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ALTERNATIVE ANALYSIS REPORT
ASH ROAD PROPERTIES
221 SYCAMORE ROAD
TOWN OF VESTAL, NEW YORK
NYSDEC BCP SITE #C704032

Prepared For:

WEST COVINA ROYALE, LP

AND

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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Revisions: October 2014

February 2014

Project No. 209183

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Certification

I, Kenneth Teter, P.E. certify that I am currently a NYS registered professional engineer and that this Alternative Analysis Report (AAR) 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).

Kenneth Teter, P.E. — Date 10/27/14

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1 INTRODUCTION

The Alternative Analysis Report (AAR) has been prepared on behalf of West Covina Royale, LP for the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Site #C704032, located at 221 Sycamore Road in the Town of Vestal, Broome County, New York (Site). See Drawing No. 1.

As a Volunteer to a Brownfield Cleanup Program Application ("Application") West Covina Royale LP, proposes to implement appropriate remedial measures necessary to address hazardous constituents that have the potential to adversely affect human health or cause significant off-site impact.

The AAR identifies and evaluates remediation alternatives to address impact to soil and groundwater at the Site from historical uses of the Site. The alternatives that will be evaluated will take into consideration site-specific conditions, the protection of public health and the environment, and applicable regulations. The AAR will address alternatives that are appropriate to mitigate potential threats to public health and the environment, and is consistent with remedial objectives of the Site.

The Site is zoned commercial. The AAR takes into consideration remedial options that are consistent with zoning. At the time that the AAR was prepared, there were no re-development plans for the Site.

1.1 General Overview

West Covina Royale LP entered into a Brownfield Cleanup Agreement (BCA) with NYSDEC to investigate and as necessary, remediate the Ash Road Properties. A multi-phase Remedial Investigation (RI) and an Interim Remedial Measure (IRM) was completed by GeoLogic NY, Inc. (GeoLogic) in accordance with the NYSDEC approved RI-IRM Work Plan, dated August 12, 2010, and revised September 29, 2010.

A RI/IRM Report was submitted on November 19, 2013 and approved by NYSDEC on December 30, 2013.

The 6NYCRR Part 375 Restricted Use Soil Cleanup Objective for Commercial (SCO's) are the

identified objectives for Ash Road Properties under the BCA. Future land use restrictions, institutional and engineering controls may be applied to a portion of the Site.

1.2 Site Background Information

The Ash Road Properties occupies a portion of the 14.47-acres Lowe's Home Center property, tax map number 158.10-2-13. The Site has been identified by four tax map parcel designations prior to the incorporation of these four parcels, as well as other parcels, into the one 14.47-acre parcel. The Site encompasses perimeter parking for the Lowe's Home Center. The majority of the Site is covered with asphalt pavement with intermittent grass areas along the southern and western perimeters (see Drawing No. 2).

The Site is roughly rectangular in shape and encompasses about 1.54 acres with Ash Road forming the southern property boundary and Sycamore Road forming the western property boundary. Further south is a restaurant, an automotive supply business, and an automotive rental and repair business. Parking area for the Lowe's Homer Center borders the Site on the north with the Lowe's Home Center building located approximately 300 feet north. Residential properties border the Site on the east. Further west are retail businesses.

Commercial buildings were formerly present on the Site since at least 1965. The buildings were demolished in 1996.

The Site was formerly occupied by two businesses, Town Square Body Shop and Hall Plumbing. Town Square Body Shop performed auto-body repairs as well as automotive painting, washing and waxing. The Hall Plumbing building was occupied by a contractor's office and warehouse.

As indicted above, the Site is part of a larger parcel, and its limits have not been designated through a survey. As determined by previous investigations and the findings presented in the RI/IRM report, the extent of environmental impact is limited to the west portion of the Site limits.

1.3 Summary of Previous Investigations

Previous evaluations that have been completed at the Site identified elevated concentrations of chlorinated solvents that have exceeded NYSDEC TOGS 1.1.1 Ambient Water Quality Standards (NYSDEC water quality standards), and 6 NYCRR Part 375, Subpart 375-6.8 Soil Cleanup Objectives. The two studies discussed below identified the highest levels of

contamination near the southwest corner of the former Town Square Body Shop.

The contaminants of concern (COCs) are chlorinated solvents, specifically Tetrachloroethene, and its transformation products. Petroleum fuel-related compounds have also been detected in groundwater at the Site at concentrations generally less than 10 ug/L (parts per billion-ppb).

