ADDENDUM
to the
REMEDIAL ACTION WORK PLAN
and
REMEDIAL ACTION REPORT

for

RICK'S AUTO REDEVELOPMENT
136 – 138 East Genesee Street
Village of Baldwinsville, Onondaga County, New York
Brownfield Cleanup Program No. B7-0652-04-01
DEC BCP Site No. C734085

Prepared for:

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INTRODUCTION

This addendum presents a BCP remedial alternatives analysis to attain Track 1 for the former Rick's Auto site in the Village of Baldwinsville, Onondaga County. The results of six independent Interim Remedial Actions (IRMs) completed during the site remedial investigation were described fully in the Remedial Investigation Report. These IRMs, coupled with the resulting significant decline in groundwater contaminant concentrations, have significantly improved the site environmental condition. However, portions of the site contain groundwater concentrations above the SCGs.

REMEDIAL ALTERNATIVES ANALYSIS IN COMPARISON TO BCP TRACK 1

The recommended site remediation is the six completed IRMs plus natural attenuation as the remedy. In addition, it is recommended to implement engineering and administrative controls to address residual site groundwater and soil vapor concerns. However, the imposition of engineering and institutional controls is not a Track 1 option for issuance of the Certificate of Completion for a BCP site. This addendum presents an analysis of the actions and costs that would be required to bring this site into a Track 1 condition.

The remedial objectives to attain a Track 1 completion would be to address the source of the soil vapors and groundwater contamination: the groundwater plume. The following approaches are evaluated:

- Chemical oxidation of the plume.

- Excavation of soils within the plume and replacement with clean fill, and groundwater treatment within the plume limits on the site.

Option 1: In-Situ Chemical Oxidation

The residual groundwater contamination is petroleum-based, exhibiting a benzene, toluene, ethylbenzene and xylenes (BTEX) profile. Hydrogen peroxide has been demonstrated as an effective oxidant to degrade BTEX compounds. Furthermore, the literature also clearly shows that effectiveness of hydrogen peroxide is optimized when the concentration of the OH^- radical is highest. Fenton's Reagent, a combination of hydrogen peroxide and iron, has been shown in numerous studies to produce the highest concentration of OH^- radicals. Therefore, the cost estimate is based on application of Fenton's Reagent to the subsurface.

One large positive characteristic of hydrogen peroxide is that it leaves no residual, is non-toxic, and decays completely to water and oxygen. A negative factor is its short half-life of 4 hours. While peroxides are effective at degrading BTEX compounds, they will also completely and spontaneously decay in less than 48 hours. The application of hydrogen peroxide or Fenton's Reagent to chemically oxidize BTEX in the groundwater at this site relies upon the ability to deliver and quickly distribute the oxidant throughout the affected groundwater zone.

The site hydrogeology, described in the Remedial Investigation Report, indicates the site soils are predominantly fine sandy silts, dense silts and some clay in a fining downward sequence. The soils are of moderate to low permeability. Given this site profile, it is very difficult to deliver and disperse hydrogen peroxide throughout the subsurface so it can destroy the residual groundwater contamination. An estimate of the quantity of peroxide required to chemically oxidize BTEX in site groundwater has been made for an estimated quantity of affected soil. This quantity has been doubled to allow for multiple injections and to account for inefficiency (loss due to spontaneous decay) in delivering the peroxide to the soil pores containing adsorbed contaminant.

The affected zone at the site is shown on Figure 1. It is calculated as surface area, shown to a depth of 8 feet. This area is based on an estimated subsurface impact area of approximately 10,500 square feet.

The estimated cost to implement Fenton's Reagent to the subsurface zones that display any groundwater impact is within a range of $230,000 to $570,000.

Option 2: Soil Excavation, Disposal and Replacement

Figure 1 shows the area of excavation evaluated. Some of this soil lies along and within the State right-of-way for Route 31. This area also contains buried utility lines for water, sewer, and natural gas piping that would have to be cautiously excavated and backfilled. This would slow the work to avoid rupturing established utility lines and services.

The soils to be removed are outside the IRM excavation limits. Up to a volume of 3,100 cubic yards (at 2.5 tons per cubic yard = 7,800 tons) of soil may be excavated and disposed of to remove all residual site contamination. This soil would be sampled for landfill characterization and disposed of at a qualified landfill.

