Environment

Prepared for: Prairie Ronde Realty Company Dowagiac, Michigan

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Final Corrective Measures Plan

Prairie Ronde Realty Company
415 East Prairie Ronde Street
Dowagiac, Michigan
MID 005 068 507

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ACRONYMS

ABC® .... Anaerobic Biochem
ABC®+ .... Anaerobic Biochem Plus Zero Valent Iron
AS.............. Air Sparge
CAMP .... Corrective Action Monitoring Plan
CMP .... Corrective Measures Plan
COPC .... Chemicals of Potential Concern
DCE........... cis-1,2-dichloroethene
ERA .... Ecological Risk Assessment
ERD........... Enhanced Reductive De-chlorination
FBRA......... Furnace Brick Remediation Area
GAC........... Granular Activated Carbon
GPM .... Gallons per Minute
GSI .... Groundwater Surface Water Interface
MDEQ........ Michigan Department of Environmental Quality
MDNR........ Michigan Department of Natural Resources
MNA .... Monitored Natural Attenuation
NPDES...... National Pollutant Discharge Elimination System
O&M .... Operation and Maintenance
OBP........... Old Borrow Pit
OSSR .... Oil and Solvent Storage Room
PCB........... Polychlorinated Biphenyls
PRR........... Prairie Ronde Realty
PW............. Purge Well
SSDPS ...... Sub-slab Depressurization System
SSA .... Supplemental Soil Assessment
SVE .... Soil Vapor Extraction
SVOC .... Semi-Volatile Organic Compound
TCA 1,1,1-trichloroethane
TCE .... Trichloroethene
USEPA ...... U.S. Environmental Protection Agency
UST .... Underground Storage Tank
VC .... Vinyl Chloride
VIA............. Volatilization to Indoor Air
VMP........... Vapor Monitoring Point
VOC........... Volatile Organic Compound
VSR .... Verification of Soil Remediation
ZVI............. Zero Valent Iron

1.0 INTRODUCTION

This document presents a Corrective Measures Plan (CMP) for a former manufacturing plant property located at 415 Prairie Ronde Street in Dowagiac, Michigan (MID 005 068 504). This property was acquired by Prairie Ronde Realty Company (PRR) from Sundstrand Corporation (UTC/Sundstrand) in 1995. **Figure 1** is a Site location map showing the PRR property and nearby areas. **Figure 2** is a map showing the PRR property and building. Throughout this CMP, “PRR property” is the property owned by PRR. “PRR building” is the industrial building on the PRR property. “Site” refers to the PRR property and areas impacted by releases of chemicals of potential concern (COPC) from the PRR property.

The shallow soil and groundwater beneath this plant were impacted by volatile organic compounds (VOCs), primarily trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), prior to PRR acquiring the property. The contamination was discovered in 1983. Subsequently, UTC/Sundstrand (formerly Sundstrand Heat Transfer, Inc.) entered into a Consent Judgment with the Michigan Department of Environmental Quality (MDEQ, formerly the Michigan Department of Natural Resources, MDNR) to abate the contamination. In 1984, a groundwater remediation system with 12 purge wells was installed and put into operation. The original purge well system has been modified as the contaminant conditions changed; seven original purge wells have been closed, and five new wells have been installed. The groundwater is treated in an air stripping tower and is discharged to a nearby drain.

Beginning in 1994, UTC/Sundstrand voluntarily installed a soil vapor extraction (SVE) system on the property to expedite remediation. UTC/Sundstrand and PRR subsequently voluntarily installed an air sparge (AS) system after PRR purchased the property in 1995. The AS system was installed at two locations: at the PRR building and northwest of the PRR property. During the last quarter of 2008, the SVE and AS systems were shut down after the removal efficiency decreased and with notice to the U.S. Environmental Protection Agency (USEPA) and MDEQ.

Ongoing monitoring and supplemental Site studies have shown the various remediation systems have reduced the VOC impact to the Site’s soil and groundwater. TCE and other VOC concentrations have declined at a rate typically in the range of 15% to 20% per year. However, several areas of relatively higher VOC concentrations remain, primarily in the original source areas at the plant.

In 2004, MDEQ requested the USEPA assume the regulatory lead for this Site, and PRR subsequently entered into a Consent Agreement with USEPA to complete the Site’s environmental assessment and remediation.

Under the Consent Agreement, an enhanced reductive de-chlorination (ERD) pilot study using a proprietary formula designated as Anaerobic Biochem Plus Zero Valent Iron (ZVI) (ABC®+) was performed by PRR at the Oil and Solvent Storage Room (OSSR) Area. The ABC®+ pilot test results are summarized in the *Report of ABC®+ Pilot Test, (*Mursch, 2011A, also **Appendix D**). This report concludes ABC®+ is effective at degrading TCE and its daughter products.

Additional off-PRR property soil vapor and indoor air monitoring were performed under the Consent Agreement. A sub-slab depressurization system (SSDPS) was installed as an interim remedial measure at one residence in response to the indoor air monitoring results. The former SVE system at the PRR building was converted to a SSDPS in 2012.

This CMP is being submitted in accordance with the USEPA Consent Agreement requirements. Section 2 provides interim and final goals for corrective measures. Several corrective measures options are evaluated in Sections 3 and 4. The proposed corrective measures include continuing to operate the groundwater collection and treatment system as necessary to protect surface water, ERD to further reduce TCE and other VOC concentrations in groundwater, monitored natural attenuation (MNA), land use restrictions and SSDPSs at one residence and the PRR building. **Appendix J** describes the SSDPS installed to address air in the PRR building. These corrective measures are able to achieve the goals specified in this CMP.

1.1 Current and Reasonably Expected Land Use

The PRR property includes approximately 33 acres of land located in Dowagiac, Michigan. It is used for industrial and commercial purposes (offices, warehousing and some machining). **Figure 1** is a Site location map.

The PRR property is zoned for heavy industrial use. Adjacent properties to the north, east and south of the PRR property are also zoned for heavy industrial use. Adjacent properties west of the PRR property are also in the City of Dowagiac and are zoned for residential use. Property further to the north of the PRR property is in Wayne Township and is zoned for open space/recreation. Zoning maps for the City and Township and descriptions of the heavy industrial zoning are in **Appendix A**.

The PRR property use will remain industrial. A Restrictive Covenant for the PRR property limits future uses to industrial, warehouse and commercial purposes that under applicable law do not require the property to meet environmental clean-up or remediation standards for residential uses. The Restrictive Covenant also prohibits underground storage tanks (USTs) for petroleum or other hazardous substances and using any chlorinated solvents on the PRR property. This Restrictive Covenant is recorded at the Cass County Register of Deeds (Liber 991, page 446 – 491) and a copy is in **Appendix B**.

The *Master Plan for Land Use for the County of Cass, Michigan* (Cass County Planning Commission, 2002) identifies the City of Dowagiac as a “primary growth area” and the Township north of the PRR property as “general agriculture,” and does not suggest land use changes at or near the PRR property.

The impacted groundwater extends northwest of the PRR property into nearby areas in the City of Dowagiac and Wayne Township. This part of Wayne Township is zoned for open space and recreation, and much of it is wetland. Impacted groundwater is not used for drinking water in the City or in the Township. **Figure 1** shows the PRR property, the surrounding neighborhoods, Dowagiac City limits and undeveloped areas in Wayne Township to northwest of the PRR property

Recent data from the 2010 United States Census indicates approximately 730 residents live in the neighborhoods within 0.2 mile radius of the non-residential PRR property. Of these 730 residents, approximately 220 are under 18 years old and approximately 100 are over age 65. No sensitive receptor units (schools, day care facilities, hospitals, dormitories, prisons, retirement housing, etc.) were identified within 0.2 miles of the non-residential area.

Wetlands exist to the west, northwest, north and northeast of the Site. These wetlands extend onto a small part of the northeast corner of the PRR property. The wetlands to the northeast are documented habitat of a Federally-protected species, Mitchell’s satyr butterfly. The *Ecological Risk Assessment* (AECOM, 2011) provides additional information on the wetlands and butterfly.

The Restrictive Covenant (see **Appendix B**) prohibits using groundwater for drinking water on PRR property. The City of Dowagiac Zoning Ordinance prohibits issuing permits to construct “a building or structure which is not served by both adequate public water and sewer facilities, or a private system approved by the County Health Department” (City of Dowagiac Zoning Ordinance, Section 2.20). The City Ordinance does not regulate existing groundwater use and has not been reviewed by the MDEQ for consistency with Part 201 of Michigan’s Act 451 of 1994 as amended (Part 201). A new or revised City ordinance may be pursued, in consultation with the MDEQ.