A Phase I and Limited II Environmental Site Assessment (ESA) were completed in 1996 by Gaynor Associates, Inc. that encompassed the Ash Road Properties Site. In 1996, there were two buildings on the Site, one occupied by Town Square Body Shop and the other by Hall Plumbing. Monarch Chemical was identified as a prior occupant of the Town Square Body Shop property; Dean Fowler Oil Company formerly occupied Hall Plumbing. The report identified floor drains in both buildings that were not connected to the municipal sewer system, and poor housekeeping practices of various automotive products inside the body shop. Contamination by petroleum and chlorinated compounds was detected in the groundwater that exceeded NYSDEC water quality standards. A total of nine borings and three monitoring wells were completed at the Site. The groundwater evaluation identified an area southwest of the then existing Town Square Body Shop building with the highest concentrations of chlorinated solvents (January 1996, Gaynor Associates).

The Site Characterization Report, Ash Road Site (7-04-032), Vestal, New York prepared by EA Engineering, P.C. in September 2009 for NYSDEC, indicated that there was a limited shallow source area of primarily chlorinated compounds located in the west portion of the Site. The highest contaminant concentration was observed near the southwest corner of the former Town Square Body Shop building. The source area appears to have impacted groundwater quality migrating northwesterly in the direction of groundwater flow. EA recommended interim remedial measures including the excavation of soil in the identified source area, and additional remedial investigation of the Site. The conclusions reached from this characterization initiated a NYSDEC notification letter to West Covina Royale, LP of the Department's intent to consider 221 Sycamore Road for inclusion on the Registry of Inactive Hazardous Waste Disposal Sites in New York State.

1.4 Geologic and Hydrogeologic Setting

The Site is located in the Susquehanna River Basin within the Susquehanna River Valley. The study area is generally underlain by four primary geologic units. There is a variable sand and

gravel fill overlying silty or clayey sand and gravel. The sand and gravel is underlain by a dense glacial till deposit. In the southern section of the Site, a lacustrine grey silt and clay deposit was observed underlying the glacial till deposit. There is an organic deposit underlying the silty or clayey sand and gravel unit within the RI/IRM area extending westward across the Site to the west.

Depth to bedrock is estimated to be at least 75 feet below ground surface in the general vicinity of the Site.

The Site overlies the NYSDEC Endicott-Johnson City Area Primary Water Supply Aquifer. The Vestal Water District municipal well, Vestal Well 4-2 is approximately ½-mile north of the Site. Depth to bedrock at this municipal well was reportedly encountered at approximately 100 feet below ground surface. Water quality at Vestal Well 4-2 had been impacted by trichloroethene, initiating both the State and USEPA to add this municipal well field to the NYSDEC and USEPA Priority Lists. Current water quality reports at Well 4-2 meet NYSDEC water quality standards; therefore, in 2012 both the State and USEPA classified the site as completed, requiring no further action.

The general direction of groundwater flow is to the northwest toward the Susquehanna River located about 2,000 feet northwest of the Site. The local groundwater flow at the Site is also to the northwest. Groundwater at the Site has been encountered within 10 feet below ground surface, within or below the organic deposit.

An intermittent stream located along the north side of the Site was channelized through a culvert during the Lowe's Home Center development. This channel flows from east to west and receives storm water runoff from the Lowe's paved parking area.

2 NATURE AND EXTENT OF CONTAMINATION

The following sections summarize and discuss the analytical results generated during the RI/IRM. Soil and groundwater 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), and Vinyl Chloride (VC).

2.1 Standards, Criteria and Guideline

Applicable or relevant and appropriate standards, criteria and guidelines (SCGs) are used to develop remedial action objectives (RAO), and to formulate remedial action alternatives for each specific media. The following is a summary of the SCGs that will be used in determining the RAO.

2.1.1 Groundwater

Groundwater at the Site is considered Class GA under 6 NYCRR Parts 700-706, Water Quality Regulations, Ambient Water Quality Standards and Guidance Values (NYS Standards).

2.1.2 Soil

The SCGs for soils are as follows:

- NYCRR Part 375 Restricted Use Soil Cleanup Objectives (SCOs) for the Protection of Groundwater.
- NYCRR Part 375 Commercial Use SCOs for the Protection of Public Health.

2.2 Summary of IRM and Soil Analyses

The quality of soils beneath the Site was evaluated by comparing the analytical results to both SCOs for Commercial Use and for the Protection of Groundwater. These comparisons found that the COCs that exceeded the Restricted SCOs for the Protection of Groundwater were tetrachloroethene, trichloroethene *cis*-1,2-dichloroethene, and vinyl chloride. The only COC that exceeded the Commercial SCO was tetrachloroethene in near surface soils at the source.