Groundwater in the open excavation would be pumped into a vacuum truck and placed into a frac tank, from which it would be pumped through granular activated carbon (GAC) and discharged to the publicly owned treatment works (POTW), under a temporary discharge permit.

The excavated soil would be stockpiled onsite and sampled for disposal characterization. Once accepted by the landfill, the soil would be loaded and trucked to its final destination. Clean fill would be backfilled into the excavation and compacted in place.

The estimated cost to implement this remedial option is in the range of $540,000 to $640,000.

SHORT-TERM EFFECTIVENESS AND IMPACT

The short-term effectiveness of Option 1 can be determined quickly after the termination of the Fenton's Reagent injections. Within 72 hours of termination, the groundwater can be sampled, as the peroxides would be completely decayed and would no longer be active to oxidize subsurface contaminant concentrations. Therefore, within a short time frame after conclusion of this option, an assessment of it effectiveness can be made. The impact is more difficult to assess. Fenton's Reagent is very reactive, but non-specific for its reactants. If background oxidant demand is higher than expected or soil permeability characteristics delay its penetration into the subsurface formation long enough for spontaneous decay, the injection may fail.

The short-term effectiveness of Option 2 (soil removal) is clear, as soil removal is permanent and finite in time. This option is highly effective in the short-term, as it serves to remove residual source areas. However, the impact of this option cannot be assessed in the short-term, but should await a long-term assessment on the order to 6 to 12 months.

LONG-TERM EFFECTIVENESS AND IMPACT

The long-term effectiveness of Option 1 (chemical oxidation) is demonstrated through several quarters of groundwater monitoring. This monitoring is needed to assess the potential for "rebound" effects, where groundwater concentrations drop initially after physical/chemical contaminant treatment is halted and residual contaminants outside the treatment zone are released/dissolved from storage within pore spaces between soil grains or adherent to soil grains due to the decline in the concentration gradient in the groundwater. This effect can result in a complete rebound of concentrations to pre-treatment levels. However, if concentrations remain lowered through successive quarterly monitoring events, then long-term effectiveness of the treatment technology is demonstrated.

Long-term effectiveness of Option 2 (soil removal) is readily assessed through groundwater sampling in the four quarters following completion of the excavation. The impact, if successful, is a sudden and permanent reduction in site groundwater volatile organic compound (VOC) concentrations.

REDUCTION IN TOXICITY, MOBILITY OR VOLUME

Option 1 (chemical oxidation) effects a reduction in volume of the contaminant in the subsurface, and in so doing, may secondarily reduce toxicity through reduction in concentration. However, if complete contaminant reduction is not achieved, it can result in enhanced mobility through the destruction of soil organic matter. Soil organic matter absorbs contaminants with the effect that contaminant mobility is reduced, so any action that reduces the organic matter mass could enhance contaminant mobility.

Option 2 (soil removal) reduces toxicity, mobility and contaminant volume through direct source removal.

IMPLEMENTABILITY

Both options are technically feasible, in that both chemical oxidation of petroleum compounds with Fenton's Reagent and soil excavation are proven technologies.

There are several obstacles to implementation of these remedial options. Chemical oxidation with Fenton's Reagent is best suited to permeable formations where the oxidant is readily delivered and distributed throughout the subsurface quickly. Heterogeneity and the fine-grained soils make this very difficult to achieve at this site. It is most likely that a significant amount of oxidant would not reach the intended "target" and instead would decay in the subsurface without accomplishing its intended purpose. Soil excavation also poses difficulty, in that the bulk of soils identified to be excavated lie along Route 31 within the State right-of-way and are intermingled with buried utilities, including water, sewer and natural gas lines. Soil excavation from around and under these utilities poses difficult and, in the case of the natural gas lines, dangerous work. Backfilling of clean fill poses the same concerns. In addition, such an excavation would require a permit from the New York State Department of Transportation (DOT), who may not grant such a permit.

An engineering judgment is required to evaluate whether the additional risk and cost to remove residual contamination is justified by the gain pursued. It does not appear that these options warrant the cost in both time and effort for the potential gain in light of the continuing improvement in groundwater concentrations at the site.

A summary of remedial options is presented in the table below. Detailed cost estimates for each option are presented in Tables 1, 2 and 3.

