FINAL
REMEDIAL DESIGN BASIS REPORT
DINABURG DISTRIBUTING
SITE NO. 828103

WORK ASSIGNMENT NO. D007619-6

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC: 3612112216

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

1,1,1-TCA	1,1,1-trichloroethane
bgs	below ground surface
cm/sec	centimeter(s) per second
CVOC	chlorinated volatile organic compound
ERH	electrical resistance heating
ft/d	feet per day
ft/ft	feet per foot
IRM	interim remedial measure
K	hydraulic conductivity
MACTEC	MACTEC Engineering and Consulting, P.C.
mg/kg	milligram(s) per kilogram
MPE	multi-phase extraction
NYSDEC	New York State Department of Environmental Conservation
PCE	tetrachloroethene
POTW	publicly owned treatment works
RD	remedial design
Report	Remedial Design Basis Report
RI	remedial investigation
ROD	Record of Decision

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

SCGs	standards, criteria, and guidance values
SCO	Soil Cleanup Objective
Site	Dinaburg Distributing site
TCE	trichloroethene
TMP	temperature monitoring points
µg/L	microgram(s) per liter
URS	URS Corporation
VOC	volatile organic compound
WA	work assignment

1.0 INTRODUCTION

MACTEC Engineering and Consulting, P.C. (MACTEC) has prepared this Remedial Design (RD) Basis Report (Report) to summarize the general design methodology/approach and assumptions to be used to develop the RD in accordance with the New York State Department of Environmental Conservation (NYSDEC) *Record of Decision* (ROD) (NYSDEC, 2011) for the Dinaburg Distributing site (Site) in Rochester, New York.

The RD is being performed under NYSDEC Work Assignment (WA) Number D007619-6 in accordance with MACTEC's Scope of Work (MACTEC, 2012). The purpose of the WA is to prepare the design specifications and construction drawings for the remedial action for the Site in accordance with the NYSDEC-MACTEC Contract, Work Element III of Schedule 1.

1.1 DESIGN APPROACH

MACTEC's Report is a description of the development of the specifications for implementation of the electrical resistance heating (ERH) treatment technology in such a manner as to balance the performance based objectives with adequate detail to hold Contractors to an equivalent standard of technical application and performance. In this regard, the design will be sufficiently generic to allow bids to be obtained from multiple qualified ERH suppliers, while simultaneously providing sufficiently stringent performance requirements that will enable the cost-effective removal of source area volatile organic compound (VOC) impacts. It is understood that each qualified ERH Contractor may have differing technical approaches and methods on technology implementation including electrode construction, electrode spacing, electrical hookup, power feed and distribution, and extraction mechanics. Some aspects of the ERH application may be confidential and proprietary, patented or of trade secret nature. To accommodate variability and equal accountability, terms such as "equivalent", "comparable", and "industry standard" will be incorporated into specifications and drawings where applicable. Additionally, the specifications will require submittals from the ERH Contractor that will allow the Engineer and NYSDEC the opportunity to review and approve the Contractor's recommended approach prior to implementation. Because the ERH Contractors have specialized expertise regarding the ERH technology, MACTEC believes it is in the best interest of NYSDEC not to direct the means and

methods for the ERH technology implementation at the Site through prescriptive specifications. Performance-based specifications can take advantage of the Contractor's expertise and place the responsibility for performance on the Contractor, while allowing innovation and operational flexibility to the Contractor that potentially results in more cost-effective remediation, but also holds the Contractor to performance requirements that are measureable.

1.2 SITE BACKGROUND AND CHARACTERIZATION SUMMARY

This subsection is a summary of the Dinaburg site background and characterization, excerpted from the Remedial Investigation (RI) Report (MACTEC, 2011). References to Unrestricted Soil Cleanup objectives are from the RI Report text and are not the intended cleanup goals for the Dinaburg ERH design, as discussed in this report.

RI Summary. The Site is located at 1012 South Clinton Avenue in the City of Rochester in Monroe County, New York. The property is located in a mixed commercial/residential area just inside the Rochester City limits. The Site occupies 0.25 acres on two parcels situated perpendicular to one another, and is currently surfaced by a combination of pavement, a concrete former building slab, and soil. The property is currently vacant and abuts several residential and commercial properties. The property and buildings were reportedly used as an automobile repair shop from around 1950 through around 1969. From 1971 to 1993, the Site was occupied by Dinaburg Distributing, Inc., which operated a dry cleaning supply company business and sold chemical solvents to various dry cleaners in the area. Dinaburg stored trichloroethene (TCE) and tetrachloroethene (PCE) in above ground storage tanks which were located in the northeast area of the Site building. The property has been vacant since 1995 and currently consists of a parking lot; the Site building and an adjacent house at 350 Benton Street were demolished in 2004 by the property owner to allow access for remediation of the Site.

The Dinaburg site has been inactive for approximately 16 years. High concentrations of VOC contaminants (PCE detected at 310 milligrams per kilogram (mg/Kg) at the 08GP-19 location in 2008 and at 1,700 mg/Kg at the GP-2 location in 2009) continue to be present in site soils near the historic source area, as well as generally in soil across the Site. PCE was detected in groundwater at a concentration of 220,000 micrograms per liter (µg/L) in MPE-16, located approximately 60 feet south of the reported historic source area at the Site. TCE was detected at the highest

concentration of 170,000 µg/L at MPE-10. PCE and TCE were also detected in sub-slab soil vapor samples collected from below buildings adjacent to the Site. Concentrations of PCE and TCE detected in Site media (soil and groundwater) in 2008 and 2009 indicate possible continued presence of dense non-aqueous phase liquid at the Site.

The primary contaminant source areas reportedly consist of leaks and spills from the historic storage tanks on the property, and spills to the ground surface in the vicinity of the Benton Street Driveway. The likely secondary source area (contaminated soils) is represented by an area within which PCE in soil exceeds its Soil Cleanup Objective (SCO) for unrestricted use as defined in NYSDEC Table 375-6.8(a): Unrestricted Use Soil Cleanup Objectives included in Appendix A. This area included the former tank storage room, the former new building extension, Benton Street driveway, and portions of the adjacent residential driveways at 338 and 350 Benton Street. Based on more recent soil and groundwater sample results, this area is approximately 8,915 square feet.

A hot spot interim remediation measure (IRM) conducted in 2005 consisted of excavation and removal of the most contaminated soils in an area measuring approximately 32 feet square by 8 feet deep. Soils outside of this removal area contained PCE contamination with concentrations noted as high as 1,500 mg/Kg detected in GP-19 (from 0-2 feet below ground surface [bgs]). This contamination was evaluated by URS Corporation (URS) to be confined primarily to the upper stratified overburden and not extend into the till layer which was noted to be present at approximately 13 feet bgs. To remediate the remaining VOCs present in soil at concentrations above their SCOs for unrestricted use, URS installed a multi-phase extraction (MPE) system as an IRM. The MPE system consisted of 18 soil and groundwater extraction wells (i.e., MPE wells) with screens set to between 10 and 13.5 feet bgs, as well as three bedrock interface groundwater extraction wells with screens set to between 20.7 and 23 feet bgs. This system began operating in February 2006 and was shut down in 2011. URS calculated that approximately 382 lbs of VOC contamination were removed via the MPE system between February 2006 and May 2010. Continued operation after 2006 had decreased rate of mass contaminant removal to a point where it was decided to cease operations.

Soils data collected in 2009 by MACTEC indicate that VOCs above the SCO for unrestricted use continue to be present across the Site in soil below the water table (groundwater present at approximately eight feet bgs). Soil samples collected in 2009 outside of the 2005 removal area

contained PCE and TCE contamination with concentrations noted as high as 1,700 mg/kg for PCE (detected in GS-2 at 11 feet bgs), and 1,400 mg/kg for TCE (detected in soil boring GS-7 at 16 feet bgs). Most of the soil samples collected in 2009 contained concentrations of PCE and TCE above their respective SCO for the protection of groundwater, and many of the exceedances of SCOs were noted to be within the till layer. Soil contamination was also noted to be present in the till to the approximate top of bedrock (See Section 1.3) at boring GS-13 (this location is off the Site property to the north).

The primary soil contaminants detected at the Site are chlorinated compounds which are representative of the dry cleaning chemicals formerly handled during Site operations.

Within the source area, contaminant concentrations generally decreased with depth suggesting that surface spills acted as the main contaminant mechanism. PCE occurred almost everywhere at significantly higher concentrations than TCE. In areas outside the former building footprints (i.e., source area) where contaminant concentrations increased with depth (GP-02 (1999), GP-03 (1999), GP-04 (1999), MW-03 (1995), and B-06 (1997)), the concentrations were generally much lower than beneath the former building footprints. This may reflect lateral spread within the vadose zone as dry cleaning solvents migrated primarily downward and moved away from their source area.

Previous reports indicated that the chlorinated solvents were confined primarily to the lacustrine overburden, and that the underlying till was acting as a barrier layer to continued downward migration of the contaminants. Part of the 2009 sampling objective was to collect data to evaluate the effectiveness of till layer to limit downward migration. Based on data collected during 2009 RI field work, it appears as if the chlorinated solvents have migrated downward into the underlying till layer. Similar to previous investigations, PCE and TCE were detected in most soil samples from the 2009 RI field efforts at concentrations exceeding the SCO for unrestricted use Contaminant concentrations show an increase with depth at nine locations (GS-1, GS-2, GS-4, GS-6, GS-7, GS-8, GS-9, GS-12 and GS-13) for TCE, and at five locations (GS-4, GS-7, GS-8, GS-10 and GS-12) for PCE, indicating contaminants have migrated downward from the glaciolacustrine overburden into the till layer. Unrestricted use SCOs were also exceeded for cis-1,2-dichloroethene (GS-1, GS-4 and GS-13), 1,1-dichloroethane (GS-3 and GS-4), xylene (m/p and o [GS-2 and GS-7]) and 1,1,1-trichloroethane (1,1,1-TCA) (GS-3).