Portions of the COPC plume with concentrations exceeding MCLs or Part 201 residential Groundwater Criteria Protective of Drinking Water extend beyond the PRR property and the Dowagiac City limits into four parcels, at most, in Wayne Township. The Restrictive Covenant and City Ordinance do not apply to the plume areas extending beyond the City limits. There are no special restrictions on groundwater use in Wayne Township other than state-wide public health codes for well construction. There is potential for groundwater use outside the City limits. However, groundwater is not used for drinking water on these four parcels and individual deed restrictions for these parcels are being considered.

In the 1990s, the City of Dowagiac extended the City water supply into the “Burmax Park” neighborhood to the west and northwest of the PRR property (Secor, 2002A). A residential well survey, completed in 1997, identified only one well in Burmax Park used as a drinking water source. This well was sampled in 1997 (Mursch, 1997, reported in Secor, 2002A, Appendix D) and 2006 (Mursch, 2006), and no COPCs were detected at concentrations exceeding MCLs or Part 201 drinking water criteria. This residential well is located outside the COPC plume and has been outside the plume for at least 15 years. In 1984 and 2012, the residence’s owner declined the opportunity to connect to the City water. This well and other non-potable water supply wells to the north and northeast of the PRR property were also sampled in 2006, and no COPCs were detected (Mursch, 2006). This well and another well in Burmax Park used to water a lawn were sampled again in February 2012, and no VOCs were detected. **Appendix I** provides additional information on the Burmax Park groundwater and wells.

One well on Louise Street sampled in the 2006 survey (Mursch, 2006) had a TCE concentration above the residential Part 201 drinking water criterion (Table 2A in the *Human Health Risk Assessment*, AECOM 2009A). This well is only used for flushing toilets and laundry, but is not used for drinking water. The risks associated with potential impacts of these uses on indoor air were evaluated. Using groundwater for flushing toilets and washing is not predicted to result in unacceptable risks to human health (see Section 1.4.1 and **Appendix G**).

Based on the surveys summarized above, there is currently no known use of impacted groundwater for drinking water and the drinking water exposure pathway is not complete. The Restrictive Covenant for the PRR property controls future use of groundwater at the property and the City Ordinance controls use of groundwater in the City limits. There is no known use of impacted groundwater related to the Site in Wayne Township; however it is possible in the future since there are no general restrictions on groundwater use in the Township or specific restrictions on the individual parcels that may be affected. Therefore, deed restrictions on the affected parcels may be pursued.

The *Human Health Risk Assessment* (AECOM, 2009A) did not identify any complete human exposure routes (see Section 1.4.1); but groundwater exposure could theoretically occur if a drinking water well were installed in an impacted area. Investigations of indoor air at the PRR building completed after the *Human Health Risk Assessment* identified potential risks associated with exposure in the PRR building. An interim remedial measure was implemented in June 2012 to address this potential risk (see Section 1.4.1), and VOC concentrations in indoor air at the PRR building were less than regional screening levels in December 2012 (Mursch, 2013).

The *Ecological Risk Assessment* (AECOM, 2011) did not identify any ecological impacts (see Section 1.4.2).

1.2 Summary of Site Conditions

This section describes current soil, groundwater, surface water, sediment and indoor air conditions and impacts. Section 1.4 summarizes risks associated with impacts. Tables summarizing analytical data are in **Appendix L**.

The subsurface conditions and extent of VOC impact at the Site have been comprehensively investigated by several entities since 1984. The Site’s hydrogeologic conditions and the nature and extent of environmental impact are well understood. **Appendix K** is an annotated list of the primary Site assessments.

1.2.1 Soil

The plant is underlain by glacial outwash deposits. In general, an upper layer of medium to fine sand grades to sandy gravel. This upper layer is typically 50 to 60 feet thick within the PRR property, and groundwater in this layer occurs under water table conditions at depths about 20 to 25 feet. The unsaturated soil under the plant is typically fine silty sand.

The Site assessments identified potential soil contamination sources (see **Table 1** and **Figure 2**). During the 1984 studies, the OSSR, north gate area, pit degreasers, API separator, and the Old Barrow Pit (OBP) were investigated and solvent impact was documented at all these locations. Additional potential source areas including electrical substations, chrome and zinc plating lines, underground fuel and oil storage tanks, aboveground gasoline storage tank, demolished residences, Furnace Brick Remediation Area (FBRA), incinerator, solvent recovery still, cooling water retention lagoons (CWRL), and degreasers were identified and investigated in the Delta Phase I and II assessments and in the *Baseline Environmental Assessment* (Delta Environmental Consultants, Inc., 1990).

These various potential source areas have been investigated for COPCs including solvents, metals, semi-volatile compounds, and in some instances polychlorinated biphenyls (PCBs). (PCBs were not detected). VOCs have been detected in the soil at the OSSR, OBP, API Separator, pit degreaser area, north gate, and CWRL. Metals have been detected in soil at concentrations above statewide background levels at the OSSR, OBP, FBRA, and pit degreaser area.

The soil data are summarized in **Table 3A** in **Appendix L** which includes soil data from samples above the groundwater table and soil that has not been excavated and removed from the PRR property as part of past remedial actions. Older soil data for VOCs were not used if more recent data were available from approximately the same location because the more recent data are more representative of current conditions.

The soil samples in **Appendix L**, **Table 3A** are organized into several “areas,” which correspond approximately to areas where COPCs were released or were potentially released in the past. These areas are:

- Cooling Water Retention Lagoons (CWRL) – These lagoons were filled in, and are now under an expansion of the PRR building. Soil data for the API separator are included with CWRL data
- Furnace Brick Remediation Area (FBRA) – Soil from this area was excavated and verification samples were collected
- Former Chrome Plating Line (FCPL)
- Former Pit Degreaser Area (FPDA)
- Former Underground Storage Tanks (FUST)
- North Gate Area (NGA), including adjacent former storage tanks
- Old Borrow Pit (OBP) and former incinerator
- Oil and Solvent Storage Room (OSSR)
- Wetland

The locations for these areas are shown on **Figure 2,** except for the wetland soil area, which is located northeast of the PRR property and Pine Lake Drain.

Certain data from the FBRA are identified as “screened” or “native” soil. The samples from the screened soil were collected from soil that was excavated as part of that area’s remediation, screened to remove furnace brick and other debris and then replaced in the excavation. The samples from the native soil were collected from the bottom of the excavation in soil that was not physically disturbed during remediation activities.

Certain soil samples were analyzed for “total” chromium, which includes trivalent and hexavalent chromium. The Michigan Part 201 criteria for hexavalent chromium are much lower than the criteria for trivalent chromium. The data were compared to Part 201 criteria for hexavalent chromium in **Table 3A, Appendix L**. This comparison to the lower criteria will tend to over-estimate the risk.

Wetlands soils are included with other soil data. The wetland where these soil samples were collected does not usually have standing water, although the soil is usually saturated. The screening levels for soil were applied to wetland soil, not screening levels for sediments. This is appropriate since the sediment screening levels are generally based on truly aquatic organisms that require standing water. These wetlands do not typically have standing water and could not support aquatic organisms. Wetland soil data were reported by Earth Tech (2007A).

Table 3B, Appendix L, identifies the types of Michigan Part 201 criteria that were exceeded in each area. The CWRL, FCPL, FPDA and OSSR are located inside the PRR building and under the floor, so people and ecological receptors are not directly exposed to these soils. The OBP and FBRA are covered with a foot or more of clean soil, so direct contact with these soils can only occur if the area is disturbed.

Additional PRR property soil evaluation was performed and summarized in a letter report from R. David Mursch dated September 30, 2011A. This letter report is provided in **Appendix C**, and concludes remediation performed at the Site has greatly reduced TCE concentrations in the soil from the levels recorded in 1983.

1.2.2 Groundwater

The Site's subsurface has glacial outwash deposits. Within the zone of interest are two aquifers separated by an aquitard layer. The water table is typically 20 to 25 feet below ground surface in the plant area and flows to the west and northwest. The topography generally dips down to the north and northwest. Some shallow groundwater vents to surface water in small seeps located west and north of the PRR property.

The upper water table aquifer has a 25- to 30-foot saturated thickness. This aquifer is roughly divided between an upper zone with fine to medium sand and a lower zone with fine to medium sandy gravel. The upper water table aquifer's upper and lower zones are continuous with each other and have almost identical potentiometric surfaces.