The soils that exhibited the highest COC concentrations including those that exceeded the Commercial SCOs were removed through the excavation of approximately 197 tons of impacted soil during the IRM. The remaining soils that exceed the SCOs for the protection of groundwater are generally within the capillary fringe and saturated zones.

Elevated levels of iron, aluminum and/or calcium were detected above the Commercial SCOs. These concentrations likely represent naturally occurring conditions or are associated with the fill deposits, and are not associated with the COCs.

Based on all the observations made during the RI/IRM, the source of the COCs was from a surface release. No other source areas of COCs were identified during the RI or during the previous evaluations at the Site.

The number of samples analyzed, the range in COC concentrations observed both pre and post-IRM, and the number of samples that exceeded the SCOs are summarized in the following table.

Table 2-1
Soil Contaminant Concentration Summary

Contaminant	Concentration Range Detected *[ppm]*	Restricted SCO[1] *[ppm]*	No. of Excursions	No. Exceeding Restricted SCO
COCs				
Tetrachloroethene	0.01823 to 240	1.3	23	5
Trichloroethene	0.0031J to 1.0	0.470	23	1
cis-1,2-Dichloroethene	0.003J to 9.4	0.250	23	4
Vinyl Chloride	0.011U to 0.03	0.02	23	1

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

2.3 Groundwater Summary

Nine monitoring wells including three well pairs are present on the Site; four of the monitoring wells were installed during a previous evaluation at the Site. Six of these monitoring wells were installed with the screened section straddling the water table, and three deeper piezometric wells were installed with the screened section placed at or into a confining layer. Three monitoring wells were installed off-site during the previous evaluation, one down gradient of the Site and two upgradient of the Site. Groundwater at these off-site monitoring well locations was also evaluated during the RI (see Drawing No. 3).

The groundwater sampling results indicate that the primary COCs are tetrachloroethene and its transformation products trichloroethene, *cis*-1,2-dichloroethene and vinyl chloride. Contaminant concentrations in groundwater are elevated above SCGs. The contaminant concentration gradient decreases with depth.

The contaminant concentrations at well MW-01 have remained similar during the sampling events that have occurred since 2008. This well is located north of the storm sewer trench and

north of the Ash Road Properties limits. The dissolved tetrachloroethene concentrations at well MW-02S have fluctuated over four orders of magnitude with a decreasing trend in contaminant concentrations post-IRM activities. This well is located south of the storm sewer trench. Given the depths of the nearby sanitary sewer trench (at or below the water table elevations at MW-02S) and the pump station (approximately 10 feet below the water table elevations at MW-02S) located west of the Site, the backfill material for these structures are likely providing a preferential flow path for groundwater in the vicinity of the pump station.

While the contaminant concentrations at well MW-09S have remained similar post-IRM, the dissolved tetrachloroethene contours post-IRM depicts a shrinking plume.

Contaminant concentrations in the deeper wells have been below the SCGs for the last three quarterly sampling events.

The number of samples analyzed, the range in COC concentrations observed, and the number of samples that exceeded the SCG are summarized in the following the table.

Table 2-2
Groundwater Contaminant Summary

Contaminant	Concentration Range *[ppb]*	SCG *[ppb]*	No. of Excursions	No. Exceeding SCG
Tetrachloroethene	1 U to 42,000	5	51	22
Trichloroethene	1 U to 7,100	5	51	20
cis-1,2-Dichloroethene	1 U to 15,000	5	51	23
Vinyl Chloride	1 U to 2,900	2	51	11
1,1,2-Trichloroethane	1U to 410J	1	51	1
1.1-Dichloroethene	1U to 13	5	51	2

Transformation of tetrachloroethene is apparent through the distribution of the COCs in groundwater. Transformation products of tetrachloroethene have accounted for as much as 90% of the contaminant distribution on groundwater samples when tetrachloroethene is present.

2.4 Soil Vapor Summary

The potential for soil vapor intrusion resulting from the presence of site-related COCs in soil and groundwater was evaluated. Soil vapor samples were collected at the Site's boundaries for analyses. The concentrations of the COCs that were detected above the quantitation limits are

presented in the following table.