Based on concentrations of TCE and PCE detected in the 2009 soil samples, as well as an estimated area of soil contamination exceeding standards, criteria, and guidance values (SCGs) for unrestricted use (based on the data collected by MACTEC in 2009 and URS in 2008), the mass of remaining PCE and TCE contamination in soil at the Site is assumed present in the till to approximately the top of bedrock.

Although groundwater concentrations of PCE and TCE detected in the MPE wells had an initial drop of just over 70% in the first four months of the system operation, concentrations do not appear to indicate any decreasing trend from June 2006 to May 2010. In addition, although the highest detected groundwater concentrations have occurred in samples from the overburden, VOCs, primarily PCE and TCE, are also present in the groundwater in the overburden/bedrock interface zone, as well as in the deeper bedrock zone at concentrations above SCGs. This indicates continued migration of the contamination in groundwater from the shallow overburden source through the till layer.

Representative cross-sections and cross-section locations depicting site conditions determined in 2009 during the RI are shown in Figures 1.1, 1.2, and 1.3.

Sampling in the vicinity of the Site indicates that VOC contamination has partitioned from soil and groundwater to soil vapor. Results of 2004 soil vapor sampling in three buildings near the Site indicated that PCE was present in the soil vapor and was migrating into the buildings at two locations (same building foundation). Based on these results, a sub-slab depressurization system was installed at the two buildings (one system addresses both locations because of the shared foundation).

1.3 SUMMARY OF TREATMENT AREA GEOLOGY, GROUNDWATER HYDROLOGY, AND GROUNDWATER FLOW

This subsection presents a summary of the treatment area geology, groundwater hydrology, and groundwater flow excerpted from the RI Report (MACTEC, 2011).

Treatment Area Geology. The treatment area is underlain by approximately 22 to 23 feet of overburden overlying Silurian age dolostone bedrock. The overburden consists of man-made fill

overlying glacial deposits. The glacial deposits are underlain by a weathered bedrock zone of variable thickness, referred to by URS as the overburden/bedrock interface zone.

The fill material consists of re-worked silty sand and contains gravel, bricks, concrete and wood. The fill material ranges in thickness from zero to approximately eight feet in and immediately around the Site, and, where present, overlies glaciolacustrine sediments.

The glacial deposits at the Site are a combination of both glacial tills (till) and glaciolacustrine (lacustrine) sediments. The till at the Site lies immediately above the overburden/bedrock interface (weathered bedrock) zone. The stratified lacustrine sediments lie upon the till and do not appear to contact the overburden/bedrock interface zone. The lacustrine sediments were differentiated from the till based on the presence of alternating thin beds of clayey silt and sand observed in soil borings at the Site.

In general, the glacial deposits at the Site consist of clayey silt, sandy silt and silty clay interbedded with thin sand layers. Within the lacustrine sediments the sandier seams range in thickness between a few inches and a few feet. At depth the glacial deposits consist of angular dolostone fragments in a silty clay (till) with occasional boulders. A gravelly weathered bedrock (overburden/bedrock interface zone) is present atop competent bedrock.

Bedrock at the Site consists of a low relief Silurian age dolostone of the Lockport Group, described by URS as medium gray, hard, fine to medium grained, mostly featureless or with some zones of wavy carbonaceous laminae. URS reports that there are a few scattered zones that contain vugs (small cavities) or smaller "pinpoints" of dissolution porosity, along with some white calcite and galena secondary mineralization observed in a few scattered zones. The recovered core samples were reported as being generally broken with rock quality designations ranging from 13 to 56 percent (very poor to fair rock quality). The treatment area consists of sedimentary bedrock, which is applicable to ERH.

Site Groundwater Hydrology. Groundwater at the Site exists in both overburden and bedrock water-bearing units. Further, the overburden water-bearing units exhibit unconfined and semi-confined properties that are distinguished by differences in their geology, hydraulic conductivities

and water level elevations. Groundwater is generally encountered from approximately five to fifteen feet bgs.

Conceptually, there are three local water-bearing units below the Site. From top (ground surface) to bottom, the units consist of 1) a *glacial deposit (lacustrine and till) unit*, 2) an *overburden/weathered bedrock interface unit*, and 3) a *bedrock unit*. Fill material, where present, was reported to exist primarily within the vadose zone.

The *glacial deposit unit*, consisting of silt, clay, sand and gravel, is between 22-23 feet thick in the treatment area with saturated conditions starting between five feet bgs to 8 feet bgs (5.9 to 7.6 feet bgs measured by MACTEC in May and June 2009), with a typical depth to water of approximately six to seven bgs. This unit is further subdivided into an upper stratified lacustrine layer and a lower lodgment till layer. The till layer is present in the source area at between seven and thirteen feet bgs (with typical depths around eight feet bgs), and extends to the top of weathered bedrock.
The lacustrine zone consists of discrete layers, seams and lenses of clayey silt and silty sand. Discontinuous perched groundwater lenses were identified in sand seams within the upper lacustrine layer outside the treatment zone as represented by water level measurements in monitoring well MW-01A, which appears to fluctuate over time and at times appears to be “dry”. Observations such as these are characteristic of a well that is screened in a perched water zone. Perched zones were not specifically noted in the treatment area, but may exist in some small areas.

The glacial till is characterized by unstratified silty clay with varying amounts of sand and gravel. The lodgment till was observed as being a semi-confining layer (or aquitard) to the interface and bedrock units immediately below it.

The *interface unit*, referred to as the overburden/bedrock interface zone, is a thin, semi-confined aquifer with a relatively high hydraulic conductivity (K) when compared to the units above and below it. This unit consists of sand and gravel-sized weathered bedrock with varying amounts of silt, clay and cobbles, as well as the upper layer of fractured rock. Within the proposed ERH treatment area, the till was noted to extend to the bedrock surface, although bedrock fragments were noted within the till matrix. The high K zone in this area was noted to be present within the first two feet of bedrock, where weathered fractures were noted.

The *bedrock unit* is a fossiliferous dolostone of Silurian age. Previous reports described the existence of dislocated and rotated slabs of bedrock, based on steeply dipping laminae observed in the MW-03C rock core and "the highly localized variation in auger refusal" observed during drilling. The presence of dislocated and rotated slabs of bedrock may explain the unexpectedly high bedrock elevation encountered at RW-01. Of the borings installed to date, only MW-03C was installed deeper than the top of competent rock.

URS stated that for the purposes of pumping test data analysis, the bedrock unit was modeled as an aquiclude, i.e., a low-permeability unit that forms a boundary to the local groundwater flow system. URS further states that it is likely that the boundary is less than absolute.

Groundwater Flow. The direction of local groundwater flow was interpreted by URS to be from the east and northeast to the west, southwest and southeast in both the glacial deposits and the overburden/bedrock interface units. The hydraulic gradient in the glacial deposits was calculated to range between 0.006 feet per foot (ft/ft) and 0.02 ft/ft, with the horizontal hydraulic gradient in the interface unit reported at around 0.02 ft/ft. Vertical flow observations indicated a significant downward gradient based on monitoring well pair measurements. Vertical hydraulic gradients were calculated by URS that range in the downward direction between 0.13 ft/ft at the MW-09 S/K well pair and 0.87 ft/ft at the MW-11 S/K well pair. Vertical gradients measured by MACTEC, eight days after the MPE system shutdown, ranged in the downward direction from 0.63 ft/ft at the MW-9S/K well pair to 1.76 ft/ft at the MW-10 S/K pair. There were also significant downward gradients measured from the SB-10 microwell to the adjacent MW-14K interface well, with gradients measured at 3.18 ft/ft. URS suggested that the high vertical gradients may be interpreted to indicate that the flow rate or "connectiveness" between units is low.

The hydraulic conductivities (K's) of the glacial deposits and bedrock were not directly investigated by URS for their Remedial Investigation Report or by MACTEC, but were previously estimated in the 1998 Sear-Brown report based on an analysis of grain-size distributions and slug test data. Sear-Brown calculated the following representative K's for the three units at the Site:

- Glacial Deposits: $K = 2.5 \times 10^{-4}$ centimeters per second (cm/sec), or 0.71 feet per day (ft/d)
- Overburden/Weathered Bedrock Interface: $K = 5.9 \times 10^{-3}$ cm/sec, or 16.7 ft/d
- Bedrock: $K = 8.2 \times 10^{-4}$ cm/sec, or 2.3 ft/d

The hydraulic conductivity of the overburden/weathered bedrock interface unit was calculated from data recorded during a 72-hour pumping test conducted by URS. The calculated K value for this unit was presented as 4.2×10^{-3} cm/sec (12 ft/d), which correlates well with Sear-Brown's previous estimate based on slug test data.