Underlying this upper water table aquifer is a variable but persistent aquitard layer with inter-bedded clay, fine silty sand, clayey silt and clayey sand, which sometimes has been referred to as the "clay layer." The aquitard is typically several feet thick, but in some areas it is 10 or more feet thick.

The soil below the aquitard has inter-bedded sand and gravel that together form a semi-confined aquifer (generally referred to as the "deep" or "lower" aquifer). Groundwater level measurements show an upward hydraulic gradient across the aquitard throughout the Site. This means groundwater and COPCs in the upper water table aquifer are very unlikely to migrate to the deeper aquifer under natural conditions. Groundwater from the deeper semi-confined aquifer will flow into the upper water table aquifer and will eventually discharge to down-gradient surface waters.

The Site's groundwater has been assessed for various COPCs including VOCs, semi-volatile organic compounds (SVOCs) and metals. At each identified potential source area listed in **Table 1**, groundwater has been sampled and analyzed for COPCs. **Appendix L, Table 1** presents recent (October, 2012) groundwater data for VOCs. **Appendix L, Table 2** presents the most recent groundwater data for metals.

VOC constituents related to former solvent use at the plant have been identified in the groundwater, and remediation efforts have been underway since 1985. **Figure 4** is a map showing the impacted groundwater based on September 2011 monitoring data (*Third Quarter 2011 Monitoring Report*, Mursch, 2011B) and includes the extent of the impacts regardless of the well depth (this delineation includes wells screened above and below the aquitard).

The assessment and monitoring data document limited VOC impact in the deep aquifer. The impacted area of the deep aquifer is much smaller than the impacted area of the shallow water table aquifer and the COPC concentrations in the deep aquifer are much lower than in the shallow aquifer. **Figure 5** is a map showing TCE concentrations in the deep wells screened below the aquitard layer. All COPC concentrations in these wells were less than the Michigan Part 201 groundwater surface water interface (GSI) criteria, and impacts were mostly limited to wells located on the PRR property.

No other COPCs have been detected in groundwater at levels warranting additional assessment or remediation. Groundwater samples from 15 monitor wells were analyzed in 2006 for metals (arsenic, barium cadmium, chromium, copper, lead, nickel and zinc). These data are summarized in **Appendix L, Table 2**. With a single exception, all metal concentrations were less than the applicable Michigan Part 201 GSI and drinking water criteria and were consistent with regional background concentrations. Only the zinc concentration slightly exceeded the GSI criterion in one well up-gradient from the Site. The monitoring report concluded there was no indication of a release of metals to groundwater from operations at the PRR property.

Site-wide comprehensive assessments of vertical and horizontal VOC impact limits were completed in 1984, 2002, and 2005. Based on these assessments and on the ongoing groundwater monitoring program, VOC concentrations and the horizontal extent of groundwater impacted by VOCs have decreased. The reduction in horizontal extent of groundwater impact in the upper aquifer is illustrated in **Figure 3** for 1983, 2004, and 2011.

Figures 4 and 5 illustrate the current extent of impacted groundwater in the shallow water table aquifer and the deep aquifer based on data from September 2011. VOC impacts have been significantly abated in the groundwater (see **Figure 4**). The September 2011 monitoring data (Mursch, 2011B) document the remaining TCE and other VOC concentrations are generally above the Michigan Part 201 drinking water criteria (which is not a presently complete exposure pathway), but VOC concentrations off the PRR property are generally below the Michigan Part 201 GSI criteria for protecting surface water. The data also show no VOCs exceed the Michigan Part 201 GSI criteria in monitoring points screened within the shallow groundwater in the upper aquifer, which is most likely to discharge to surface waters. Chemical concentrations in shallow groundwater in the shallow water table aquifer that potentially vents to surface water are below the GSI criteria.

VOC concentrations above the GSI criteria in the deeper groundwater in the shallow water table aquifer remain in four areas, which are illustrated on **Figure 4**. These areas are located at and down-gradient of the former OSSR, near the former degreaser pit area, between the PRR property and the adjacent Creative Foam Products property to the northeast, and northwest of the PRR property.

1.2.2.1 Discharge to Surface Water

The assessment and monitoring data show shallow groundwater containing dissolved VOCs potentially vents to surface water and seeps along Pine Lake Drain and to Pine Lake northeast of the Site, and to an unnamed drain west of Louise Street to the west of the Site.

The VOC concentrations in the shallow groundwater, which represents the maximum potential VOC concentrations that could reasonably be expected to discharge to surface water, are shown on **Figure 4**. TCE concentrations in potentially venting groundwater are less than the relevant 200 ug/L GSI criterion, and other VOC concentrations are also less than the Michigan Part 201 GSI criteria and water quality values.

The surface water in the unnamed drain had TCE levels above the GSI criterion when it was initially investigated in 1983/1984 with concentrations as high as 5,000 ug/L (EDI Engineering and Science, 1984). TCE levels in surface water in the unnamed drain have been below the 200 ug/L GSI/water quality value since at least 2000. Surface water in the drain was sampled at two locations (SG-5 and SG-6) in 2000 and 2001 during regular quarterly monitoring events, and nine locations (DR-1 and DR-3 through DR-10) were sampled in 2002 as part of the *Phase I Current Conditions Report* (Secor, 2002A). The unnamed drain was re-sampled in April 2007 at two locations, and all VOC concentrations were below detection limits (Earth Tech, 2007B).

Seep UT-2 (along the unnamed drain west of Louise Avenue) has been sampled annually since 2004 as part of the groundwater monitoring program. The seep is generally sampled in the spring, because it is typically dry in the summer and fall months. TCE concentrations have decreased since sampling began (see Figure 19 in the *Third Quarter 2011 Monitoring Report*, Mursch, 2011B). The TCE concentration in UT-2 was 43 ug/L during the September 2011 monitoring event (Mursch, 2011B), which is less than the 200 ug/L GSI/water quality value. All other VOC concentrations in UT-2 were also less than the GSI/water quality values in the September 2011 monitoring event (Mursch, 2011B).

The vinyl chloride (VC) concentration at SP-5 (located near the northeast corner of PRR property) was 17 ug/L in 2002 (*Phase I Current Conditions Report*, Secor, 2002A), slightly exceeding the 15 ug/L GSI criterion in effect at that time. SP-5 was re-sampled in 2009, and the VC concentration was 15 ug/L (Mursch, 2009). In 2010, GSI criterion for VC was lowered to 13 ug/L, so the 2009 VC concentration in SP-5 slightly exceeded the new GSI criterion. SP-5 was sampled again in February and March, 2012 (Mursch, 2012), and the VC concentrations were 19 and 21 ug/L, respectively. Surface water is not always present at SP-5 and when present forms a small puddle. The GSI criterion is based on human exposure by partial body contact activities such as swimming, which are not possible at SP-5. The water quality value for protecting aquatic life is 930 ug/L (based on chronic toxicity), so the GSI criterion also protects aquatic life. Aquatic toxicity is not expected at the concentrations detected in SP-5.

Except for the minor VC exceedance in SP-5, VOC concentrations in venting groundwater, surface water and seeps are less than Michigan Part 201 GSI criteria/water quality values in the September 2011 data.

1.2.2.2 Volatilization from Soil and Groundwater to Indoor Air

In 1994, the plant installed a SVE system under the plant to remove VOCs from the soil beneath the plant building. Nine SVE wells were installed and operated for four years. In 1998, the SVE system was expanded by adding 13 additional SVE wells under the plant, in conjunction with installing an AS system for remediating the groundwater. By this time, testing showed the SVE system had greatly reduced VOC concentrations in the soil, and system's purpose was changed from remediating the soil to capturing air and VOC vapors migrating into the vadose zone as a result of groundwater AS. Soil samples from locations that formerly had very high concentrations of VOCs were collected and analyzed in 2008 (Mursch, 2008A) after operating the SVE system. TCE was the only VOC detected in these samples. The SVE system is further discussed in Section 1.3.1.3 in this report.

VOC migration from soil and groundwater into indoor air was evaluated after the SVE and AS system were turned off in 2008. Separate evaluations were completed for down-gradient residential properties and the PRR building. Both evaluations included sampling indoor air and sub-slab soil vapor. The indoor air and sub-slab soil vapor data for the residential properties are in **Appendix L, Table 4**. The indoor air and sub-slab data for the PRR building are in **Appendix L, Tables 5 and 6**.

In 2009, PRR sampled indoor air at residences to directly measure VOC concentrations in the indoor air. Only one residence (401 Louise Street) had an indoor air TCE concentration (2.3 ug/m^3) above 1.2 µg/m^3, the USEPA's screening level at that time. These findings were confirmed in a second sampling event conducted in July and August 2009. A mitigation system (a SSDPS) was installed at that residence in August 2009. AECOM (2009B) summarized the results from indoor air sampling at 20 residences.