Table 2-3
Analytical Testing Summary
Soil Vapor

Detected Constituent	Soil Gas Concentration Range (ug/m^3)			
	SVP-1 (West)	SVP-2 (South)	SVP-3 (East)	SVP-4 (North)
Tetrachloroethene	19	40	4.7	90
Trichloroethene	590	55	<0.82	73
cis-1,2-Dichloroethene	600	140	11	160
1,1-Dichloroethene	37	23	<0.62	<0.62
Vinyl Chloride	<0.39	110	<0.39	<0.39

The sample with the highest concentrations is SVP-1, located over the groundwater contaminant plume. The COCs detected in the soil vapor samples were also detected in the groundwater samples historically collected at the Site. The distribution of COCs in soil vapor further demonstrates that degradation of tetrachloroethene is occurring within the soil and groundwater systems at the Site.

3 REMEDIAL ACTION GOALS AND OBJECTIVES

A Qualitative Human Health Exposure Assessment (QHHEA) was completed as part of the RI/IRM for Ash Road Properties. One identified contaminant source area (Ash Road Properties) and one class of contaminants (chlorinated volatile organic compounds) were evaluated in the QHHEA.

The data collected at the Site indicates that COCs are present in subsurface soils at concentrations exceeding the Restricted SCOs for the Protection of Groundwater, but are below the Commercial SCOs for the Protection of Public Health. Concentrations of COCs in groundwater at the Site exceed SCGs.

There are no points of exposure identified for direct dermal contact, ingestion or inhalation with impacted soil or groundwater at the Site under current conditions either to Site occupants or to the community.

There is the potential for future exposure to COCs through inhalation to Site occupants if future development includes the construction of a building in the western section of the Site.

Exposure to the COCs in the subsurface soils, soil vapor or groundwater under current Site conditions is limited to municipal and utility workers. The potential exposure pathways for municipal and utility workers are considered complete. In addition, future building contractors, as a group, have the potential of exposure to subsurface soils, soil vapor and groundwater.

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 RI/IRM, the present and anticipated use of the Site 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 3-1
Remedial Action Objectives

Media	Remedial Action Objective
Soil	RAOs for Public Health Protection: • Prevent ingestion/direct contact with impacted subsurface soils. • Prevent inhalation of or exposure to persons to COCs volatilizing from soil.
Groundwater	RAOs for Public Health Protection: • Prevent ingestion of groundwater with COCs levels exceeding SCGs. • Prevent contact with or inhalation of COCs from impacted groundwater. RAO for Environmental Protection: • 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.

4 ALTERNATIVE ANALYSIS

The purpose of an Alternative Analysis (AA) is to use information collected during the RI/IRM to develop alternative remedies that will achieve the specific RAO.

As a volunteer to the BCP, the alternatives developed and evaluated in this analysis will address on-site contamination.

This AA 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 SCOs that are protective of public health and the environment as established in 6 NYCRR Part 375-3.8(e).

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

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

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

4.1 Description of Evaluation Criteria

4.1.1 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.

4.1.2 Compliance with Standards, Criteria and Guidances (SCGs)

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

4.1.3 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 the RAOs established for the Site.

4.1.4 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.

4.1.5 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.

4.1.6 Implementability

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

4.1.7 Cost Effectiveness

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 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

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

The remedial technologies 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.).

The approach used for the screening and selection process is 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 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. 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.

As a Volunteer, West Covina Royale, LP is responsible to address on-site groundwater contamination through source removal or control, to address the feasibility of groundwater quality restoration, and to prevent further migration of any plume off-site at the boundary, which may include actions that would maintain and monitor any stabilization of the plume.

The process used in the screening of feasible remedial options for soil, soil vapor and groundwater 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 SCOs/SCGs.

5.1 Remedial Technologies for COCs in Soil

Groundwater quality at the Site has been impacted from one source area identified during both the previous investigations and during the RI/IRM. The source of groundwater impact was identified to be from a surface release of tetrachloroethene in the western portion of the Site. These soils were excavated and removed, to the extent feasible, from the Site during the implementation of the IRM.

5.1.1 Institutional Controls

By the removal of surface and subsurface soil impacted by tetrachloroethene, the potential of exposure to the community and current occupants to these soils have been further minimized or eliminated. The contaminant concentrations that remain in the soils are below the SCOs that have been developed for the Protection of Public Health for Commercial properties. Based on potential future use of the Site and the restrictions placed on future use by local zoning, no further remedial efforts for COCs in soils under this technology are planned. While no complete exposure pathway has been identified for the community or Site occupants to soils impacted by COCs that exceed the SCOs under current site conditions, an environmental easement and a Site Management Plan (SMP) would provide a notification mechanism for potential future exposures. Institutional controls are feasible for achieving the RAO for soils and are retained for further consideration.