1.4 PROPOSED SITE REMEDIAL ACTION SUMMARY

The ROD (NYSDEC, 2011) for the Dinaburg site describes the site remedy as follows: "Installation of an in-situ electrical resistance heating system in the area of the former Dinaburg building and the 350 Benton Street property to address on-site VOC soil contamination. Implementation of this alternative will include electrical resistance heating of on-site soil and groundwater to volatize VOC contamination and vapor recovery extraction wells for vapor recovery."

In addition, the ROD includes provisions for:

- imposition of an environmental easement for the property that certifies completion and maintenance of institutional and engineering controls
- development of a Site Management Plan that identifies property use restrictions and engineering controls and describes the steps necessary to assure compliance with the controls.

1.5 SITE TOPOGRAPHIC AND BOUNDARY SURVEY

Popli Design Group provided a Certified Boundary Survey of the Site in May 2012 that is the basis of the site plan (see Figure 1.1). The survey included the location of Site features (buildings, pavement, sidewalk, curbing, utility poles, utilities including electric, storm drain, sewer and gas, fences, monitoring wells and property lines), easements, topographic elevations, and groundwater monitoring wells.

1.6 ERH TECHNOLOGY DESCRIPTION

ERH is an in-situ environmental remediation method utilizing the flow of alternating current electricity for remediation of contaminated soil and groundwater. Electric current passes through a specifically targeted soil volume between subsurface electrode points. The resistance to electrical

flow that exists in the soil causes the formation of heat; resulting in an increase in temperature until the boiling point of water and/or contaminants at depth is reached. After reaching this temperature, further energy input causes a phase change, changing water into steam and removing contaminants by promoting volatilization and evaporation. A subsurface vapor recovery system applies vacuum to the treatment area to collect contaminants, which are then conveyed to the surface along with recovered air and steam. Similar to soil vapor extraction, the air, steam, and volatilized contaminants are then segregated at the surface and treated in accordance with applicable NYSDEC and local discharge requirements.

A significant fraction of VOCs will be degraded in place by natural in situ processes including biodegradation, hydrolysis, and reductive dehalogenation by zero-valent iron.

- Biodegradation is observed as an anaerobic process, and elevated temperatures increase biotic reaction rates. When soils with high levels of total organic carbon are heated, some portion of carbon will convert to acetone and other water soluble compounds. Acetone provides an available biodegradable food source for microbes performing reductive dechlorination
- Hydrolysis is a water-substitution reaction in which hydrogen ions normally present in water react with organic molecules, replacing chlorine atoms. Oxidizing conditions or available oxygen is not required for hydrolysis. The rate of hydrolysis increases with temperature.
- Dehalogenation occurs with the addition of backfill of ERH electrodes which includes steel shot, a form of zero-valent iron. The presence of iron can provide a significant polishing mechanism for dissolved phase VOCs after heating has ended.

During ERH, the hydrolysis process aids overall remediation by degrading a primary contaminant to a by-product. Some low volatility organic contaminants have a short hydrolysis half life (e.g., 1,1,2,2-Tetrachloroethane and 1,1,1-TCA). As the subsurface is heated, the hydrolysis half-life of the contaminant will decrease. This results in a rapid degradation of the contaminant. Hydrolysis and reductive dechlorination are strongly affected by temperature, as described by the Arrhenius equation which in general equates to a 10 degree Celsius increase in temperature will increase the reaction rate by a factor of 2.5 (Beyke and Fleming, 2005).

ERH can be achieved by three-phase and six-phase electrical load arrangements. Three-phase heating consists of electrodes in a repeating triangular or delta pattern. Adjacent electrodes are of a different electrical phase so electricity conducts between them. Six-phase heating consists of six electrodes in a hexagonal pattern with a neutral electrode in the center of the array.

There are several laws that govern an ERH remediation. Dalton's law governs the boiling point of a relatively insoluble contaminant. Raoult's law governs the boiling point of mutually soluble co-contaminants and Henry's law governs the ratio of the contaminant in the vapor phase to the contaminant in the liquid phase.

ERH is adaptable to all soil types and sedimentary bedrock. ERH is also effective in both the vadose and saturated zones. Certain lithologies can limit traditional methods of remediation by preventing a reliable removal/destruction pathway for the contamination of concern. Because electricity can and does travel through any lithology that contains some water, ERH can be effective in any soil type. By forming buoyant steam bubbles during the heating process, ERH creates a carrier gas that transports the contamination of concern up and out of any soil type. ERH is not capable of desiccating the subsurface. In order for the subsurface to conduct electricity, there must be water present in the subsurface. Conductivity will cease before the subsurface is desiccated.

After ERH treatment, elevated subsurface temperatures will slowly cool over a period of time, typically several months, and gradually return to ambient. This period with elevated temperatures is an important part of the remediation process. The elevated temperatures will enhance bioremediation, hydrolysis and iron reductive dehalogenation, under the right conditions.

1.7 DEFINITION OF REMEDIATION AREA

The proposed ERH treatment area is depicted on Figures 1.1, 1.2, and 1.3. The areal extent of the treatment area is derived from the original contaminant source treatment area layout (included in this report as Appendix B) developed in the RI Report, and then subsequently updated and depicted in the ROD. The horizontal and vertical extent of the treatment area will be reviewed during the ERH design to determine if any modifications are appropriate.

2.0 REMEDIAL ACTION OBJECTIVES AND STANDARDS

2.1 CLEANUP STANDARDS

The selected cleanup standards are numerical goals based on NYSDEC Table 375-6.8(b): Restricted Use Soil Cleanup Objectives, Residential Standards. The cleanup standards are listed in Appendix A.

2.2 OBJECTIVES

Remedial action objectives outline the key parameters for tracking progress and achieving success for ERH remediation. The primary objective is to meet the cleanup standards in soil as discussed in Subsection 2.1. Remedial action objectives for tracking progress and needed to achieve success are temperature and mass recovery, as discussed below.

2.2.1 Temperature Objective

The chart below shows constituents listed in the ROD to be remediated with ERH along with their respective boiling points. Because PCE has a higher boiling point than TCE, the target temperature for remediation will be based on the boiling point for PCE unless discreet areas can be identified that are only impacted by TCE. When chlorinated volatile organic compounds (CVOCs) are dissolved in water and the vapor pressures of both the CVOC and the water increase, the result is that the two components will co-boil at a temperature lower than the listed boiling points below of the pure CVOC. As a result, it is estimated that a lower target temperature will be required at the Site. The target temperature will be analyzed and determined by the ERH Contractor. As part of the design, a rationale will be developed to demonstrate that target temperatures have been achieved throughout the treatment area, though soil confirmation sampling will determine the ultimate success of ERH treatment.

Chemical	Molecular Weight (g/mol)	Boiling Point (°C)
Tetrachloroethene (PCE)	165.83	121.14
Trichloroethene (TCE)	131.29	87

CRC, 1983

A mechanism for tracking remediation progress is monitoring the subsurface temperatures at the temperature monitoring points which is further discussed in Section 4.1.2.

2.2.2 Mass Recovery Objective

The mass recovery will be tracked to evaluate progress and indicate when confirmation sampling is appropriate, as well as when the ERH system can be turned off. The air effluent concentration as well as condensate discharge during startup will be compared to incremental air and condensate effluent samples on a regular basis to calculate the mass removal rate.

The primary mechanism of remediation progress monitoring will be measurement of the amount of constituents of concern that has been removed from the subsurface. The intent of defining a remediation progress metric is to provide a default condition where the treatment can be declared substantially complete and where only asymptotic removal rates are being achieved. Remediation progress will be monitored to determine when the removal rates are trending toward an asymptotic low point to trigger confirmation sampling. The rate of recovery is expected to be high at first as the high levels in soil gas are recovered upon start up of the vapor recovery system. The concentrations, and thus recovery rate of constituents of concern should decrease rapidly after start up. However, within a short term, as the saturated zone reaches boiling temperatures, the rate of recovery should rise again through a peak, and then tail off. Effective treatment will be defined as reaching an asymptotic condition where the weekly rate of mass collection represents only a small fraction (for example around 1%) of the total mass collected since start up. No fixed percentage value is established to determine whether the system should be operated further, or conversely, shutdown. NYSDEC would retain flexibility in these decisions.

3.0 ERH DESIGN PARAMETERS

3.1 DESIGN INPUTS

This section will describe the site conceptual model and summarize inputs required for preliminary design.

3.2 EQUIPMENT SIZE

In order to further develop this section a review of existing data (i.e., flow rates and k value) from previous reports will be used to assist ERH Contractors in evaluating the system flow rates for sizing the equipment.

3.3 PERMITTING CONSIDERATIONS (NATURAL RESOURCES, LOCAL CONSIDERATIONS)

The design will identify and evaluate permits required for ERH system remediation and will specify who is responsible for obtaining permits. These permits may include local construction permits such as sewer connection permits, sidewalk and roadway permits, electrical permits, water, gas, phone, cable, and all other utility permits and applications. Those identified include the following:

3.3.1 Monroe County Pure Water POTW - Wastewater Discharge Permit

It is anticipated that a publicly owned treatment works (POTW) permit will be required to discharge condensate that is unable to be re-used. It is envisioned that the Contractor will be responsible for obtaining the POTW discharge permit. The design will specify the allowable concentrations/volumes of contaminants allowed to be discharged to the sewer, and associated sampling requirements.

3.3.2 Electrical Permits

The Contractor will be responsible for obtaining electrical permits and electricity needed for the ERH system operation.

3.3.3 Air Emissions

An evaluation of the requirements of the State of New York air emissions permit will be completed during the design process. It is anticipated that air emissions will need to comply with NYSDEC's DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants (NYSDEC, 1997).