Post SSDPS installation sampling at the residence was done in September 2009 and summarized in the *Indoor Air and Sub-Slab Sampling Summary Report for 401 Louise Street* (AECOM, 2010). Sample results obtained from the initial post SSDPS installation sample collected September 23 through September 24 indicated the indoor air TCE concentration remained above USEPA's regional screening levels (2.1 µg/m^3, based on 1E-05 risk). Reviewing the building construction and information obtained from the resident indicated additional basement ventilation was required. Ventilation activities and subsequent sampling conducted on October 28 indicated indoor air concentrations had been reduced to levels below the screening level. A 30-day post ventilation sample collected on December 3, 2009 showed indoor air TCE concentrations at the 401 Louise are lower than USEPA's conservative screening level, and the SSDPS is functioning properly.

The current indoor air data show inhalation of indoor air is not a complete exposure route/path for VOCs to reach indoor receptors at off-PRR property residential buildings.

In March 2012, AECOM prepared a work plan for indoor air and sub-slab soil vapor at the PRR building (AECOM, 2012A). The USEPA approved the work plan, and the sampling was initiated in March, 2012. The initial indoor air evaluation at the PRR building included monitoring VOC concentrations in indoor air from seven areas of the building, seven sub-slab monitoring locations and an ambient air location. The results from this sampling are included in AECOM (2012B), and are summarized below.

- TCE concentrations in indoor air exceeded the industrial regional screening level at six of the seven locations.
- VOC concentrations other than TCE in indoor air were less than the regional screening levels at every location.
- Concentrations for all VOCs in indoor air at the PRR building were less than the Occupational Safety and Health Administration's Permissible Exposure Limits (PELs).
- TCE concentrations in sub-slab soil vapor exceeded the regional screening level at all seven sub-slab sample locations.
- VOC concentrations other than TCE in the sub-slab soil vapor were less than the screening levels at all seven locations.

PRR increased ventilation to the building as an initial response to the indoor air results. Post-ventilation monitoring indicated ventilation reduced TCE concentrations in indoor air, but the concentrations have exceeded the regional screening level at certain locations during some sampling events. The post-ventilation indoor air results are presented in **Appendix L, Table 5**. A sub-slab depressurization system was installed in the summer of 2012 (see Section 1.3.3 and **Appendix J**).

1.2.2.3 Deep Aquifer Evaluation

The upper aquifer at this Site is underlain by an aquitard layer, and an upward hydraulic gradient generally crosses the aquitard. Due to the aquitard layer and the upward gradient, there is relatively little VOC impact in the lower aquifer. However, prior to 1984 the plant used groundwater wells completed in the lower aquifer for plant water supply and non-contact cooling water. Pumping from production wells likely caused some vertical VOC migration through the aquitard layer near the production wells. These historical impacts have decreased since 1984, but some impact remains in a small area at the OSSR. **Appendix L, Table 1** presents recent (October 2012) data for the deep aquifer.

The deep aquifer in the OSSR area was actively remediated with a deep purge well (the 500 gallons per minute (GPM) well) until 2007, when the well was shut down with USEPA agreement. The 500 GPM well was shut down because of concerns this deep purge well was "dragging" TCE down into the deeper aquifer (Mursch, 2008B). Subsequent monitoring data indicate the VOC concentrations in the deep aquifer are stable or declining (Mursch, 2011B, Mursch, 2013).

TCE concentrations exceeded the 5 ug/L MCL in monitor wells 06-17 and 06-18, which are the wells screened in the deep aquifer closest to the OSSR. The TCE concentration in 06-19, located near the PRR building's northeast corner, also exceeded the MCL. The 6.2 ug/L TCE concentration in 06-21, located in the Site's northwest part, was slightly above the MCL (Mursch, 2011B).

TCE and other VOCs have not been detected in monitor wells 02-01, 02-11, 06-22 and 83-19D in the deep aquifer directly down-gradient of the OSSR. **Figure 5** is a map showing concentrations in the deep aquifer monitor wells from the September 2011 monitoring event. **Figure 6** is a cross section which includes some deep aquifer wells.

1.2.3 Surface Water and Sediment

Down-gradient of the Site are surface waters including Pine Lake, the Pine Lake Drain, and the unnamed drain west of Louise Avenue. Shallow groundwater vents to these surface water features.

The surface water and sediments in the surface waters were investigated in 1984, 2001, 2002 and 2007. In addition, certain surface water seeps have been sampled on an ongoing basis as part of the Site's monitoring program.

The surface water samples obtained during the original 1984 assessment show surface water was impacted by VOCs. TCE concentrations in surface water ranged from less than 0.001 to 5,000 µg/l at that time. In the early 1980's, TCE was also detected in surface water samples in drains upstream of the Site at concentrations up to 130 µg/l (EDI Engineering and Science, 1984). TCE presence in surface water upstream of the PRR property indicates there were other TCE sources to these surface water bodies. Ongoing monitoring and recent sampling show the VOC concentrations in surface water have declined and are now all below Michigan Part 201 GSI criteria and generally below laboratory detection limits, except for an ephemeral surface water seep where the VC concentration slightly has exceeded the Michigan Part 201 GSI criterion (see Section 1.2.2.1).

Sediments were investigated by Secor (2002B). VOCs were not detected in sediments. Metals were detected above Ecological Screening Levels in Pine Lake sediments and one sample from Rudy Road Drain upstream of the PRR property. Since metals have not been detected in groundwater down-gradient of the PRR property at concentrations above Michigan Part 201 criteria, the metals in the Pine Lake and Rudy Road Drain sediments are naturally occurring or originate from another source (Mursch, 2006).

1.3 Interim Remedial Measures

Since the environmental issues were identified at the PRR property in the early 1980s, a series of interim remedial measures have been undertaken and completed. These include excavating and removing soil and installing and operating a groundwater pump-and-treat system, a SVE system, an AS system and SSDPSs at one residence and the PRR building.

Interim remedial measures have removed an estimated 225,890 pounds of TCE from groundwater and soil at the PRR property. **Figure 7** illustrates the pounds of TCE removed from soil and groundwater per day since the beginning of interim remedial measures in 1986 through the fall of 2012 (26 years). This figure includes TCE removed by the purge wells, the SVE system and the combined SVE/AS system at the PRR building; it does not include TCE removed by excavation or by AS to the northwest of PRR property. TCE was used in **Figure 7** because it is the major COPC and because other VOCs were not consistently included in the older analytical data. Other VOCs are present and were also removed by the interim remedial measures. The removal estimates are based on concentration and flow data for the purge wells and other interim remedial measures. Pumping ceased at some purge wells and other purge wells were added during this time.

Flux rates illustrated in **Figure 7** indicate remediation of the Site may be divided into five general phases:

Phase 1, 1986-1994. Only the purge wells were operating during this time. Initially the purge wells removed approximately 40 pounds per day TCE, decreasing to about 12 pounds per day in 1994. The wells down-gradient of the OSSR captured most of the TCE during this time. The other purge wells, which functioned more to control plume migration than to remove TCE, captured less TCE and the rates of capture decreased more rapidly than wells in or near the source areas.

Phase 2: 1995-1999. The SVE system was added in 1995 to remove TCE from soil under the PRR building. The flux of TCE removed increased significantly due to the SVE. This TCE was removed from the soil vapor before the TCE impacted groundwater, expediting overall cleanup of the Site. The SVE system became less efficient over time, and removal rates dropped from 55 pounds per day to approximately 10 pounds per day in the fall of 1999. The removal of TCE by the purge wells also decreased gradually from 12 to 6 pounds per day during this time. The purge wells down-gradient of the OSSR accounted for most of the TCE removed by the purge wells.

Phase 3: 2000-2008. An air sparge (AS) system was added under most of the PRR building to increase removal of TCE from soil and groundwater, and the rate of TCE collected by the SVE increased to approximately 93 pounds per day in the fall of 2000. The flux of TCE removal decreased to less than 0.5 pound per day by the fall of 2007, and the combined SVE/AS system was therefore shut down.

Phase 4: 2006 – 2012. Two new purge wells were installed to better contain TCE entering groundwater from the OSSR area. PW-13 was installed at the OSSR in 2006 and captured 2.8 pounds per day of TCE, which was 41% of the total flux capture at that time. PW-15 was installed in 2007 down-gradient of the OSSR to replace the 500 GPM well.