Remedial Option	**Cost Range**
Natural Attenuation	~$68,000
Chemical Oxidation	$230,000 to $570,000
Soil Disposal, Clean Fill	$540,000 to $640,000

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TRACK 1 REMEDIAL ALTERNATIVE ANALYSIS
TABLE 1 - IN-SITU CHEMICAL OXIDATION

Cost Line Items	Cubic Yards	Tons	Unit Cost	Unit	Quantity	Cost	Comments
Soil Volume	3,118	7,795					
Hydrogen Peroxide Demand*							Application doubled for low permeability soils
Low Oxidant Demand (10 g/kg soil)			$4.5	gal	37,386	$168,237	Low background demand at 10 g H_2O_2/kg soil
High Oxidant Demand (30 g/kg)			$4.5	gal	112,158	$504,712	High end demand 30 mg/kg soil
Iron (FeSO4)			$2	gal	11,216	$22,432	10% of the demand peroxide
Injection point Installation			$3,600	LS	1	$3,600	Driller to install 8 injection points (2 days)
Field Supplies			$2,000	LS	1	$2,000	
Project Mgmt (Engineer)			$115	hr	40	$4,600	Includes permitting and notifications
Technician			$60	hr	80	$4,800	
Geologist			$90	hr	96	$8,640	Includes oversight of injection well installation
Engineering Design (15%)			$125	hr	32	$4,000	
Sampling and Analysis							
Soil (VOC)			$98	sample	50	$4,888	STARS Memo #1 confirm. samples + QA/QC
Water (2 rounds VOC+QA/QC)			$98	sample	57	$5,572	
Reporting			$125	hr	40	$5,000	
						$230,000	low range
						$570,000	high range

Notes:

* 10 - 30 gm oxidant/kg of soil found in literature to estimate dose. Limit to 10% concentration to avoid excess heat.
Cost of enhanced bioremediation ranged from $20 - $80 per cu yd (Federal Remediation Technologies Roundtable).
Alternate literature source estimated 24.5 gal H_2O_2 per cubic yard of soil at 35% conc., actual applied at 10% due to heat.

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TRACK 1 REMEDIAL ALTERNATIVE ANALYSIS
TABLE 2 - EXCAVATION, DISPOSAL AND REPLACEMENT OF IMPACTED SOIL

Cost Line Items	Cubic Yards	Tons	Unit Cost	Unit	Quantity	Cost	Comments
Soil Volume	3,118	7,795					
Contaminated Soil Transportation			$50	ton	7,795	$389,750	density 2.5 tons/cu yd
and Disposal			$50	ton	5,846	$292,313	density 1.875 ton/cu yd
Clean Bank Run Gravel/Cobble Fill			$15	ton	7,795	$116,925	
Equipment: Excavation	Excavator		$1,200	day	15	$18,000	500 cy/day
	Mob/Demob		$2,000	LS	1	$2,000	
	2 dump trucks		$500	truck/day	40	$20,000	3 loads/truck/day
Road Removal and Replacement			$17,000	LS	1	$17,000	
Groundwater Removal Vac Truck			$500	day	15	$7,500	
Frac Tank			$1,500	month	1	$1,500	
Carbon treatment: Groundwater			$1,500	/drum	2	$3,000	purchase and disposal
Post Excavation: Site Restoration			$2,000	LS	1	$2,000	grading and reseeding
Project Mgmt (Engineer)			$115	hr	32	$3,680	
Technician			$65	hr	128	$8,320	
Geologist			$90	hr	40	$3,600	
Engineering Design			$125	hr	40	$5,000	
Sampling and Analysis							
Soil VOC			$98	sample	50	$4,888	STARS Memo #1 confirm. samples + QA/QC
Disposal Characterization			$750	sample	12	$9,000	
Post GW sampling (2 rounds)			$98	sample	30	$2,933	Includes 4 QA/QC per round
Comm. Air Monitoring Program			$1,000	day	15	$15,000	
Reporting			$125	hr	40	$5,000	
						$540,000	Low range
						$640,000	High range

