risks associated with exposure to COCs. The short-term effectiveness or benefits of the placement of an aeration tower system at Well No. 42 are minimal since the concentrations at Well No. 42 currently meet SCGs, and would not be required for placing Well No. 42 back into production.

Installation of an aeration tower system would provided little to no benefit over a blending scheme with an enhanced monitoring program.

6.6.5 Implementability

Although the installation of an aeration tower system would be accomplished through conventional construction methods, additional components to the Foster Island water system may need to be replaced or modified.

6.6.6 Compliance with SCGs

While the SCGs for drinking water have not been exceeded at Well No. 42, a water treatment system is an option for providing a safe-guard should COC concentrations exceed SCGs.

6.6.7 Cost

The cost development for a aeration tower system, and the operation, monitoring and maintenance assumes the following:

- Installation of a tower aeration system.
- Operation, Maintenance and Monitoring of the water treatment system for a period of 1-year.

Capital Costs:	$415,000
Annual OM&M Costs:	$30,000
Annual Monitoring Costs:	$28,000

7 RECOMMENDATION

The recommended remedial alterative that directly addresses the contaminant source at the Site by reducing the mass of COCs in subsurface soils, reduces the contaminant mass in groundwater, and eliminates potential exposure through the ingestion of drinking water is a combination of alternatives 3, 4 and 5. These will be implemented following the completion of the Remedial Design Investigation outlined in Section 3.

The general elements of the selected remedy are as follows:

A SVE extraction system will be installed, monitored and operated at the Castle Cleaner Site for a period of 3-years or until asymptotic conditions are reached. If the additional remedial design investigation for vapor intrusion indicates that the vapor mitigation is warranted, vapor mitigation systems may be installed at the identified properties.

An in-situ biostimulation injection event will be performed within the +500 ug/L tetrachloroethene contaminant plume. Hydrogen producing substrate will be injected through single-use injection points. Post-injection monitoring will be performed at select locations to evaluate the localized groundwater conditions near the IRZ.

A blending scheme with an enhanced monitoring program at Well No. 42 will be developed with the City of Elmira Water Board. The operational guidelines for Well No. 42 will set specific action levels for determining allowable pumping rates at Well No. 42 relative to total water demand and COC concentrations. The blending program will be incorporated into the Site Management Plan (SMP) and will include an annual review of the City of Elmira's expected water demands.

Groundwater monitoring will be performed on a quarterly basis at select monitoring wells for a period of 5-years.