5.2 Remedial Technologies for COCs in Groundwater

The potential migration of any on-site plume off-site has been reduced through source removal and is supported by the reduction of contaminant concentrations in groundwater at the Site.

5.2.1 Institutional Controls

Under Institutional Controls, no active groundwater remediation would be implemented. While groundwater quality at the Site exceeds SCGs, no complete dermal or ingestion exposure pathway has been identified to the community or Site occupants to groundwater

impacted by COCs. The Site and adjoining properties are serviced by the municipal water supply system. The Vestal Water District municipal well, Vestal Well 4-2 is approximately ½-mile north of the Site. The Site is located outside the Town of Vestal designated Critical Environmental Area for the Vestal Well Field 4-2, 4-3 and 4-4 Recharge Areas.

Implementation of Institutional Controls is feasible if implemented in conjunction with other remedial technologies to achieve the ROAs for groundwater and is retained for further consideration.

5.2.2 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 and geological factors that can influence the applicability of ISCO and its effectiveness for this project.

The degradation of tetrachloroethene is apparent with the detection of various transformation products in the dissolved state in the groundwater samples that have been collected for analyses. The injection of a chemical oxidant into the subsurface will change current soil and groundwater chemistry that will influence the natural microbial population that is currently degrading the COCs. Chemical oxidants such as sodium and potassium permanganate are disinfectants. The injection of these types of reagents will likely slow and may stop the natural attenuation that is occurring at the Site.

The feasibility of this technology is questionable due to the proximity of buried utilities in the study area with the high potential that the oxidant will be carried off-site through utility trenches. The storm water utility trench has been demonstrated to influence groundwater and contaminant flow at the Site.

The technology has not been retained for further discussion under the selection criteria due to the high potential of reducing or stopping natural attenuation processes that are occurring at the Site.

5.2.3 In-Situ Bioremediation

The objective of enhanced in-situ bioremediation 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. 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 bioremediation substrate.

While the purpose of bioremediation is to increase the viability of a population of a particular group of microbes to degrade a particular contaminant, this process is already occurring within the groundwater system at the Site, indicating that the existing geochemical conditions are favorable for biodegradation. As indicated in Section 5.2.2, changing the existing groundwater chemistry at the Site through the injection of a biostimulant would likely influence the microbial population distribution, potentially negatively influencing the rate of degradation that is already occurring at the Site. This technology can meet the RAO for environmental protection by reducing contaminant concentrations in groundwater, but typically would not achieve the RAO for Public Health in prevention of inhalation of COCs from impacted groundwater. This technology has been retained for further discussion under the selection criteria.

5.3 Remedial Technologies 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. These matrices are applicable when considering the technology reducing inhalation pathway in residential and commercial buildings.

5.3.1 Institution and Engineering Controls

Institutional Controls with a SMP and environmental easement would be effective in assuring that the RAO for preventing potential inhalation exposure to contaminant soil vapor at the Site is evaluated during future site development. Engineering Controls, if warranted, can be implemented to mitigate vapor intrusion should the Site be developed in the future. These controls are feasible and are 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.

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

No Further Action indicates that no additional remedial action beyond the IRM will be conducted at the 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 will continue to 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 groundwater, soil or 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 Site occupants to soils impacted by

COCs. Soils that have been impacted by COCs lie below the Site asphalt pavement. No buildings are currently present on the Site. There is a potential of vapor intrusion via vapor migration at the Site should additional development at the Site include the construction of a building in the western portion of the Site.

6.1.2 Reduction of Toxicity, Mobility, and Volume

While under the no action alternative, the impacted groundwater, soil and soil vapor would not be treated, recycled or destroyed through active treatment; data obtained during the RI/IRM has demonstrated that natural attenuation of COCs is occurring at the Site

Natural attenuation processes 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.

6.1.3 Long-term Effectiveness and Permanence

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 notification mechanisms, 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 human health exposure pathways via direct contact and inhalation.

6.1.4 Short-term Impact and Effectiveness

No additional remedial action beyond the IRM 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 that are occurring in soil and groundwater at the Site.

6.1.7 Cost

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

6.2 Alternative 2 – Natural Attenuation, Groundwater Monitoring, Engineering Controls and Institutional Controls

Alternative 2 would provide mechanisms to monitor the natural attenuation of COCs that remain in soil and groundwater at the Site and to control future use limitations of the Site through the placement of engineering controls, if warranted, and institutional controls.