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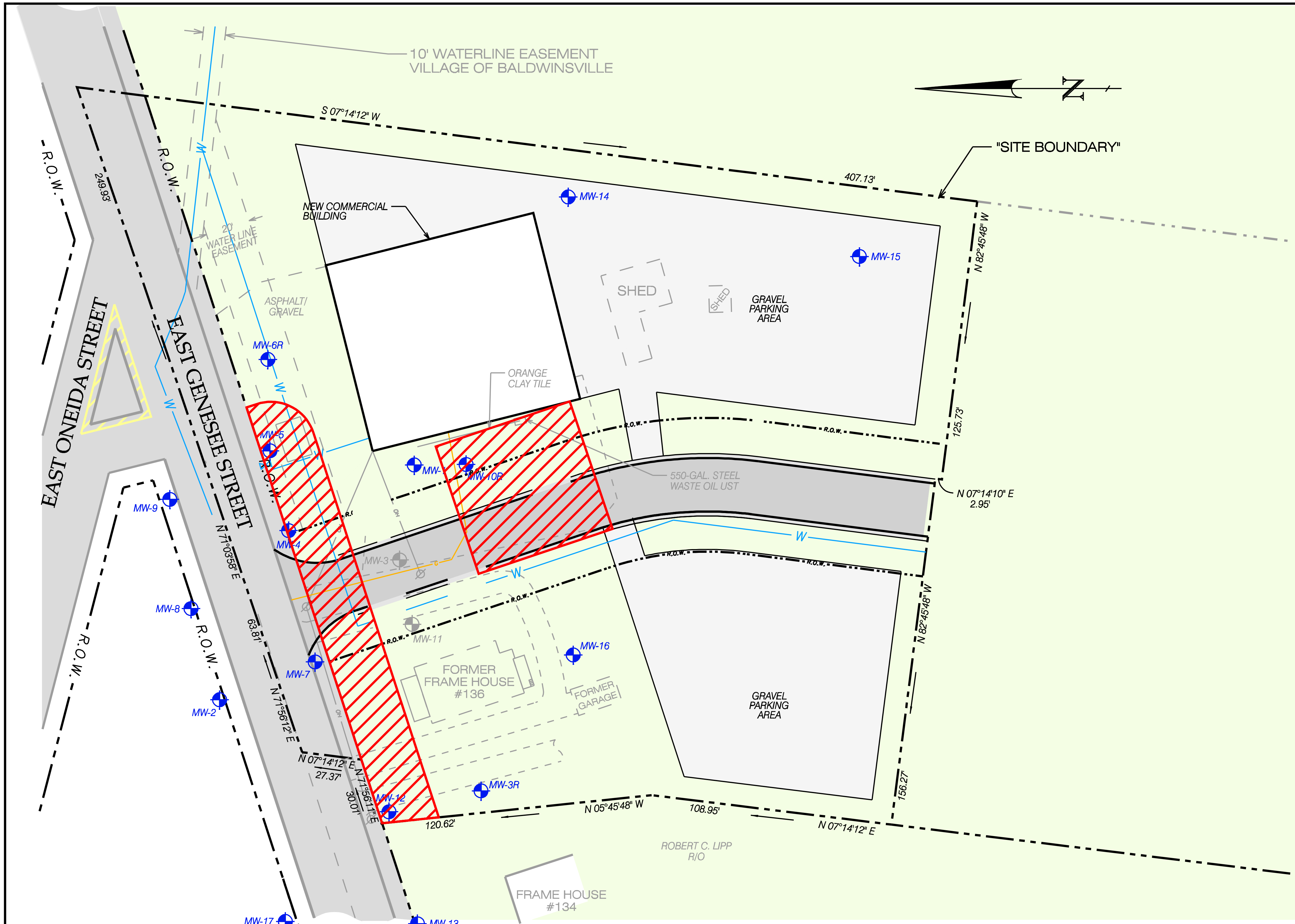
TRACK 1 REMEDIAL ALTERNATIVE ANALYSIS
TABLE 3 - NATURAL ATTENUATION - YEAR 1