Air emissions will be generated by the ERH system. If necessary, emissions from the system will be controlled (treated) before discharge to the atmosphere. The methodology for air treatment, such as thermal oxidation or carbon absorption, will be left to the Contractor. The design will specify air emission limits and air/vapor emissions sampling necessary to comply with State requirements

4.0 ERH SYSTEM DESIGN SUMMARY

4.1 ELECTRODE DESIGN

The design will specify the depths of the electrodes, electrode placement/spacing rationale, and temperature monitoring point locations and depths.

4.1.1 Electrode Placement

The design will specify that the contractor is responsible for developing the electrode spacing and depth necessary to treat the target treatment zone to a temperature goal that will successfully remediate impacted soils to the required clean up standard. The design will require appropriate ERH placement and construction capable of general uniform heating which can also accommodate independent discrete area heating. The design will incorporate the ability for adjustment of electrical current application adjustments capable to heat sub areas within the targeted ERH area that may not be responding uniformly. The ERH Contractor will be responsible for developing the details for electrode placement within the treatment area.

4.1.2 Temperature Monitoring Points

A minimum number of temperature monitoring points (TMPs) will be specified. Thermocouples will be placed at specified intervals at each TMP for measurement of temperature.

4.2 VACUUM WELL DESIGN/ VACUUM EXTRACTION

Vapors will be recovered by vertical or horizontal vapor extraction wells, as appropriate. The vertical vapor extraction wells will be optimally located and may be co-located with electrodes. A sufficient number of vapor recovery wells are needed to maintain a negative pressure in the treatment area during ERH to demonstrate capture of volatilized contaminants and to help prevent vapor intrusion into nearby buildings. Vacuum monitoring points will be required to demonstrate vacuum influence throughout the treatment area. Locations and construction of the vacuum wells will be developed by the ERH Contractor.

4.3 TREATMENT AREA LOGISTICS

Treatment area logistical considerations that will need to be incorporated into the design include the PCU laydown area and electrical line routes available for connecting the electrodes as well as areas which will need to be configured to allow access of drill rigs between the electrodes for confirmation sampling. There may also be areas that need to remain open for vehicular traffic. The Contractor will need to create ramps or alter configuration to allow for access.

4.4 HANDLING OF PROCESS WATER

4.4.1 Vapor Condensation and Treatment:

Extracted vapors will be condensed. The fluids from the condenser will likely require treatment to acceptable levels. It is anticipated that the treated water will be discharged to the sanitary sewer; however, recycling of treated water to the electrode drip lines may be permissible and also be a sustainability benefit. The Contractor will be responsible for selecting the treatment methodology, such as carbon absorption or air stripping to meet sewer discharge permit limits.

4.5 MONITORING WELL REPLACEMENT

A review of the existing monitoring wells construction material will determine which monitoring wells may be used during ERH treatment, which wells will need to be reinstalled as stainless steel to prevent melting, and if any additional wells are required to provide adequate coverage to evaluate groundwater in the vicinity of the ERH treatment area. Specifications for monitoring well abandonment and replacement will be developed as part of the design. A detail will be provided for the installation of new or replacement monitoring wells.

4.6 ELECTRICAL DESIGN

The electrical distribution design will be left to the Contractor; however, a brief electrical specification will be developed so that compliance with applicable State and local electrical codes is maintained. Available power from the local electrical utility will be provided. The Contractor

will be required to provide maximum power output, average estimated usage and remote shut-off and safety disconnects for emergency shut-off. The Contractor is responsible for obtaining the necessary power.

4.7 ABOVE-GROUND PIPING DESIGN

Piping is preferred to be above-ground where possible. Pipes connecting the ERH extraction wells to the larger manifolds and the ERH extraction equipment should be constructed of material which is suitable for the high temperatures of the steam and vapor collected, as well as for chemical compatibility with the extracted CVOCs. The ERH area will be fenced to limit access. The aboveground ERH lines should be insulated as a safety precaution to prevent burns, and to limit the amount of vapor that condenses within the piping.

4.8 BELOW -GROUND PIPING DESIGN

This section will discuss the requirements for the connection to the sewer. If underground piping (depending on the time of year remediation is performed) is required, specifications for trenching and backfill will be developed.

4.9 INSTALLATION AND OPERATIONAL SEQUENCE

Project Sequence: This section lists the phases of the project from start to finish. The phases will include the following:

- Engineer Review of Contractor Work plan
- Procurement
- Permitting
- Site Preparation
- Site Grubbing and Clearing, Where Applicable
- Utility Installation
- Engineer Review of Contractor Submittals
- Monitoring well abandonment/replacement
- ERH System Installation

- ERH System startup
- ERH Heating
- Operational Monitoring
- Confirmation Monitoring
- ERH Shutdown
- Post Confirmation Monitoring
- ERH Dismantlement
- Site Restoration

4.10 DISPOSAL OF CONTAMINATED MATERIALS

The design will identify waste characterization, handling, and disposal procedures for ERH installation waste and Investigative Derived Waste for both soil and water (purge water and development water.

5.0 GREEN ELEMENTS OF DESIGN

The NYSDEC Division of Environmental Remediation is committed to applying green remediation concepts. Cleanup of NYSDEC sites should utilize remedial activities that minimize ancillary environmental impacts by minimizing energy consumption, conserving natural resources, maximizing the reuse of land and recycling of materials. Incorporating green remediation concepts ensures the consistent and pro-active application of more sustainable methods to remediate sites while still protecting public health and the environment and striving to achieve the established cleanup goals.

5.1 GENERAL PROCEDURES

Green remediation concepts and techniques will be considered during the remedial program from site characterization and implementation of the remedy to long-term site management obligations with the goal of improving cleanup sustainability. See Appendix C for specific examples.

5.2 DOCUMENTATION OF GREEN REMEDIATION EFFORTS

In addition to statutory and regulatory requirements, Contractor work plans must include a discussion of the green remediation practices/technologies employed throughout the ERH system process. Green remediation principles must also be considered during each periodic review and remedial system optimization review conducted during the site management phase.

6.0 INFRASTRUCTURE REQUIREMENTS

6.1 OWNER/NYSDEC FURNISHED INFRASTRUCTURE

6.1.1 Site Access

It is anticipated that the NYSDEC will work with the Site Owner as well as adjacent property owners as necessary to make arrangements for access. Primary Site access is anticipated to be from Benton Street. On-site access routes will be further developed during the design process and shown on the Contract Drawings.

6.1.2 Site Security

The Contractor will be solely responsible for the security of the Contractor work areas, equipment, materials, and supplies. The design will include development of specifications for fencing to be utilized for security and health and safety purposes. The ERH remediation area will be fenced to prevent access to the remediation area. This will be installed as safety precaution to prevent accidental exposure to high voltage and CVOCs. Requirements for fencing will be provided in the specifications. The Contractor will be responsible for ensuring Site visitors are escorted as necessary and do not enter contaminated or otherwise hazardous areas without authorization. A visitors' entrance/exit log will be maintained. Furthermore, security personnel will be required to check the Site during off-hour operational periods (e.g., evenings and weekends) and maintain a log of such inspections.

6.2 CONTRACTOR FURNISHED INFRASTRUCTURE

The Contractor will be required to furnish all temporary facilities and controls necessary to execute the Work.

6.2.1 Electrical Power

The Contractor will be required to make all contacts and arrangements for electrical power necessary to execute the Work (e.g., field trailer, generators, and welders). Also, the Contractor will be required to evaluate the effect of ERH power demand on local and area businesses, and provide protection from potential accidental power interruptions that could be caused by the current draw of the ERH system, as well as providing a secondary power source to keep the treatment system operational (i.e., maintain vacuum on the subsurface) in the event of a power failure.

6.2.2 Water/Sanitary Facilities

The Contractor will be required to provide an adequate supply of potable water for drinking and hand washing. Ancillary supplies (e.g., soap, paper towels, trash bin) will also be provided and maintained by the Contractor. The Contractor will be required to provide and maintain sanitary facilities in sufficient numbers for the use of all persons employed in the Work. When no longer needed, all items will be removed from the Site and properly managed/dispose of.

6.2.3 Contractor/Engineer Office Areas/Trailer

Contractor will be required to furnish, install, and maintain one field trailer for use by the ENGINEER/DEPARTMENT and Contractor. The trailer will be required to have separate rooms as follows: (1) office for the ENGINEER/DEPARTMENT, (2) office for the Contractor, and (3) conference room. It need not have integrated water and sanitary facilities as long as approved (i.e., Contractor-provided) conveniences are readily accessible nearby. The trailer will be required to have adequate furnishings, lighting, electric, heating/cooling, phone and internet service, etc. All utilities will be paid for by the Contractor.

6.2.4 Decontamination Facilities

The Contractor will be required to construct a decontamination pad on a properly graded and prepared surface. The decontamination pad will be located as close to the active work area as practical for the purpose of cleaning equipment and trucks prior to leaving the Site. The decontamination pad will consist of an aggregate (sand and crushed stone) working base,

impervious geomembrane, nonwoven geotextile, and a collection sump and pumping system (detail to be provided in the Contract Drawings). Liquid waste resulting from decontamination operations will be collected and stored in a tank for testing prior to disposal (either discharged directly to sewer or transported off-site to a permitted facility).

6.2.5 Interferences

During the design process, potential site interferences will be assessed including overhead wires, other utilities, nearby buildings, etc.