6.2.1 Overall Protection of Human Health and the Environment

This alternative can meet the protectiveness criterion for both human health and the environment.

6.2.2 Reduction of Toxicity, Mobility, and Volume

Natural attenuation processes 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.

6.2.3 Long-term Effectiveness and Permanence

Reduction of COCs in groundwater may not achieve the RAO for the protection of public health associated with exposure to soil vapor. The implementation of engineering controls, if warranted, will eliminate the potential of exposure via vapor intrusion, if future development at the Site should occur. Establishing institutional controls will be effective in achieving the RAO for exposure to future site occupants, and construction and utility workers through the development of a Site Management Plan and placement of an Environmental Easement on the Site.

6.2.4 Short-term Impact and Effectiveness

The short-term impact of this alternative has little potential of impacting human health and the environment during the implementation phase. There are no identified risks to the community or site-occupants from the implementation of this alternative.

6.2.5 Implementability

There are no concerns with the ability to implement this alternative.

6.2.6 Compliance with SCGs

While this alternative along with many presumptive remedial technologies generally do not achieve SCGs, the goal of these technologies for the type of contaminants that exist at the Site is to reduce the contaminant to a less toxic or non-toxic form. The reduction of tetrachloroethene is already occurring under current Site conditions.

6.2.7 Cost

The cost development for this alternative assumes the following:

- Groundwater Monitoring on a quarterly basis for 1 year and annually for 3 years.

  - Quarterly and Annual Monitoring Costs $28,000

- Engineering Controls/Institutional Controls including a Site Management Plan, Alta Survey and Environmental Easement.

- Implementing EC/IC $40,000

6.3 Alternative 3 – In-Situ Bioremediation, Groundwater Monitoring, Engineering Controls and Institutional Controls

Alternative 3 would provide mechanisms to potentially accelerate the biological degradation that is currently occurring to the COCs that remain in soil and groundwater at the Site and to control future use limitations of the Site through the placement of institutional controls and, if warranted, engineering controls. Groundwater monitoring would be included as a component of this remedial alternative.

6.3.1 Overall Protection of Human Health and the Environment

This alternative can meet the protectiveness criterion for both human health and the environment.

6.3.2 Reduction of Toxicity, Mobility, and Volume

While the natural processes, which are currently active at the Site would continue to reduce the levels of contaminants at the Site for Alternative 2, augmented in-situ bioremediation may increase the rate of contaminant reduction in soil and groundwater.

6.3.3 Long-term Effectiveness and Permanence

Reduction of COCs in groundwater through augmented in-situ bioremediation may not achieve the RAO for the protection of public health associated with exposure to soil vapor. The implementation of engineering controls, if warranted, will eliminate the potential of exposure via vapor intrusion, if future development at the Site should occur. Establishing institutional controls will be effective in achieving the RAO for exposure to future site occupants, and construction and utility workers through the development of a Site Management Plan and placement of an Environmental Easement on the Site.

6.3.4 Short-term Impact and Effectiveness

The short-term impact of this alternative has little potential of impacting human health and the environment during the implementation phase. There are no identified risks to the community or site-occupants from the implementation of this alternative.

6.3.5 Implementability

While there are no concerns with the ability to implement this alternative, the injection of bioremediation reagents into the subsurface may alter the existing environment that is currently supporting the dehalogenation processes. Even minor changes in pH can stall the current degradation processes that have been observed.

6.3.6 Compliance with SCGs

While this alternative along with many presumptive remedial technologies generally do not achieve SCGs, the goal of this technology is to shorten the already occurring biodegradation of the COCs.

6.3.7 Cost

The cost development for this alternative assumes the following:

- In-Situ Bioremediation

  - One Injection Event of a Bioremediation Reagent $20,000

- Groundwater Monitoring, Quarterly for 6 months, Annually for 2 years.

  - Quarterly and Annual Monitoring Costs $15,000

- Engineering Controls/Institutional Controls including a Site Management Plan, Alta Survey and Environmental Easement.

  - Implementing EC/IC $40,000

7 RECOMMENDATION

The recommended remedial alternative that addresses the identified RAOs in a timely manner is Alternative 3. While the source area has been removed to the extent feasible and natural degradation processes are currently active, the acceleration of these processes through augmented bioremediation may increase the rate of reduction of the on-going impact to groundwater quality both at the Site and off-site.