Cost Line Items	Analysis	Unit Cost	Unit	Quantity	Cost	Comments
Laboratory Analytical - Year 1 - GROUNDWATER						
Groundwater sample, 1st, 2nd and 4th qtrs.	8260	$104	sample	18	$1,863	TCL plus STARS lists, no QA/QC
Groundwater sample, 1st, 2nd and 4th qtrs.	8270	$230	sample	18	$4,140	TCL plus STARS lists, no QA/QC
Groundwater sample, 3rd qtr.	8260	$104	sample	20	$2,070	TCL plus STARS lists, incl. 4 QA/QC samples
Groundwater sample, 3rd qtr.	8270	$230	sample	20	$4,600	TCL plus STARS lists, incl. 4 QA/QC samples
Category B samples	8260	$21	sample	2	$4,600	10% 3rd qtr samps (16 not incl. QA/QC)
Category B samples	8270	$46	sample	2	$4,600	10% 3rd qtr samps (16 not incl. QA/QC)
DUSR		$200	LS	1	$200	
Field Supplies		$1,000	LS	1	$1,000	pump, bailers, poly sheeting, gloves
Project Mgmt (Engineer)		$115	hr	4	$460	oversight, 4 qtrs sampling
Technician		$60	hr	20	$1,200	4 qtrs sampling
Geologist/Engineer		$90	hr	4	$360	4 qtrs sampling
Reporting		$125	hr	40	$5,000	3 ltr rpts (4 hr ea), 1 annual rpt (24 hr)
Laboratory Analytical - Year 2 - GROUNDWATER						
Groundwater sample, 1st, 2nd and 4th qtrs.	8260	$104	sample	18	$1,863	TCL plus STARS lists, no QA/QC
Groundwater sample, 1st, 2nd and 4th qtrs.	8270	$230	sample	18	$4,140	TCL plus STARS lists, no QA/QC
Groundwater sample, 3rd qtr.	8260	$104	sample	20	$2,070	TCL plus STARS lists, incl. 4 QA/QC samples
Groundwater sample, 3rd qtr.	8270	$230	sample	20	$4,600	TCL plus STARS lists, incl. 4 QA/QC samples
Category B samples	8260	$21	sample	2	$4,600	10% 3rd qtr samps (16 not incl. QA/QC)
Category B samples	8270	$46	sample	2	$4,600	10% 3rd qtr samps (16 not incl. QA/QC)
DUSR		$200	LS	1	$200	
Field Supplies		$1,000	LS	1	$1,000	pump, bailers, poly sheeting, gloves
Project Mgmt (Engineer)		$115	hr	4	$460	oversight, 4 qtrs sampling
Technician		$60	hr	20	$1,200	4 qtrs sampling
Geologist/Engineer		$90	hr	4	$360	4 qtrs sampling
Reporting		$125	hr	40	$5,000	3 ltr rprts (4 hr each), 1 annual rpt (24 hr)
Laboratory Analytical - Year 1 - SOIL VAPOR						
Vapor sampling point installation		$575	location	6	$3,450	install new vapor monitoring points at locations 4, 5, 6, 10, 11, 12
Geologist/Engineer		$90	hr	8	$720	installation oversight
Soil vapor sample, 1 round	TO-15	$316	sample	6	$1,898	volatiles only per TO-15
Field Supplies		$360	LS	1	$360	helium detector, gloves
Project Mgmt (Engineer)		$115	hr	2	$230	oversight
Technician		$60	hr	10	$600	one sampling round
Geologist/Engineer		$90	hr	4	$360	one sampling round
Reporting		$125	hr	4	$500	1 letter report
TOTALS					**$68,000**	

Note: The cost for TCL + STARS analysis may be slightly higher than shown.



Key

Property Line - Post Subdivision

Right of Way

R/O Reputed Owner

MW-4 Monitoring Wells

MW-3 Former Monitoring Well

Proposed Soil Removal

Notes:

1. Basemap Reference:

"Part of the lands of Stephen Golden, part of Lot No. 86, Town of Lysander, Onondaga County, State of New York." Prepared by: Harold Tarbell, Syracuse, New York; Dated: April 23, 1949.

2. "Part of Farm Lot No. 86, Town of Baldwinsville, Onondaga County, State of New York." Prepared by Ovid White; Dated: June 20, 2003.

3. MW-6 & MW-10 were damaged during site development activities. MW-6R & MW-10R are replacement wells installed in the same locations as the original wells

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PROJECT: RICK'S AUTO REDEVELOPMENT

CLIENT: CL DEVELOPMENT, L.L.C

LOCATION: VILLAGE OF BALDWINSVILLE, ONONDAGA COUNTY, NEW YORK

DWG. TITLE: SITE PLAN
REMEDIAL ALTERATIVES ANALYSIS
ADDENDUM TO RAWP/RAR

PROJECT No.: 2003115
FILE NAME.: Figure 4
SCALE: 1' = 50'
DATE: JULY 2006
ENG'D BY: SAZ
DRAWN BY: JMD
CHECKED BY: DRV

SHEET NO.: FIGURE 1