7.0 ERH SYSTEM MONITORING

7.1 PERFORMANCE MONITORING

The design will identify performance data associated with sampling.

7.1.1 Soil Sampling

To document the extent of remediation accomplished, confirmatory soil samples will be collected when mass removal rates have reached asymptotic conditions and temperatures in the treatment area have reached the target. The confirmatory soil samples would be used to evaluate the effectiveness of the ERH technology and the need to continue ERH operation. Soil sampling results would be used as a basis to measure the Contractor's performance in meeting the cleanup standards for soil.

The Contract Documents will include the flexibility to restart ERH as an option. The Contractor will be required to collect and analyze a specific quantity of samples (to be specified in the Contract Documents). Special techniques will be specified for sample collection to minimize the potential for loss of volatile organics from the sample. These techniques may include immediate capping of the sample collection tube followed by immediate cooling in an ice water trough. Once cooled, the sample sleeve would be cut open, and a core would be taken from the sample and placed in a vial for delivery to the laboratory. Samples would be taken from random locations throughout the area and depth of treatment. The results of these samples will be submitted to the NYSDEC for review and evaluation.

7.1.2 Groundwater Sampling

Because of the large extent of the plume, extending far offsite, absolute remediation of groundwater is not a goal of ERH treatment. However, groundwater samples will also be collected to evaluate contaminant reduction and track the estimate mass remaining in groundwater before, during, and after treatment, while groundwater is available for sampling. Groundwater will be sampled from wells within the treatment area. The proposed well locations will be identified in a

figure to be included in the design package. Because temperatures would be high, special groundwater purging and sampling techniques will be specified. The design will incorporate requirements for pre-installed dedicated Teflon® tubing, well depressurization as needed, purging through a heat exchanger coil and ice bath to reduce the groundwater temperature to ambient conditions prior to placement in the sampling container.

7.1.3 Air Sampling

Air sampling will include both influent and effluent air samples from the ERH treatment system. These samples will be used to measure the mass removal of the ERH treatment from the in-situ conditions as well as pre and post air treatment process evaluation. The air sampling plan will be specified in the design package by outlining the frequencies for air samples at each location.

As part of its Health and Safety requirements, the Contractor will implement an air-monitoring program to assess on-site conditions and boundary conditions of ambient air quality. The air sampling plan will specify in the design package the frequencies for ambient air samples and recommend sampling locations.

7.2 SYSTEM OPTIMIZATION

The Contractor will be required to discuss in its workplan the flexibility of the system to address issues when remedial action objectives are not met in terms of mass removal and temperature goals.

8.0 SITE RESTORATION

8.1 WELL/ELECTRODE CLOSURE

This section will outline the specifications for abandonment and closure of groundwater monitoring wells, vapor extraction wells, and electrodes.

8.2 SITE SURFACE RESTORATION

The Site will be graded and finished in kind with existing surface conditions. Surface treatments could include asphalt concrete pavement, Portland cement concrete pavement, and vegetation (i.e., topsoil, seed, and mulch) where applicable.

9.0 REFERENCES

Beyke and Fleming, 2005. In Situ Thermal Remediation of DNAPL and LNAPL using Electrical Resistance Heating. Wiley Periodicals, Inc. Remediation Summer 2005.

CRC, 1983. "Handbook of Chemistry and Physics 62nd Edition 1981-1982", Boca Raton, FL.

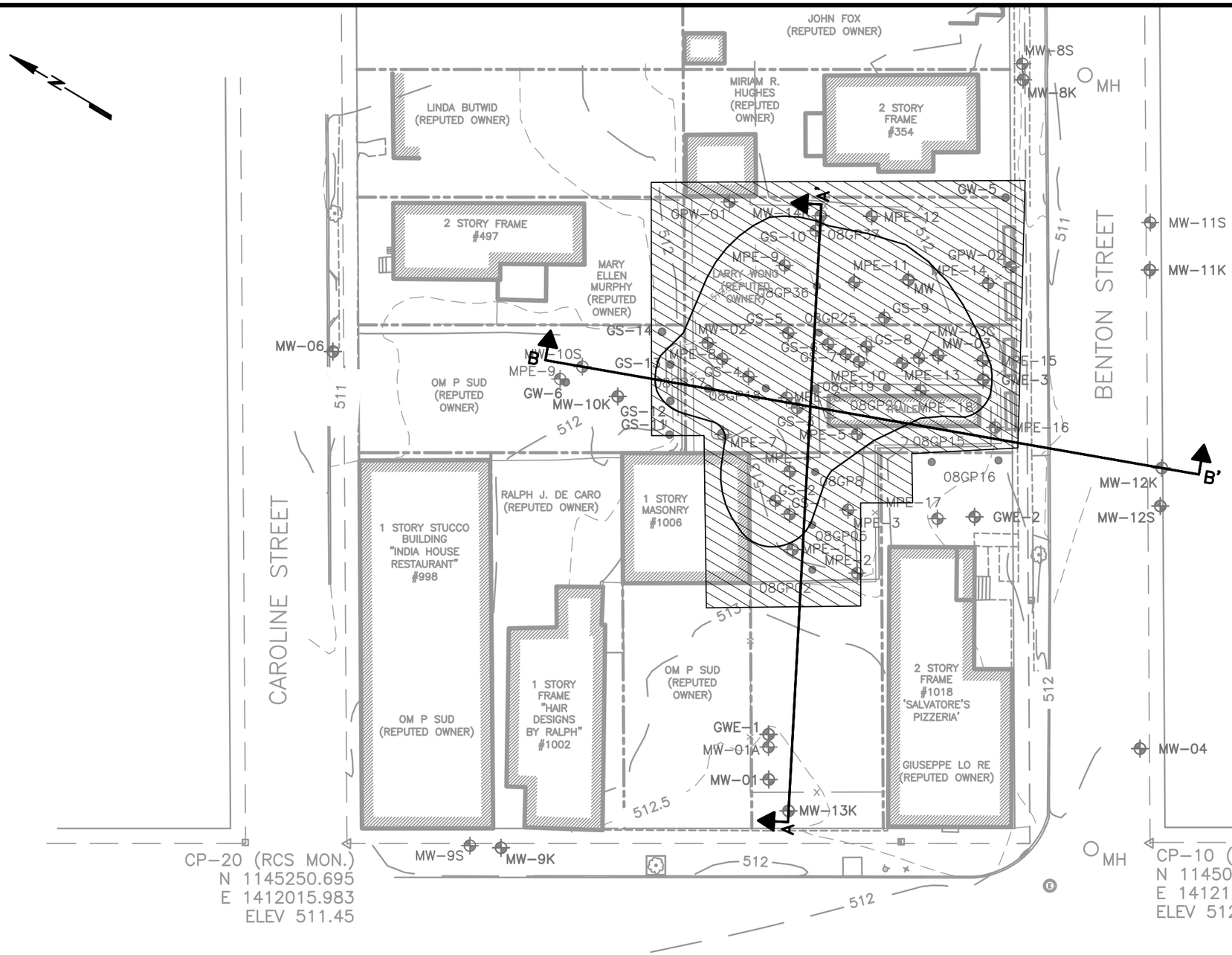
MACTEC Engineering and Consulting, P.C. (MACTEC), 2012. Statement of Work included in Response to NYSDEC Work Assignment D007619-6, Schedule 2.11 Package Submittal. May 18.

MACTEC, 2011. Final Remedial Investigation/Feasibility Study Report, Dinaburg Distributing, Inc., prepared for the New York State Department of Environmental Conservation. February.

New York State Department of Environmental Conservation (NYSDEC), 2011. Record of Decision, Dinaburg Distributing, Inc., Operable Unit Number: 01, State Superfund Project, Rochester, Monroe County, Site No. 828103. March.

NYSDEC, 1997. DAR-1, Policy for the Control of Toxic Ambient Air Contaminants, New York State Department of Environmental Conservation. Issuance Date November 12, 1997.

FIGURES



LEGEND

- CROSS SECTION LOCATION
- EXPLORATION ONLY LOCATION
- EXPLORATION AND WELL LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- ESTIMATED SOURCE AREA (SOILS > 10 MG/KG PCE)
- APPROXIMATE AREA OF PROPOSED ELECTRICAL RESISTANCE HEATING (ERH) TREATMENT

EXPLORATION/WELL KEY

08GP	2008 GEOPROBE SOIL BORING
GPW	GROUNDWATER PIEZOMETER
GS	GEOPROBE SOIL BORING WITH MICROWELL (NOS. 1–10) OR GEOPROBE SOIL BORING (NOS. >10)
GW	GEOPROBE WATER SAMPLE
GWE	GROUNDWATER EXTRACTION WELL
MPE	MULTI PHASE EXTRACTION WELL
MW	GROUNDWATER MONITORING WELL

NOTES:

1. COORDINATES ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (CORS) – NEW YORK STATE PLANE COORDINATE SYSTEM, WEST ZONE.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. MAPPING UNITS ARE U.S. SURVEY FEET.
4. THE CONTOUR INTERVAL IS ½ FOOT.
5. GEOPROBE SOIL BORINGS GS–11 THRU GS–14 AND GEOPROBE WATER SAMPLES GW–5 AND GW–6 WERE LOCATED VIA GPS (I.E., NOT SURVEYED).
6. THERE MAY BE ADDITIONAL EXPLORATIONS/WELLS THAT ARE NOT SHOWN.