Phase 5: 2008 – 2012. The ABC+ enhanced reductive de-chlorination (ERD) interim remedial measure began in the fall of 2008 at the OSSR. ABC+ has been injected several times. PW-13 was shut down and used as a monitor well at this time since it would otherwise pump out the ABC+ being added to groundwater. The concentrations of TCE in the converted PW-13 decreased from approximately 1,500 ug/L to 10 ug/L during this time. PW-15, down-gradient of the OSSR, accounts for most of the TCE removed during this phase. In the summer of 2012 the SVE system was re-started to function as a long-term source reduction mechanism and a SSDPS.

The following sections provide additional information on interim remedial measures.

1.3.1 PRR Property Soil

The soil at the PRR property has been remediated by excavation and SVE.

1.3.1.1 Excavation at Former Oil and Solvent Storage Room (OSSR) and Old Borrow Pit (OBP) Area

Contaminated soil was excavated and removed from the PRR property at the OSSR and the OBP in the mid-1980s. The work was performed under a MDEQ approved work plan and under MDEQ's oversight.

In 1984, eight USTs which historically contained TCE, TCA, fuel oils and manufacturing oils were emptied and removed. The soil surrounding these tanks was excavated to a depth of approximately 16 feet and disposed off-Site. A total of 508 cubic yards of soil was removed from the 2,670 square foot area in the OSSR. The mass of TCE removed by the excavation is not known. The soil was manifested as hazardous waste, and was disposed at an off-Site facility. The excavation's extent was limited to protect the building's structure. The excavation was backfilled with clean soil and then covered with a concrete slab (Secor, 2002A). PRR was not able to locate any documentation regarding confirmation samples or the excavation limits; however, the approximate excavated area is shown on **Figure 2**.

Available soil data for the OSSR and associated risks were reviewed and compared to Michigan Part 201 cleanup criteria in Table 1 of the *Human Health Risk Assessment* (AECOM, 2009A) (see **Appendix C**). This impacted soil removal from the OSSR is an acceptable part of the proposed final remedy, because a significant amount of impacted soil was removed and the remaining COPC concentrations in the soil were less than the Michigan Part 201 Direct Contact cleanup criteria.

The *Ecological Risk Assessment* (AECOM, 2011) concluded that there were no ecological risks associated with remaining soil at the OSSR because there were no ecological exposures. The OSSR is inside the PRR building and the excavated area is under the building's floor.

In December 1984, soil at the OBP was excavated down to the groundwater surface and laterally until confirmation soil samples showed the soil with concentrations above MDEQ's direct contact criteria had been removed to the MDEQ's satisfaction. Approximately 4,826 cubic yards of material were excavated and disposed at an off-Site facility (Secor, 2002B). **Figure 2** shows the location and approximate excavation boundary. Following the soil removal, confirmation samples were taken from the OBP. Split samples analyzed showed remaining TCE and TCA concentrations up to 780 mg/kg. Re-sampling in January 1985 showed similar results with 170 to 520 mg/kg TCE levels. The pit was again sampled in July 1985, when analytical results showed TCE concentrations up to 3,900 mg/kg. Additional soil and groundwater investigations at the OBP occurred in 1990, 1995, 1996 and 1998. These investigations included installing soil borings, exploration trenches and monitor wells. Sampling from these investigations showed only relatively low TCE and other VOC concentrations remained. Recent sampling has also shown infrequent low SVOC concentrations, and generally background concentrations of metals, except for copper. The copper appears to be present due to furnace brick disposal in the area. The furnace brick has been addressed as required by the MDEQ and is summarized in the following section.

Available soil data for the OBP and associated risks were reviewed and compared to Michigan Part 201 cleanup criteria in Table 1 of the *Human Health Risk Assessment* (AECOM, 2009A). Removing this impacted soil from the OBP is an acceptable part of the proposed final remedy, because a significant amount of impacted soil was removed and the remaining COPC concentrations in the soil were less than the Michigan Part 201 Direct Contact cleanup criteria.

The *Ecological Risk Assessment* (AECOM, 2011) concluded that there were no ecological risks associated with remaining soil at the OBP because the area is within the industrial PRR property and of limited or no ecological concern.

1.3.1.2 Excavation at Furnace Brick Remediation Area (FBRA)

Used furnace brick was disposed before 1984 in the PRR property's north end next to the OBP. The furnace brick was derived from a copper melting oven, and had copper mixed in with it. The soil was screened, and accumulated bricks were removed in 1997 under a MDEQ approved work plan (Mursch, 1997). The furnace brick material retained on the screen was removed to an off-Site landfill. The total manifested furnace brick waste for the 1997 removal was 1,308 cubic yards. The mass of TCE removed by this excavation is not known.

After removing the brick, the area was sampled in accordance with the Michigan's verification of soil remediation (VSR) procedures in use at that time (MDNR, 1994). Following this work, the exposed natural soil and the material passing the screen were sampled and analyzed for copper. In the 32 samples analyzed, the copper content ranged from 5,500 to 19,000,000 ug/Kg compared to the current 73,000,000 ug/Kg industrial direct contact criterion and the 20,000,000 ug/Kg residential direct contact criterion. The VSR sampling demonstrated the area had been remediated to the Site-specific criteria established by MDEQ (Mursch, 2005). The area was then graded, covered with topsoil and seeded.

Available soil data for the FBRA and associated risks were reviewed and compared to cleanup Michigan Part 201 criteria in Table 1 of the *Human Health Risk Assessment* (AECOM, 2009A). (This table is also in **Appendix L, Table 3A**.) Removing this impacted soil from the FBRA is an acceptable part of the proposed final remedy, because a significant amount of impacted soil was removed and the remaining COPC concentrations in the soil were less than the Michigan Part 201 Direct Contact cleanup criteria.

As required by the MDEQ, PRR monitored the groundwater underneath the FBRA to verify copper in the soil had not impacted groundwater. No copper was detected in groundwater near the FBRA during this monitoring program.

The *Ecological Risk Assessment* (AECOM, 2011) concluded that there were no ecological risks associated with remaining soil at the FBRA because the area is within the industrial PRR property, which is of limited or no ecological concern, and because the FBRA was covered with clean soil following excavation.

1.3.1.3 Soil Vapor Extraction (SVE)

In 1994, the plant installed a SVE system to remove residual VOCs from the soil beneath the plant building. The system was designed on the basis of a Site-wide soil vapor study and a full-scale pilot test. Nine SVE wells were installed at locations selected based on the soil vapor study. The system operated at a total air flow rate on the order of 1,000 cubic feet per minute, and the air was directed through carbon adsorption beds where the VOCs were captured. The carbon beds were steam-stripped at regular intervals, and the recovered solvent was drummed for off-Site disposal.

In 1998, the SVE system was expanded by adding 13 additional SVE wells in conjunction with installing an AS system for remediating the groundwater. By this time, testing showed the SVE system had greatly reduced VOC levels in the soil, and the system's purpose changed from remediating the soil to capturing air and VOC vapors migrating into the vadose zone as a result of the groundwater sparging. In 2008, supplemental soil sampling indicated no further soil remediation was required, and the SVE system was shut down after appropriate notice to the USEPA and MDEQ (*Report of Supplemental Soil Assessment,* (SSA) Mursch, 2008A).

The SSA's objective was to determine whether additional PRR property non-residential soil remediation would be required. The review began by compiling historical soil data, and evaluating possible remaining soil impact areas. This evaluation also included reviewing historical soil gas data obtained through the plant's SVE system from the system's inception through June of 2008. As discussed in the SSA, the soil gas data showed TCE concentrations in the soil had declined significantly. In 1995, shortly after SVE began, the system recovered approximately 55 pounds per day TCE. By late 2007 the extraction rate had declined to generally less than 0.5 pounds per day (**Figure 7**), with most of the individual soil gas samples having no TCE above the laboratory detection limits. Based on the measured TCE extraction rates, the SVE/AS system removed approximately 101,500 pounds of TCE from the soil and groundwater.

The SSA included a comparison of the SSA soil data to the Michigan Part 201 generic GSI protection criteria. The highest TCE concentration reported in the 10 samples was 420 µg/kg (micrograms per kilogram), less than the 4,000 µg/kg Michigan Part 201 GSI protection criterion. The highest TCE concentration reported in the historical soil data (not including data from soil subsequently excavated and removed from the Site) was 9,500,000 µg/kg. This location inside the OSSR was re-sampled as part of the SSA, and a 110 µg/kg TCE concentration was obtained. This comparison illustrates the successful TCE reduction in the unsaturated soil at the PRR property through the SVE remediation efforts.