The components of the recommended remedy are as following:

- Pre-injection groundwater sampling of existing wells to include monitoring of field parameters (pH, DO, ORP, specific conductance and temperature).
- A network of injection points are proposed within the 500 ppb PCE plume in the shallow groundwater zone. Bioremediation reagent to be determined in the Remedial Action Work Plan (RAWP).
- Field parameter monitoring and post-injection performance sampling of monitoring wells will be completed at intervals to be determine in the RAWP. Anticipate monitoring will extend up to 6 months post-injection.
- Implement IC/EC with Site Management Plan and Easement.

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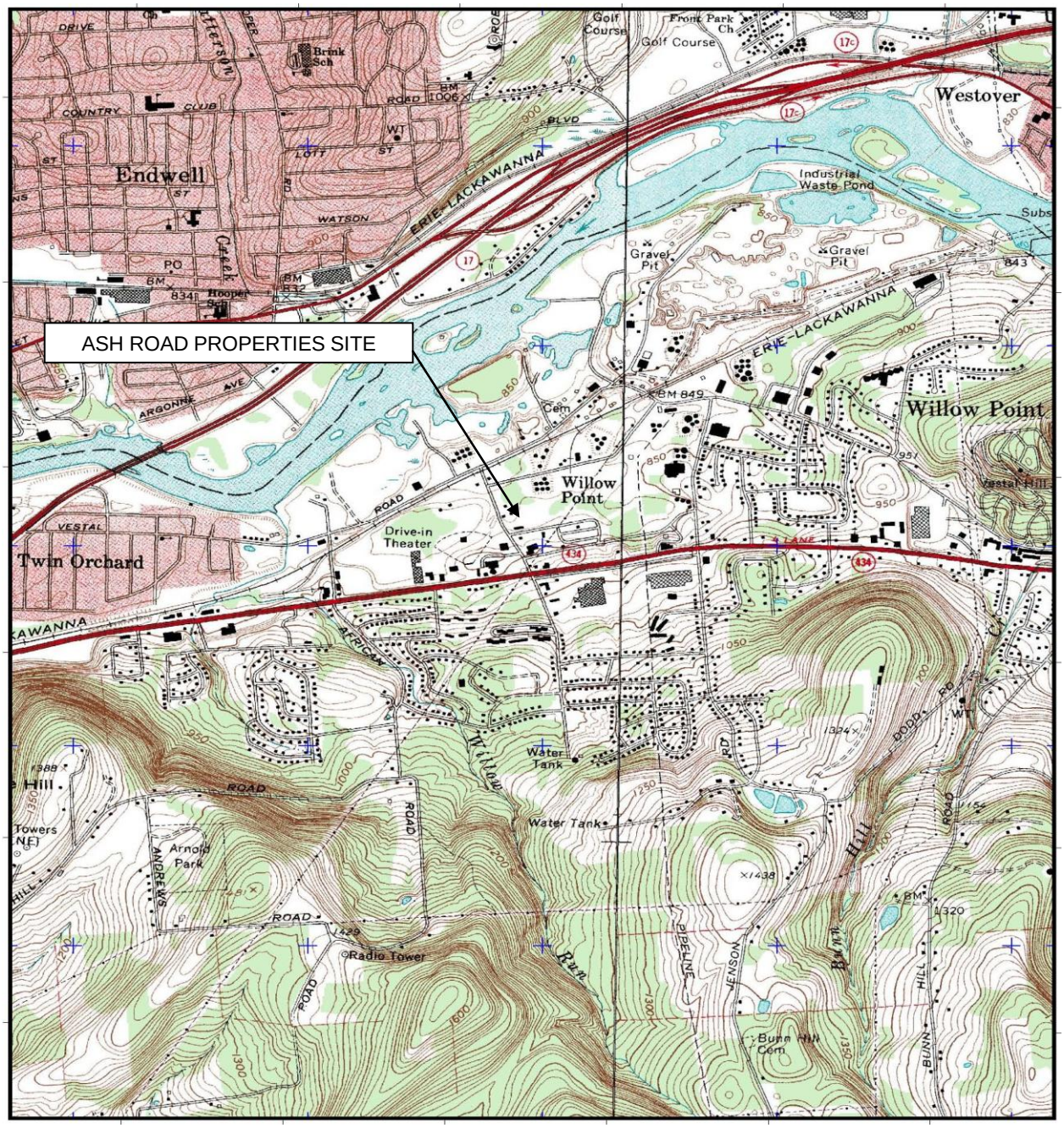

Reference: Base Map USGS 7.5 MIN. Quad. Endicott, NY, 1976
Approximate Scale: 1" = 2000'

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Project North

GeoLogic

GeoLogic NY, Inc.