REFERENCES

1. BASE SURVEY ADAPTED FROM FILE DINABURG_3DM_BDY.DWG BY POPLI CONSULTING ENGINEERS & SURVEYORS DATED MAY 8, 2012.
2. ESTIMATED SOURCE AREA OBTAINED FROM FIGURE 5, PROPOSED REMEDIAL ACTION PLAN, DINABURG DISTRIBUTING, INC., OPERABLE UNIT NO. 01, SITE NO. 828103, FEBRUARY 2011.

0 15 30 60
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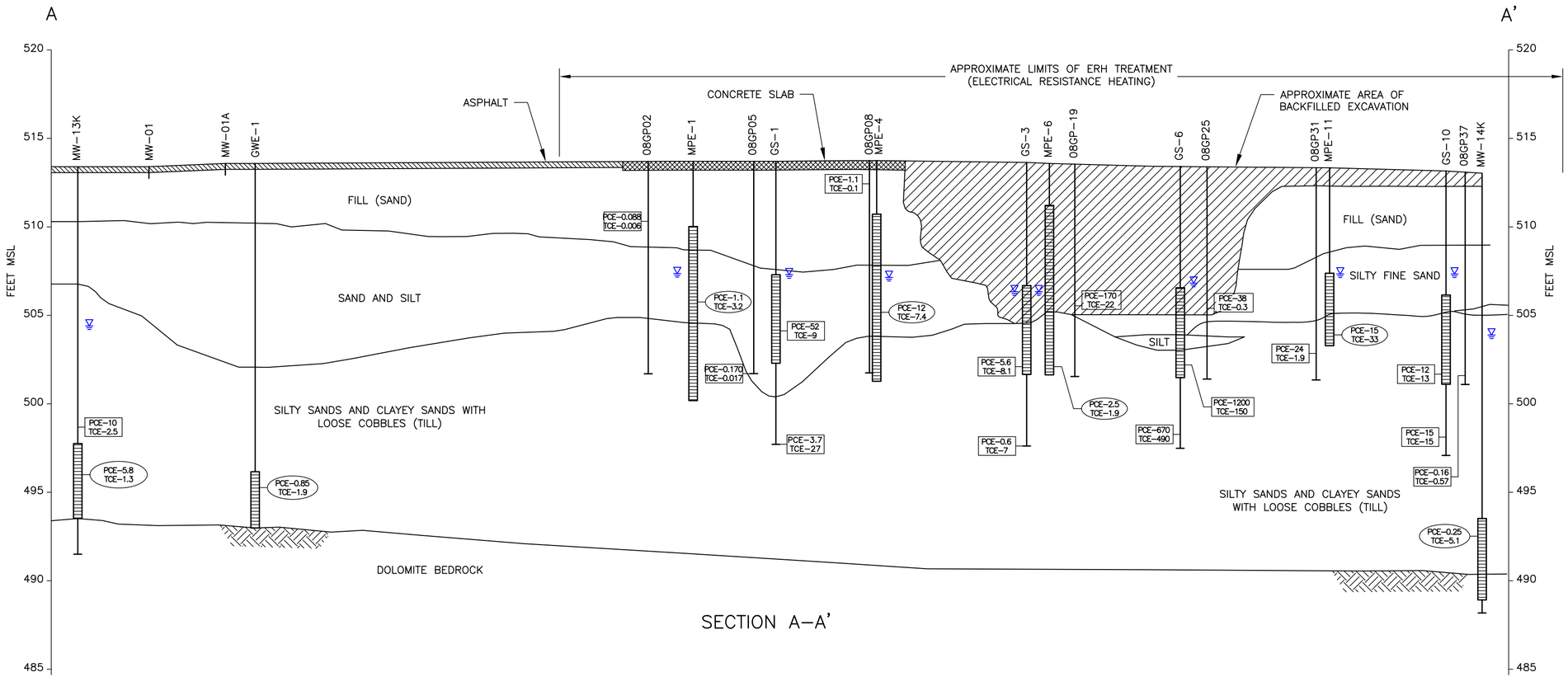
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Checked/Date: KLS 07/12/2012

Design Basis Report
Dinaburg Distributing
Rochester, New York

MACTEC

SITE PLAN
PROJECT 3612112216
FIGURE 1.1

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SECTION A–A'

LEGEND:

- GROUNDWATER LEVEL
- PCE TETRACHLOROETHENE
- TCE TRICHLOROETHENE
- PCE-10 / TCE-2.5 — SOIL (CONCENTRATION IN PARTS PER MILLION, mg/kg)
- PCE-5.8 / TCE-1.3 — GROUNDWATER (CONCENTRATION IN PARTS PER MILLION, mg/L)

0 2.5 5 10
SCALE IN FEET
VERTICAL

0 5 10 20
SCALE IN FEET
HORIZONTAL

Prepared/Date: DEL 07/02/2012
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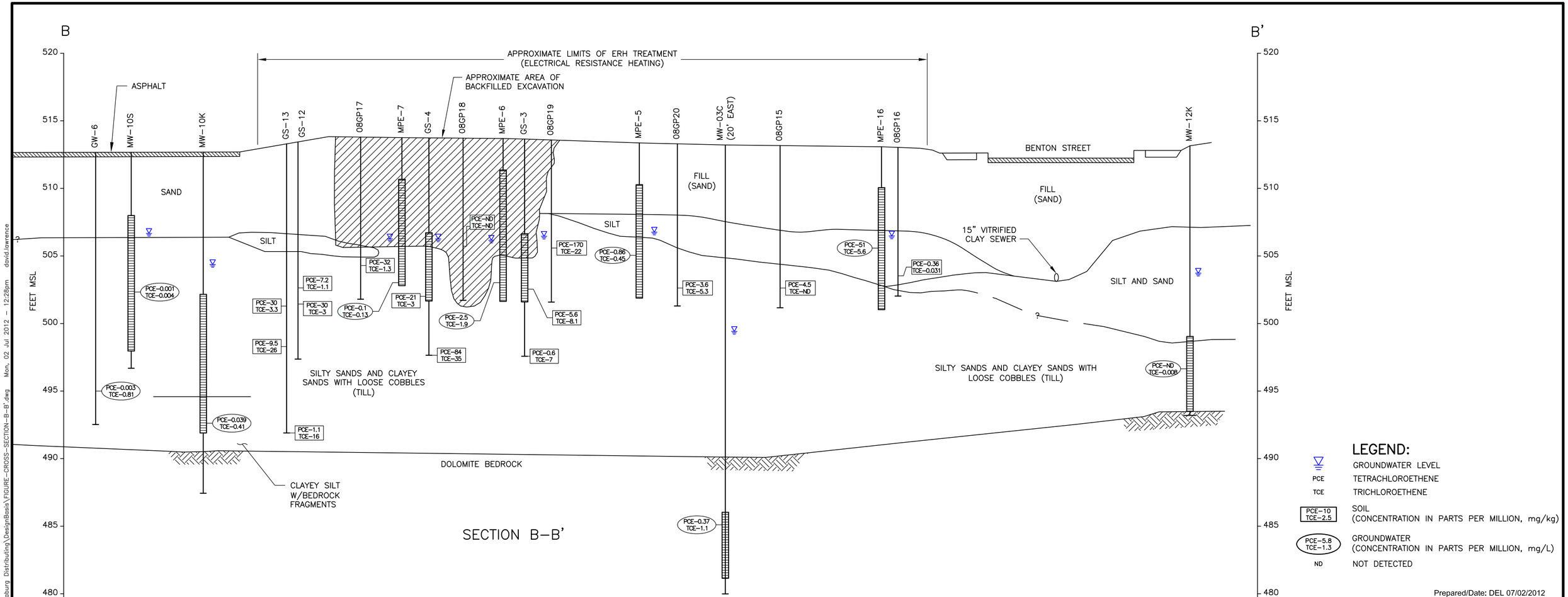
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Rochester, New York

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CROSS SECTION A-A'
PROJECT 3612112216
FIGURE 1.2

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SECTION B–B'

Prepared/Date: DEL 07/02/2012
Checked/Date: CRS 07/02/2012

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CROSS SECTION B-B'
PROJECT 3612112216
FIGURE 1.3

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APPENDIX A

TABLE 375 6.8(a,b) - NYSDEC REMEDIAL PROGRAM SOIL CLEANUP OBJECTIVES

(b) Restricted use soil cleanup objectives.