Sub-slab and indoor air sampling in the PRR building in March 2012 detected TCE concentrations that exceeded the USEPA's regional screening levels for industrial buildings (AECOM, 2012B). During the summer of 2012, the SVE wells were converted to a sub-slab depressurization system (SSDPS) in response to these TCE concentrations. A new blower was installed and the vapor is discharged through the existing permitted air emission stack, which is part of the air stripping tower used to treat groundwater. The purpose of the SSDPS is to maintain a null pressure gradient or vacuum under the building slab. Conversion of the SVE wells and operation of the SSDPS is described in **Appendix J**. As of December, 2012, concentrations in indoor air at the PRR building were less than regional screening levels for industrial buildings at all monitored locations (Mursch, 2013). Some additional wells for depressurization were installed in January, 2013 at the request of the USEPA.

1.3.2 Groundwater

The Site has engaged in extensive groundwater remediation for VOC impacts since 1985. The remediation has included a system with purge wells and AS, and PRR recently investigated and piloted using enhanced bioremediation. A Restrictive Covenant for the PRR property is also in place to prevent use of groundwater for drinking water (see Section 1.1 and **Appendix B**).

1.3.2.1 Purge Wells and Groundwater Treatment

In 1985, a 12 purge well system was installed and operated to capture and remediate groundwater, and this system is still operating. The purge wells are located near the source areas and along the forward edge of the impacted groundwater to protect surface water bodies. The recovered groundwater is pumped to an air stripper. The air stripper removes VOCs from the water, which is then discharged to Rudy Road drain, which drains into Pine Lake. VOCs removed from the groundwater in the air stripper are captured in carbon vapor adsorption beds. The discharges to surface water and to air are covered by appropriate State permits.

In 1996 and 1997, the purge well system's effectiveness was evaluated and reviewed to determine whether changes in the system might be appropriate. The monitoring data showed the VOC extent and concentrations in the groundwater had been greatly reduced. Based on this evaluation, one purge well (PW), PW-11 was closed and a new purge well PW-12 was installed with prior notification and approval by MDEQ.

The purge well system was again evaluated in 2006 and 2007. VOC concentrations in the groundwater near the surface water interface had generally been reduced to below MDEQ criteria for venting to surface water (Michigan Part 201 GSI criteria), but TCE concentrations remained above the GSI criteria in some areas. The system was modified by closing down purge wells PW-4, PW-6, PW-7 and the deep purge well referred to as the 500 GPM well. These were replaced by new purge wells PW-13, PW-14, PW-15 and PW-16, which were positioned to more effectively address the areas with VOC concentrations still above the Michigan Part 201 GSI criteria. In conjunction with the new wells, the old purge wells PW-8, PW-9 and PW-10 were upgraded with new pump motors to increase their effective pumping rates. These modifications were performed after notification and approval by the USEPA and MDEQ.

The following table summarizes typical groundwater extraction rates for the purge wells in operation. Purge well locations are shown on **Figure 4**. These purge wells are all screened in the upper water table aquifer in the upper sand unit.

Groundwater Purge Well	GPM (ft^3/day)	Screen Interval
PW-1	147 (28,299)	Upper Sand Unit
PW-5	71 (13,668)	Upper Sand Unit
PW-8	212 (40,813)	Upper Sand Unit
PW-9	192 (36,963)	Upper Sand Unit
PW-10	137 (26,374)	Upper Sand Unit
PW-12	63 (12,128)	Upper Sand Unit
PW-14	96 (18,481)	Upper Sand Unit
PW-15	285 (54,866)	Upper Sand Unit
PW-16	45 (8,663)	Upper Sand Unit

Figure 4 shows the September 2011 groundwater concentrations at various monitoring and purge wells.

The *Fourth Quarter 2012 Monitoring Report* (Mursch, 2013) presents graphs with trends in TCE concentrations over time for 59 monitor and purge wells. TCE concentrations in most wells clearly decrease over time.

Approximately 124,565 pounds of TCE has been removed from groundwater by the purge wells since the purge system started, based on purge well flow and concentration data. The pump and treat system is an acceptable part of the proposed final remedy because a significant amount of TCE was removed from impacted groundwater, expansion of the contamination is controlled and discharge of groundwater with COPC concentrations higher than Michigan Part 201 GSI criteria to surface water is mitigated.

The USEPA agreed to trial shut-down of PW-1 and PW-9 based on the *Fourth Quarter 2012 Monitoring Report* (Mursch, 2013), and requested monthly monitoring of the GSI compliance wells associated with these purge wells. PW-1 and PW-9 were shut down and monthly monitoring of these GSI compliance wells began in January 2013.

1.3.2.2 Air Sparge (AS)

As part of the remediation system review in 1996 and 1997, PRR evaluated the feasibility of using AS technology to expedite the groundwater remediation. Pilot tests were performed at the OSSR in the main plant and at an area near the northwestern edge of the groundwater impacts. Based on these tests, two AS systems were installed in 1998 and 2000.

The first AS system was installed under the plant and included 15 air injection wells. This AS system was coupled with 13 additional SVE wells (described above) to enhance capturing VOCs migrating from the groundwater into the soil vadose zone as a result of the air sparging. A second AS system with 10 air injection wells was installed at the northwestern part of the groundwater impact area. The AS and SVE well locations are shown on **Figure 2**.

The AS systems were intended to reduce the VOC concentrations in the groundwater located in the upper 15 to 20 feet of the shallow aquifer to meet the Michigan Part 201 GSI criteria. PRR reviewed the AS systems in 2008 during PRR's supplemental soil sampling review (discussed in Section 1.3.1.3 above), along with reviewing the SVE systems. It was determined the systems had substantially reduced VOC concentrations and were no longer efficient due to decreased recovery rates. Subsequently the systems were therefore shut down after appropriate notice to the USEPA and MDEQ. Approximately 101,500 pounds of TCE was removed from soil and groundwater by the combination of SVE and AS. This estimate applies to the SVE/AS system at the PRR building and does not include TCE removed by the off-Site AS operated to the northwest of the PRR property since monitoring data are not available for that area. AS is an acceptable part of the proposed final remedy because a significant amount of TCE was removed from impacted groundwater.

1.3.2.3 Enhanced Reductive De-chlorination (ERD) Pilot Study

Although the purge and sparge systems were effective at reducing VOC concentrations through the impacted groundwater, there remain some areas with VOC concentrations above Michigan Part 201 GSI criteria. These are isolated pockets which have proved difficult to remediate with the purge and sparge technologies. Therefore, PRR investigated applying injection technologies to further reduce VOC concentrations in these areas. In 2008, PRR performed Phase I of the ABC®+ pilot test injection, a proprietary formula with fatty acids, lactates and ZVI. The formula is designed to cause rapid de-chlorination of TCE and other chlorinated VOCs through direct contact with powdered iron, and then to promote long-term reduction of these remaining compounds' concentrations by stimulated anaerobic biological activity. The pilot test performance was satisfactory, and this technology is feasible for this Site. A follow-up supplemental injection was completed in July 2009 to address a limited area. Phase I pilot test results confirmed the ABC®+ technology was effective and safe. In the fall of 2010, PRR performed a Phase II pilot test to evaluate injection rates and doses needed for full-scale application. The findings from the two ERD pilot test phases are summarized in the *Report of* ABC®+ *Pilot Test*, (Mursch, 2011A), which is included as **Appendix D**. The USEPA has approved additional injections of ABC®+ for 2013 at the OSSR as further pilot testing of this interim remedial action.

1.3.3 Indoor Air

Following residential (off-PRR property) near-slab, sub-slab, and indoor air investigations, one property was found with indoor air concentrations exceeding USEPA's screening level for residential properties (AECOM, 2009B). A SSDPS was installed at this location (401 Louise) in August 2009 to address VOC concentrations in indoor air. Post SSDPS installation sampling at 401 Louise was completed in September 2009 and summarized in the *Indoor Air and Sub-Slab Sampling Summary Report for 401 Louise Street* (AECOM, February 2010) and in Section 1.2.2.2 of this report. This potential residential exposure pathway has thus been eliminated. The indoor air and sub-slab soil vapor data for the residential properties are in **Appendix L, Table 4**.