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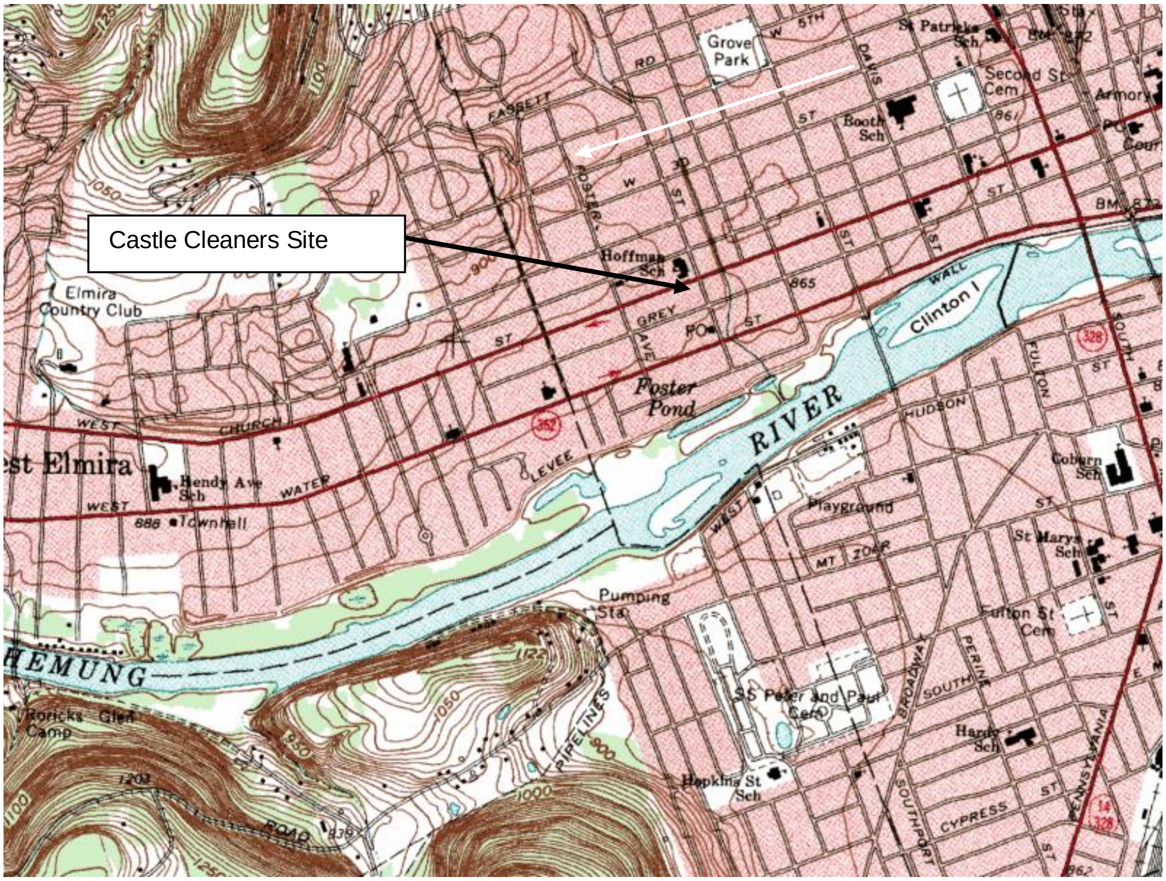

Source: USGD Topographic Map, Elmira Quadrangle, 1976

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Project North

GeoLogic

GeoLogic NY, Inc.

SITE LOCATION PLAN
CASTLE CLEANERS SITE
221 HOFFMAN STREET
ELMIRA, NEW YORK

DRAWN BY:	SCALE:	PROJECT NO:
SC	1:24,000	209053
REVIEWED BY:	DATE:	DRAWING NO:
FCE	Feb. 2012	1

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LEGEND:

- ELMIRA MUNICIPAL WATER SUPPLY WELL LOCATION
- MONITORING WELL LOCATION
- 10 ppb — HYDROCARBON PLUME CONTOUR IN SAND & GRAVEL
- 10 ppb — CHLORINATED COMPOUNDS PLUME CONTOUR IN SAND & GRAVEL
- SOIL VAPOR INTRUSION TARGET AREA 2011-2012
- PROPOSED ADDITIONAL SOIL VAPOR INTRUSION TARGET AREA
- PROPOSED MONITORING WELL LOCATION

APPROXIMATE SCALE:

0'10' 250' 500'