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
Metals							
Arsenic	7440-38-2	16[f]	16[f]	16[f]	16[f]	13[f]	16[f]
Barium	7440-39-3	350[f]	400	400	10,000 [d]	433	820
Beryllium	7440-41-7	14	72	590	2,700	10	47
Cadmium	7440-43-9	2.5[f]	4.3	9.3	60	4	7.5
Chromium, hexavalent [h]	18540-29-9	22	110	400	800	1[e]	19
Chromium, trivalent[h]	16065-83-1	36	180	1,500	6,800	41	NS
Copper	7440-50-8	270	270	270	10,000 [d]	50	1,720
Total Cyanide [h]		27	27	27	10,000 [d]	NS	40
Lead	7439-92-1	400	400	1,000	3,900	63[f]	450
Manganese	7439-96-5	2,000[f]	2,000[f]	10,000 [d]	10,000 [d]	1600[f]	2,000[f]
Total Mercury		0.81[j]	0.81[j]	2.8[j]	5.7[j]	0.18[f]	0.73
Nickel	7440-02-0	140	310	310	10,000 [d]	30	130
Selenium	7782-49-2	36	180	1,500	6,800	3.9[f]	4[f]
Silver	7440-22-4	36	180	1,500	6,800	2	8.3
Zinc	7440-66-6	2200	10,000 [d]	10,000 [d]	10,000 [d]	109[f]	2,480
PCBs/Pesticides							
2,4,5-TP Acid (Silvex)	93-72-1	58	100[a]	500[b]	1,000[c]	NS	3.8
4,4'-DDE	72-55-9	1.8	8.9	62	120	0.0033 [e]	17
4,4'-DDT	50-29-3	1.7	7.9	47	94	0.0033 [e]	136
4,4'-DDD	72-54-8	2.6	13	92	180	0.0033 [e]	14
Aldrin	309-00-2	0.019	0.097	0.68	1.4	0.14	0.19
alpha-BHC	319-84-6	0.097	0.48	3.4	6.8	0.04[g]	0.02
beta-BHC	319-85-7	0.072	0.36	3	14	0.6	0.09
Chlordane (alpha)	5103-71-9	0.91	4.2	24	47	1.3	2.9
delta-BHC	319-86-8	100[a]	100[a]	500[b]	1,000[c]	0.04[g]	0.25
Dibenzofuran	132-64-9	14	59	350	1,000[c]	NS	210
Dieldrin	60-57-1	0.039	0.2	1.4	2.8	0.006	0.1
Endosulfan I	959-98-8	4.8[i]	24[i]	200[i]	920[i]	NS	102
Endosulfan II	33213-65-9	4.8[i]	24[i]	200[i]	920[i]	NS	102
Endosulfan sulfate	1031-07-8	4.8[i]	24[i]	200[i]	920[i]	NS	1,000[c]
Endrin	72-20-8	2.2	11	89	410	0.014	0.06
Heptachlor	76-44-8	0.42	2.1	15	29	0.14	0.38
Lindane	58-89-9	0.28	1.3	9.2	23	6	0.1
Polychlorinated biphenyls	1336-36-3	1	1	1	25	1	3.2

(b) Restricted use soil cleanup objectives.

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
Semivolatiles							
Acenaphthene	83-32-9	100[a]	100[a]	500[b]	1,000[c]	20	98
Acenapthylene	208-96-8	100[a]	100[a]	500[b]	1,000[c]	NS	107
Anthracene	120-12-7	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Benz(a)anthracene	56-55-3	1[f]	1[f]	5.6	11	NS	1[f]
Benzo(a)pyrene	50-32-8	1[f]	1[f]	1[f]	1.1	2.6	22
Benzo(b)fluoranthene	205-99-2	1[f]	1[f]	5.6	11	NS	1.7
Benzo(g,h,i)perylene	191-24-2	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Benzo(k)fluoranthene	207-08-9	1	3.9	56	110	NS	1.7
Chrysene	218-01-9	1[f]	3.9	56	110	NS	1[f]
Dibenz(a,h)anthracene	53-70-3	0.33[e]	0.33[e]	0.56	1.1	NS	1,000[c]
Fluoranthene	206-44-0	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Fluorene	86-73-7	100[a]	100[a]	500[b]	1,000[c]	30	386
Indeno(1,2,3-cd)pyrene	193-39-5	0.5[f]	0.5[f]	5.6	11	NS	8.2
m-Cresol	108-39-4	100[a]	100[a]	500[b]	1,000[c]	NS	0.33[e]
Naphthalene	91-20-3	100[a]	100[a]	500[b]	1,000[c]	NS	12
o-Cresol	95-48-7	100[a]	100[a]	500[b]	1,000[c]	NS	0.33[e]
p-Cresol	106-44-5	34	100[a]	500[b]	1,000[c]	NS	0.33[e]
Pentachlorophenol	87-86-5	2.4	6.7	6.7	55	0.8[e]	0.8[e]
Phenanthrene	85-01-8	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Phenol	108-95-2	100[a]	100[a]	500[b]	1,000[c]	30	0.33[e]
Pyrene	129-00-0	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Volatiles							
1,1,1-Trichloroethane	71-55-6	100[a]	100[a]	500[b]	1,000[c]	NS	0.68
1,1-Dichloroethane	75-34-3	19	26	240	480	NS	0.27
1,1-Dichloroethene	75-35-4	100[a]	100[a]	500[b]	1,000[c]	NS	0.33
1,2-Dichlorobenzene	95-50-1	100[a]	100[a]	500[b]	1,000[c]	NS	1.1
1,2-Dichloroethane	107-06-2	2.3	3.1	30	60	10	0.02[f]
cis-1,2-Dichloroethene	156-59-2	59	100[a]	500[b]	1,000[c]	NS	0.25
trans-1,2-Dichloroethene	156-60-5	100[a]	100[a]	500[b]	1,000[c]	NS	0.19
1,3-Dichlorobenzene	541-73-1	17	49	280	560	NS	2.4
1,4-Dichlorobenzene	106-46-7	9.8	13	130	250	20	1.8
1,4-Dioxane	123-91-1	9.8	13	130	250	0.1[e]	0.1[e]
Acetone	67-64-1	100[a]	100[b]	500[b]	1,000[c]	2.2	0.05
Benzene	71-43-2	2.9	4.8	44	89	70	0.06
Butylbenzene	104-51-8	100[a]	100[a]	500[b]	1,000[c]	NS	12
Carbon tetrachloride	56-23-5	1.4	2.4	22	44	NS	0.76
Chlorobenzene	108-90-7	100[a]	100[a]	500[b]	1,000[c]	40	1.1
Chloroform	67-66-3	10	49	350	700	12	0.37

(b) Restricted use soil cleanup objectives.

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
Ethylbenzene	100-41-4	30	41	390	780	NS	1
Hexachlorobenzene	118-74-1	0.33[e]	1.2	6	12	NS	3.2
Methyl ethyl ketone	78-93-3	100[a]	100[a]	500[b]	1,000[c]	100[a]	0.12
Methyl tert-butyl ether	1634-04-4	62	100[a]	500[b]	1,000[c]	NS	0.93
Methylene chloride	75-09-2	51	100[a]	500[b]	1,000[c]	12	0.05
n-Propylbenzene	103-65-1	100[a]	100[a]	500[b]	1,000[c]	NS	3.9
sec-Butylbenzene	135-98-8	100[a]	100[a]	500[b]	1,000[c]	NS	11
tert-Butylbenzene	98-06-6	100[a]	100[a]	500[b]	1,000[c]	NS	5.9
Tetrachloroethene	127-18-4	5.5	19	150	300	2	1.3
Toluene	108-88-3	100[a]	100[a]	500[b]	1,000[c]	36	0.7
Trichloroethene	79-01-6	10	21	200	400	2	0.47
1,2,4-Trimethylbenzene	95-63-6	47	52	190	380	NS	3.6
1,3,5- Trimethylbenzene	108-67-8	47	52	190	380	NS	8.4
Vinyl chloride	75-01-4	0.21	0.9	13	27	NS	0.02
Xylene (mixed)	1330-20-7	100[a]	100[a]	500[b]	1,000[c]	0.26	1.6

All soil cleanup objectives (SCOs) are in parts per million (ppm). NS=Not specified. See Technical Support Document (TSD). Footnotes

[a] The SCOs for residential, restricted-residential and ecological resources use were capped at a maximum value of 100 ppm. See TSD section 9.3.

[b] The SCOs for commercial use were capped at a maximum value of 500 ppm. See TSD section 9.3.

[c] The SCOs for industrial use and the protection of groundwater were capped at a maximum value of 1000 ppm. See TSD section 9.3.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.

[e] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the SCO value.

[f] For constituents where the calculated SCO was lower than the rural soil background concentration as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 2 SCO value for this use of the site.

[g] This SCO is derived from data on mixed isomers of BHC.

[h] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[i] This SCO is for the sum of endosulfan I, endosulfan II, and endosulfan sulfate.

[j] This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1.

APPENDIX B

ERH TREATMENT AREA DERIVATION

Legend

- Estimated Area of Soil Contamination Hot Spot (400 square ft)
- Estimated Area of Soil Contamination above SCGs (5900 sqare feet)