Indoor air and sub-slab samples from the PRR building were collected in March 2012, in accordance with an approved work plan (*Indoor Air and Sub-Slab Soil Gas Sampling Work Plan for PRR Building*, AECOM, March 2012). These results are in AECOM, 2012B. TCE concentrations inside the PRR building exceeded USEPA's regional screening levels in March, 2012. Increased ventilation in the building reduced the TCE concentrations in indoor air, and the SVE system was converted into a SSDPS control migration of sub-slab soil vapors into the PRR building (see **Appendix J**). Cracks and other penetrations of the floor of the building that could allow TCE to enter the building from sub-slab soil are being patched or plugged on an on-going basis. Indoor air monitoring is done monthly (see **Appendix J**). As of December 2012, VOC concentrations in indoor air at the PRR building were less than regional screening levels for industrial buildings at all monitored locations (Mursch, 2013). The indoor air pathway at the PRR building is potentially complete, but is currently mitigated.

The *Sub-Slab Depressurization System Operation and Monitoring Plan* (**Appendix J**) provides additional information on the SSDPS at the PRR building.

SSDPS is an acceptable part of the proposed final remedy because it addresses potential exposure of people to COPCs in indoor air.

1.4 Conclusions from the Human Health Risk Assessment & Screening Level Ecological Risk Assessment

The following sections present the conclusions from the *Human Health Risk Assessment* (AECOM, 2009A) and the *Ecological Risk Assessment* (AECOM, 2011), supplemented with more recent data and evaluations.

1.4.1 Human Health Risk Assessment

A *Human Health Risk Assessment* (AECOM, 2009A) was completed in September 2009. The *Human Health Risk Assessment* evaluated risks associated with soil, groundwater and surface water. The *Human Health Risk Assessment* (AECOM, 2009A) did not evaluate indoor air at residences or the PRR building, because data were not available when the *Human Health Risk Assessment* was completed. Potential risk associated with vapor intrusion and indoor air was evaluated after the HHRA was completed and is included in this section of the CMP.

Risks associated with current uses of soil, groundwater and surface water are acceptable. For all exposure pathways/routes evaluated, the *Human Health Risk Assessment* documented the pathways were either not complete or the concentrations at the exposure point are less than applicable risk-based Michigan Part 201 criteria.

Risks associated with exposure to residential indoor air were found to be potentially unacceptable at one house based on monitoring completed after the HHRA. A SSDPS was installed at that house. Subsequent indoor air monitoring at the house confirmed that the risks associated with indoor air are now acceptable.

Risks associated with exposure to industrial indoor air at the PRR building were found to be potentially unacceptable based on monitoring completed after the HHRA. A SSDPS/SVE system was installed at the building and ventilation of the building was increased to mitigate exposure to chemicals in the PRR building's air. These measures have reduced concentrations of COPCs in indoor air, but the potential risks are still not in the acceptable range and mitigation is continuing.

Some presently incomplete exposure pathway/routes for human health risk assessment are <u>potentially</u> complete if certain activities such as installing water supply wells or excavating soil were to occur. There is no known use of impacted groundwater for drinking water purposes. Institutional controls are in place to address some potentially complete exposure routes. A Restrictive Covenant (**Appendix B**) is in place to prevent using groundwater on the PRR property for drinking water purposes. Local City Ordinance (Dowagiac City Zoning Ordinance, Section 2.20) requires new construction to be served by the public water supply or for the water supply to be approved by the County Health Department. There are presently no specific restrictions on using groundwater outside the City (see **Figure 1** for City limits).

The following exposure routes/pathways are potentially complete. Some potentially complete pathways are based on COPC concentrations exceeding Michigan Part 201 criteria at a limited number of samples collected from 20 feet or more under the PRR building, so actual human exposures are very unlikely.

1. **Soil protection for groundwater:** Certain soil samples, primarily under the PRR building and at the former FBRA and OBP areas, contained COPCs at concentrations exceeding the Michigan Part 201 residential groundwater protection criteria for soil. This exposure route is not currently complete, because impacted groundwater is not used for drinking water. Metals have not been detected in down-gradient wells above Michigan Part 201 criteria, indicating the metals in soil are not impacting groundwater.

2. **Residential ingestion of groundwater outside of the PRR property:** COPC concentrations in groundwater exceed Michigan Part 201 drinking water criteria and Maximum Contaminant Levels. Impacted groundwater is not used for drinking water, so this exposure pathway/route is not complete. Using impacted groundwater for drinking water is unlikely, but is a potentially complete exposure pathway outside the PRR property and beyond City limits. The risks associated with ingestion of groundwater are currently acceptable because there is no complete exposure pathway,

3. **Residential groundwater ingestion on the PRR property:** A Restrictive Covenant is in place to prohibit residential use and prevent groundwater use on the PRR property for drinking water. The Restrictive Covenant is in **Appendix B**. The risks associated with ingestion of groundwater are acceptable because there is no complete exposure pathway.

4. **Groundwater dermal contact (residential and non-residential):** COPC concentrations were less than Michigan Part 201 residential and non-residential groundwater dermal contact criteria in all wells included in the third quarter 2011 monitoring event (Mursch, 2011B). Vinyl chloride concentrations exceeded the groundwater dermal contact criterion in the third quarter of 2012 in two wells on the PRR property where ABC+ was injected for the enhanced reductive dechlorination pilot study (see **Appendix L, Table 1** and Section 1.3.2.3). This exposure pathway/route is incomplete because groundwater from these wells is not used and there is no exposure. The risks associated with groundwater dermal contact are therefore acceptable.

5. **Soil direct contact:** One sample (02-254) under the PRR building had an arsenic concentration slightly exceeding the non-residential criterion for direct soil contact. The upper 95% confidence limit of the mean arsenic concentration in this area was less than the direct soil contact criterion. This exposure pathway/route is presently incomplete, because the upper 95% confidence limit of the mean arsenic concentration in this area was less than the direct soil contact criterion and because the location of the single concentration that exceeded the criterion is under the building and not normally accessible. The risks associated with direct contact with soil are acceptable.

6. **Surface water ingestion and direct contact:** Concentrations in the surface water were less than the Michigan Part 201 GSI criteria except at SP-5. The VC concentration at SP-5 collected in 2002 was 17 ug/L, slightly more than the 15 ug/L MDEQ GSI criterion in effect at that time. SP-5 was re-sampled in September 2009, and the VC concentration was 15 ug/L (Mursch, 2009), but the GSI criterion was subsequently changed by MDEQ to 13 ug/L. SP-5 was sampled again in February and March 2012, and the VC concentrations were 19 and 21 ug/L, respectively. Surface water is not always present at SP-5 and when present forms a small puddle. The GSI criterion is based on human exposure by partial body contact activities such as swimming, which are not possible at SP-5. SP-5 is also difficult to access. This exposure pathway/route is not complete due to the small size, intermittent presence and seep location. The risks associated with surface water ingestion and direct contact are acceptable.

1.4.1.1 Non-Drinking Water Groundwater Use

The *Human Health Risk Assessment* also evaluated potential human health risks associated with using groundwater for aquaculture at a nearby residence. The groundwater is used for rearing bait minnows. The estimated COPC concentrations in indoor air were less than USEPA regional screening levels of COPCs for residential indoor air (2.1 ug/m^3, USEPA, 2012). Using groundwater for raising bait minnows is not predicted to result in unacceptable risks to human health. (These results are presented in Section 2.4.5 and Appendix C of *Human Health Risk Assessment and Screening Level Ecological Risk Assessment*, AECOM, 2009A.)

The USEPA requested an additional evaluation regarding the impact of using groundwater for flushing toilets and washing. The same model was used to evaluate impacts on indoor air associated with using groundwater for flushing and washing as was used for evaluating aquaculture impacts on indoor air. Input parameters were changed to reflect domestic groundwater use for toilets and wash water. This model, input parameters, and results are presented in **Appendix G**. The estimated COPC concentrations in indoor air associated with using groundwater for flushing toilets and washing were less than USEPA regional screening levels for COPCs in indoor residential air (USEPA, 2012). Using groundwater for flushing toilets and washing is not predicted to result in unacceptable risks to human health.

1.4.1.2 Indoor Air

Indoor air at residences and in the PRR Building was sampled and evaluated after the *Human Health Risk Assessment* (AECOM, 2009A) was completed.

The residential indoor air sampling results are in AECOM, 2009B. A SSDPS was installed at one residence in the summer of 2009 to address indoor air at a concentration greater than the regional residential screening level for TCE in indoor air (2.1 ug/m^3, see **Table 2B**), so this previous exposure pathway is not complete and the risks are acceptable. All of the residential indoor air and sub-slab soil vapor data are in **Appendix L, Table 4**.