GeoLogic

GeoLogic NY, Inc., Homer, New York

PROPOSED MONITORING WELL LOCATION AND SOIL VAPOR TARGET AREA
CASTLE CLEANERS SITE
221 HOFFMAN STREET, ELMIRA, NEW YORK

DRAWN BY:	SCALE:	PROJECT NO.:
SMC/SDW	AS SHOWN	209053
REVIEWED BY: FCE	DATE: SEPT. 2013	DRAWING NO.: 2

\..\209053\Tech\Drawings\Dissolved Plume Contour Plan for Jan 2012 09-05-13.dwg

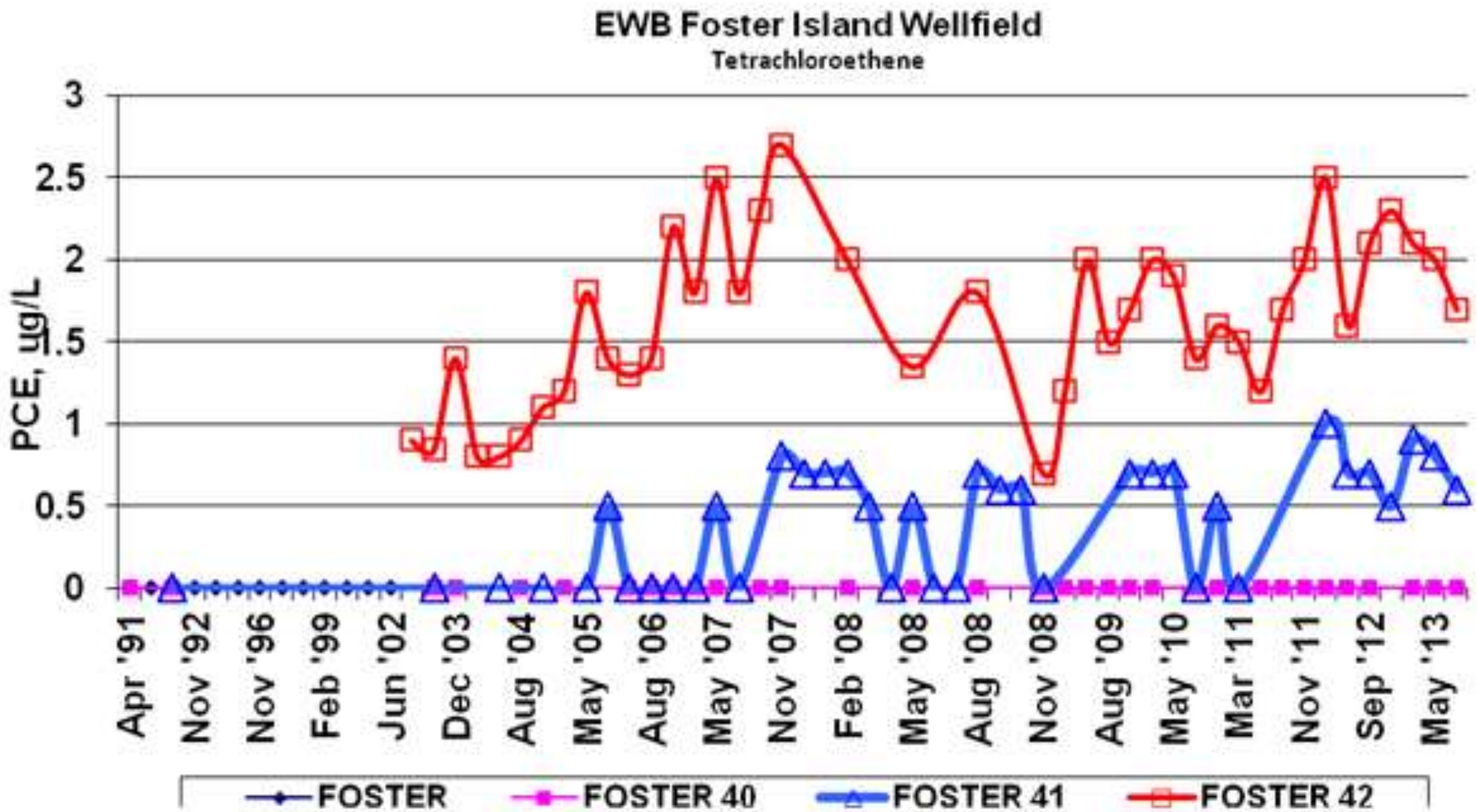
EWB Foster Island Wellfield
Tetrachloroethene
PCE, ug/L
3
2.5
2
1.5
1
0.5
0
Apr '91
Nov '92
Nov '96
Feb '99
Jun '02
Dec '03
Aug '04
May '05
Aug '06
May '07
Nov '07
Feb '08
May '08
Aug '08
Nov '08
Aug '09
May '10
Mar '11
Nov '11
Sep '12
May '13
FOSTER
FOSTER 40
FOSTER 41
FOSTER 42

Figure No. 1