SITE LOCATION PLAN
ASH ROAD PROPERTIES
Town of Vestal, New York
BCP Site #C704032

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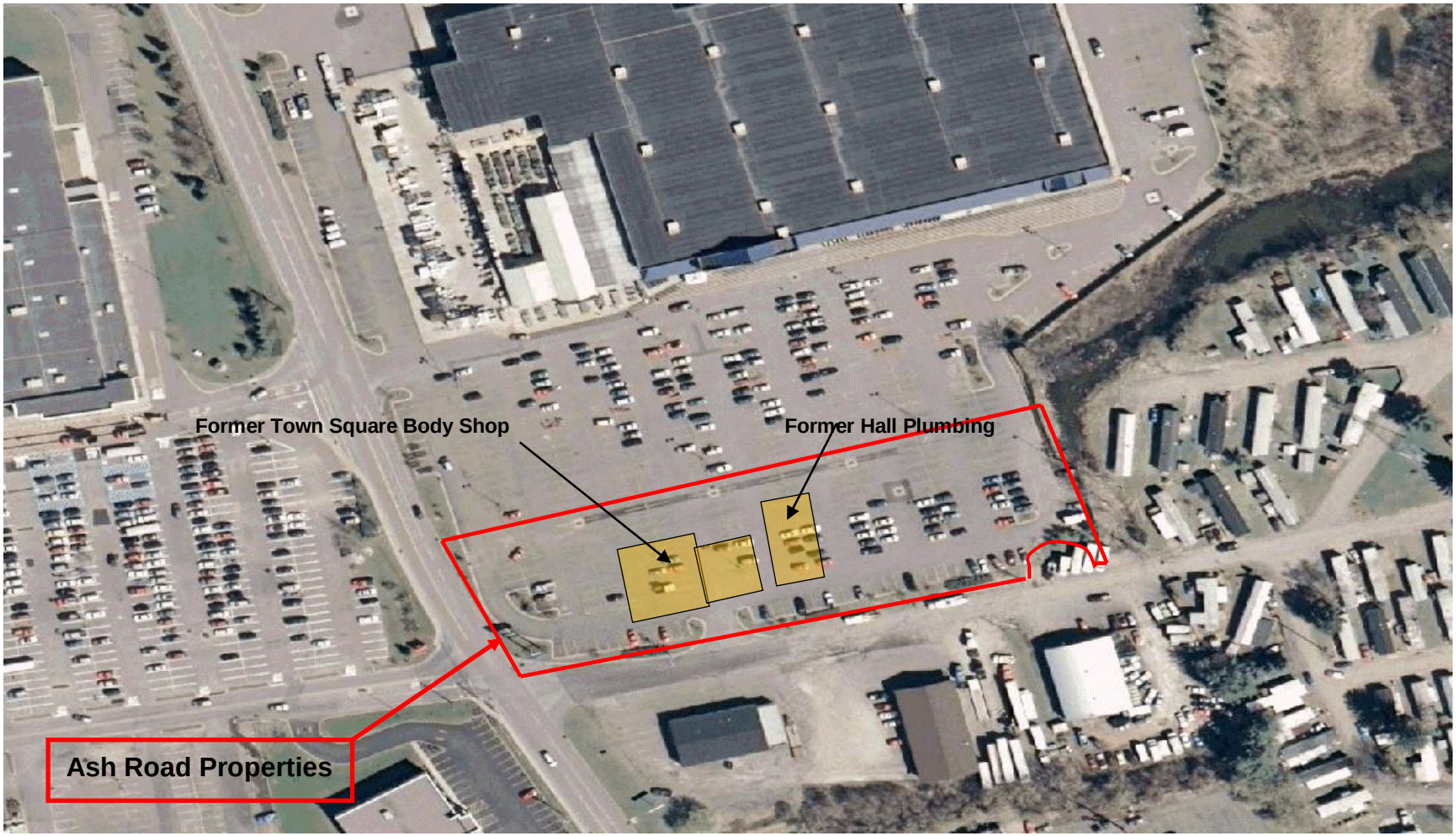

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Project North

GeoLogic

GeoLogic NY, Inc.

BCP PROJECT LIMITS
ASH ROAD PROPERTIES
Town of Vestal, New York
BCP Site #C704032

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