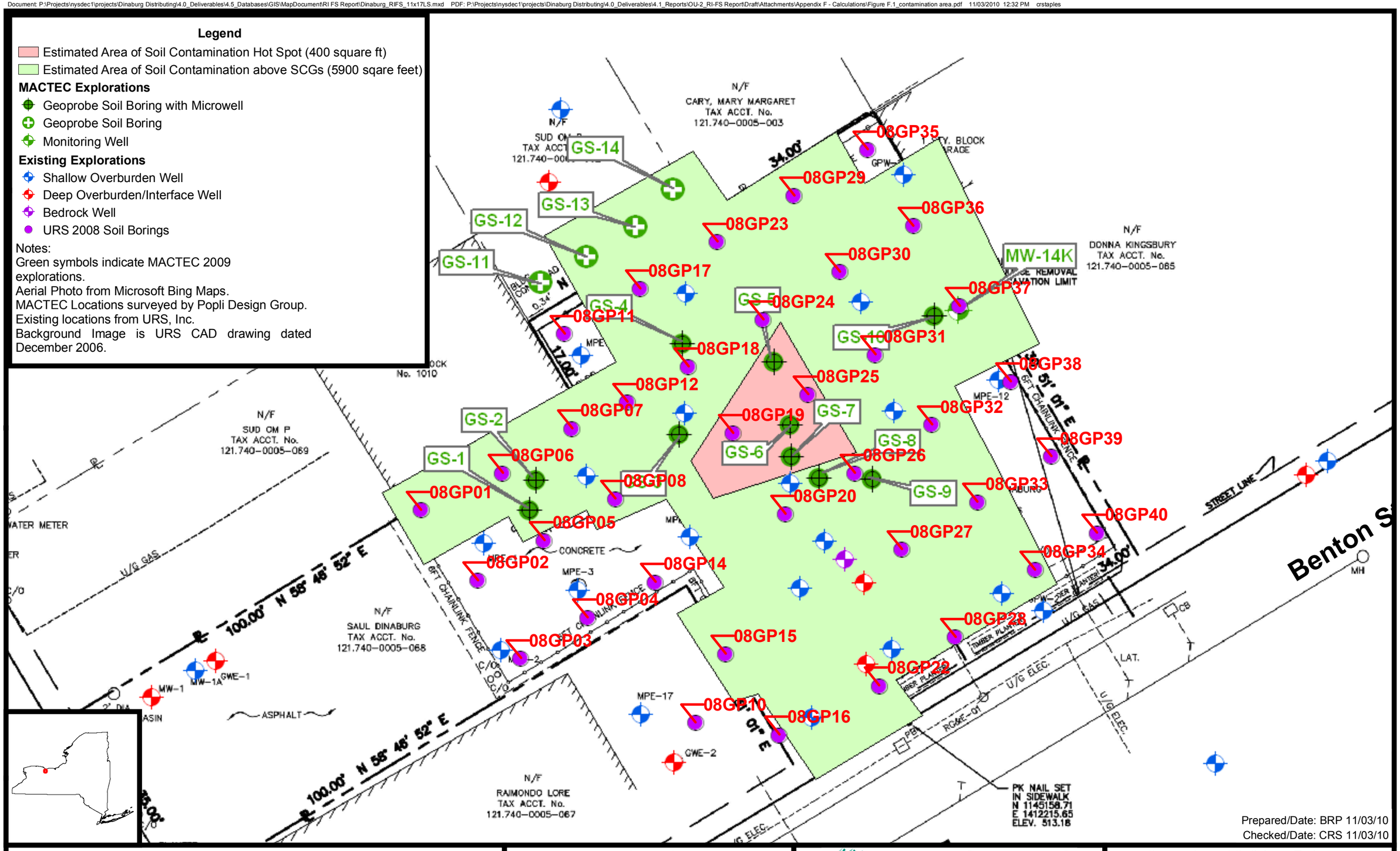
MACTEC Explorations

- Geoprobe Soil Boring with Microwell
- Geoprobe Soil Boring
- Monitoring Well

Existing Explorations

- Shallow Overburden Well
- Deep Overburden/Interface Well
- Bedrock Well
- URS 2008 Soil Borings

Notes:
Green symbols indicate MACTEC 2009 explorations.
Aerial Photo from Microsoft Bing Maps.
MACTEC Locations surveyed by Popli Design Group.
Existing locations from URS, Inc.
Background Image is URS CAD drawing dated December 2006.



Prepared/Date: BRP 11/03/10
Checked/Date: CRS 11/03/10

N
0 7.5 15
Feet

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MACTEC

Contaminated Soil Area Estimates

Project 3612-08-2107 Figure F.1

Location	Contamination Depth	Contamination Thickness Measured	PCE Concentrations - 1st Depth	PCE Concentrations - 2nd Depth	PCE Concentrations - 3rd Depth	TCE Concentrations - 1st Depth	TCE Concentrations - 2nd Depth	TCE Concentrations - 3rd Depth	Contamination Thickness to Rock (assumed)
GS-1	9 - 16+	7 +	52	3.7		9	27		11
GS-2	7 - 16+	9 +	1700	15		3.7	29		13
GS-3	8 - 16+	8 +	5.6	0.64		8.1	7		12
GS-4	8 - 16+	8 +	21	84		3	35		12
GS-5*	9 - 16+	7 +	990	340		630	370		11
GS-6*	8 - 16+	8 +	1200	670		150	490		12
GS-7*	7 - 16+	9 +	110	1200		160	1400		13
GS-8	7 - 16+	9 +	51	64		12	26		13
GS-9	7 - 16+	9 +	93	43		110	160		13
GS-10	9 - 16+	7 +	12	15		15	15		11
GS-11	0	0							
GS-12	10 - 16+	6 +	7.2	30		1.1	3		10
GS-13	10-21 (rock)	11	30	9.5	1.1	3.3	26	16	11
GS-14	10 - 16+	6 +	0	0		5.8	5.7		10

Notes:
Concentrations in mg/Kg
* = high source area borings

	Average Conc.	Geometric Mean Conc.	
PCE Source Area	751.67	573.88	
TCE Source Area	533.33	395.68	
PCE/TCE Source Area	1285.00	1039.88	(geometric mean of sum of PCE/TCE at each sample location)
PCE Outside Source	117.78	19.94	
TCE Outside Source	24.80	11.73	
PCE/TCE Source Area	142.57	37.95	(geometric mean of sum of PCE/TCE at each sample location)

Average Thickness Source=	12	* 400 sq ft	177.78	Cubic Yards
Average Thickness Other=	11.6	* 5900 sq ft	2534.81	Cubic Yards

Mass PCE/TCE = volume * concentration of contamination
Mass PCE/TCE Source = 178 cubic Yards *3000 lbs/cubic yard*1040E-6 = 555.36 lbs
Mass PCE/TCE Other = 2530 cubic Yards *3000 lbs/cubic yard*38E-6 = 288.42 lbs

Created by: CRS 11/1/2010
Checked by: NRL 11/4/2010

(3000 pounds per cubic yard based on assumed soil porosity of 0.32 = 2.65 gram/cubic cm [density of soil partical]*(1-0.32)*62.4 pounds per cubic foot * 27 feet per cubic yard = 3036 lbs/cubic yard)

APPENDIX C

EXAMPLES OF GREEN REMEDIATION TECHNIQUES

Appendix C

Examples of Green Remediation Techniques

Examples of Green Remediation Techniques Applicable to all Phases of the Remedial Programs

- Increase energy efficiency/Minimize total energy use and direct and indirect CO_2 /GHG emissions to the atmosphere
- Reduce emissions of air pollutants
- Minimize habitat disturbance and create or enhance habitat or usable land
- Conserve natural resources such as soil and water; promote the sequestration of carbon through reforestation or afforestation
- Minimize fresh water consumption and maximize water reuse during daily operations and treatment processes
- Prevent long-term erosion, surface runoff, and off-site water quality impacts
- Prevent unintended soil compaction
- Minimize waste or implement beneficial use of materials that would otherwise be considered a waste
- Minimize equipment and truck idling and use sustainably produced biofuels to reduce discharges of pollutants and GHGs to the atmosphere
- Utilize clean diesel (new or retrofitted) equipment to reduce emissions to the atmosphere
- Minimize truck travel for disposal to save energy, reduce emissions, reduce localized noise, vibration, and wear and tear on roads
- Minimize use of heavy equipment to save energy and reduce emissions

Examples of Green Remediation Techniques Applicable to the Remedy Selection, Design and/or Construction Phases

- Maintain, use, mimic or enhance natural processes where possible to effect remediation
- Encourage development and evaluation of low energy alternatives such as enhanced bioremediation, phytoremediation, permeable reactive barriers (PRBs), source removal with monitored natural attenuation (MNA), enhanced attenuation of chlorinated organics (EACO), engineered wetlands, and remedies which can be driven to MNA or monitoring only (e.g., remedies which will not need external power indefinitely)
- Use renewable energy if possible, or purchase Renewable Energy Credits

- Evaluate if a remediation system could be protective with an intermittent energy supply (e.g., pumping or venting only during daytime or adequate winds)
- Encourage the use of remediation technologies that permanently destroy contamination to reduce impacts associated with long-term site management
- Address sources more aggressively to reduce long-term operation and maintenance of treatment or containment systems
- Design for efficiency (e.g., size motors optimally) to reduce indirect emissions of electricity production
- Design adaptable systems (e.g., systems that use less energy as the site cleans up) Incorporate green building design
- Reuse existing buildings and infrastructure to reduce waste
- Reuse and Recycle construction and demolition (C&D) debris and other materials Maximize beneficial use of materials that would otherwise be considered a waste Integrate remedial design with contemplated reuse of site
- Design cover systems to be usable (e.g., habitat, recreation, renewable energy generation, bio-fuel crop production)
- Design storm water management or cover systems to recharge aquifers/minimize the creation or replacement of impervious surfaces
- Use native vegetation requiring little or no irrigation
- Reclaim treated water for beneficial use such as process water or irrigation

Examples of Green Remediation Techniques Applicable to Site Management

- Focus on optimization to reduce energy use or time to closure
- Increase energy efficiency/minimize total energy use and CO_2 /GHG emissions to the air by replacing equipment, altering operation or shutting down unnecessary equipment
- Improve reliability to reduce O&M visit frequency
- Evaluate the possibility of switching to renewable energy either directly (generated on site, off-grid or grid-tied), or indirectly through a utility (green power purchase program)
- Complete the Remedial Site Optimization Process to identify opportunities to reduce energy and other impacts
- Incorporate sustainability into periodic reviews to identify opportunities to reduce energy and other impacts
- Assess if an energy intensive remedy is still the best remedy for the site
- Evaluate the possibility of MNA for sites where this was not originally considered