Indoor air and sub-slab samples from the PRR building were collected in March, 2012, in accordance with an approved work plan (*Indoor Air and Sub-Slab Soil Gas Sampling Work Plan for PRR Building*, AECOM, March 2012). These results are in AECOM, 2012B. TCE concentrations inside the PRR building exceeded USEPA's regional screening levels for industrial buildings in March 2012. Increased ventilation in the building reduced the TCE concentrations in indoor air, and the SVE system was converted into a SSDPS/SVE to further reduce indoor air concentrations (see **Appendix J**). Indoor air monitoring is done monthly (**see Appendix E**). Concentrations of COPCs (TCE) have decreased in the PRR building, but still exceed regional screening levels and are therefore not acceptable. Mitigation of these exposures and associated risks is on-going.

1.4.2 Screening Level Ecological Risk Assessment

Ecological risks were evaluated in the ERA (AECOM, 2011). For all exposure pathways/routes for ecological receptors, the pathways were identified as being currently incomplete or COPC concentrations are less than ecological screening levels (AECOM, 2011). Therefore, ecological risks are within acceptable ranges.

The ERA uses approaches and criteria deliberately intended to ensure risk is conservatively evaluated. The uncertainty inherent in the ERA suggests the risk of adverse effects to potentially exposed ecological receptors is overestimated. Future risks are likely to be less than current risks as concentrations in groundwater continue to decrease.

The ERA made these conclusions.

1. The ERA included a step to refine screening of existing data and concludes ecological risk to biota resident in water bodies and wetlands north and west of the Site is acceptable.

2. In the wetlands/fens north of the Site and in the lake and associated drains there is no unacceptable ecological risk from impacted groundwater discharge. Higher TCE concentrations present in deeper surface aquifer layers are overlain by groundwater with lower concentrations, and the higher TCE concentrations are not discharging to surface water bodies or wetlands.

3. Unacceptable risk from surface water exposures to TCE (in the unnamed drain) and mercury (in Pine Lake) is not present based on the toxicity evaluation conducted in the ERA.

4. No organic chemicals were detected in the lake sediment with concentrations above the threshold effects levels. Metals concentrations observed in the sediment are not attributed to any impact from the Site.

5. Sensitive receptors including amphibians and Mitchell's satyr butterfly are protected by using the screening values presented in the ERA including exposure to venting groundwater, surface water in wetlands and water bodies, and exposure to soil in the butterfly's primary conservation zone.

SP-5, a seep where groundwater may vent to surface water, was re-sampled after the ERA was completed. TCE concentrations in SP-5 exceeded GSI criteria based on human health, but were less than criteria based on protecting aquatic life. No ecological impacts are expected at SP-5, because the TCE concentrations are less than criteria based on protecting aquatic life.

2.0 CORRECTIVE MEASURES GOALS

This section presents the corrective measures goals for the groundwater, surface water, soil and indoor air associated with the Site and for soil at the PRR property. The final goals are developed to protect human health and the environment.

Several types of goals are applied to different locations, media and purposes:

- Interim corrective measure goals for groundwater;
- Residential and Industrial soil gas trigger concentrations for monitoring indoor air;
- Final corrective measure goals for groundwater;
- Final corrective measure goals for surface water;
- Final corrective measure goals for soil; and
- Final corrective measure goals for indoor air.

Sediment impacts are minor compared with criteria, and there is no evidence they are related to the Site (see **Appendix H)**. No corrective measure goals are proposed for sediments.

The locations, media and purposes of these goals are identified in the following sections.

2.1 Interim Corrective Measure Goals for Groundwater

The interim corrective measure goals for groundwater are presented in **Table 2A**. The interim goals recognize groundwater discharges to surface water, but no groundwater is used at the Site for drinking water. The interim corrective measure goals are the state of Michigan's Water Quality Values/Part 201 GSI Protection criteria. These interim corrective measure goals for groundwater also protect groundwater used for raising minnows (AECOM, 2009A), ecological resources (AECOM, 2011), and potential exposure of people by inhalation of COPCs released to air by toilet flushing and washing (**Appendix G**).

The interim groundwater goals apply at wells along the GSI. These wells are identified in the *2012 Corrective Action Monitoring Plan* (CAMP) in **Appendix E.** The interim goals will be used to determine if purge wells may be turned off. The GSI wells associated with each purge well and the plan for turning off the purge wells are in **Appendix F**.

2.2 Residential and Industrial Soil Gas Trigger Concentrations for Monitoring Indoor Air

Screening for residential volatilization to indoor air (VIA) will be conducted pursuant to Section 3.3 of the CAMP (**Appendix E**) and results compared to the residential soil gas screening levels in **Table 2B.** Indoor air for the industrial PRR building will be monitored per the SSPDS Operation and Maintenance Plan (**Appendix J**). Those PRR building results will be compared to **Table 2B's** industrial soil gas screening numbers to determine whether additional actions are needed.

2.3 Final Corrective Measure Goals for Groundwater

The final corrective measure goals for groundwater will be Federal drinking water Maximum Contaminant Levels (MCLs) or such other appropriate criteria based on risk or background concentrations for naturally-occurring substances that may be developed in conjunction with USEPA/MDEQ periodic Site reviews, considering numerous factors including groundwater monitoring data, technical feasibility for achieving the proposed goals, relevant potential exposure pathways, criteria applicable at closure, and the availability and applicability of effective institutional controls to all or portions of the Site. The final goals will apply to Site wells on and off the PRR property.

2.4 Final Corrective Measure Goals for Surface Water

The final corrective measure goals for surface water may include the Michigan Part 31 water quality values, which are developed by the state under the Federal Clean Water Act authority or other criteria applicable at the time closure. The water quality values are the same as the GSI criteria. The water quality values protect aquatic life (chronic toxicity), wildlife and human health associated with partial body contact recreational activities. The final goals may be modified in conjunction with USEPA/MDEQ periodic Site reviews, considering numerous factors including surface water monitoring data, technical feasibility of achieving the proposed goals, relevant exposure pathways, values/criteria applicable at closure, and the availability and applicability of effective institutional controls to all or portions of the Site.

These water quality values/GSI criteria for surface water apply where exposures consistent with developing the values/criteria could occur.

2.5 Final Corrective Measure Goals for Soil

The final corrective measure goals for soil may include the Michigan Part 201 non-residential (industrial) volatile soil inhalation for ambient air, particulate soil inhalation criteria, direct contact criteria, criteria based on risk, criteria based on background concentrations for naturally occurring substances, and other appropriate criteria that may become available. The final goals may be modified in conjunction with USEPA/MDEQ periodic Site reviews, considering numerous factors including available soil data, technical feasibility of achieving the proposed goals, relevant potential exposure pathways, criteria applicable at closure, and the availability and applicability of effective institutional controls to all or portions of the Site.

Soil impacts were limited to soil on the PRR property where soils have been remediated. A Restrictive Covenant (**Appendix B**) and some exposure barriers are in place. The final corrective measure goals for soil apply to locations lacking exposure controls where exposures could occur. Exposure to soil will not occur at a single point, so it is appropriate to use estimates of average concentrations for an exposure area.

Corrective measures goals for soil on the PRR property based only on protecting ecological resources are not proposed, because the PRR property is zoned for and restricted to industrial use and the habitat quality is low. Furthermore, the impacted soils are generally covered with pavement, building slab or clean soil.

2.6 Final Corrective Measure Goals for Indoor Air and Sub-Slab Soil Vapor

2.6.1 Indoor Air

There are separate final corrective measure goals for indoor air for the residential properties and for the industrial PRR building. These goals apply to indoor air in portions of the buildings or residences occupied on a routine basis. For both the residential properties and the PRR building, the final goals may be the respective USEPA Regional Screening Levels (USEPA, 2012) (RSLs) listed in **Table 2B** or such other appropriate criteria that may be developed in conjunction with USEPA/MDEQ periodic Site reviews, considering numerous factors including available air data, technical feasibility of achieving the proposed goals, relevant potential exposure pathways, criteria applicable at closure, and the availability and applicability of effective institutional controls to all or portions of the Site.

The Michigan Occupational Health Standards shown in **Table 2B** are recognized as final cleanup goals by the MDEQ for certain qualifying industrial buildings, but are not accepted currently as remedial goals by the USEPA.

2.6.2 Sub-Slab Soil Vapor

Table 2B presents separate final corrective measure goals for sub-slab soil vapor for the residential properties and for the industrial PRR building. These goals apply to sub-slab soil vapor under portions of the buildings or residences occupied on a routine basis. These goals must be met for four consecutive quarters. For both the residential properties and the PRR building, the final sub-slab soil vapor goals may be the respective USEPA Regional Screening Levels (USEPA, 2012) (RSLs) listed in **Table 2B** divided by an attenuation factor of 0.03, or such other appropriate criteria or attenuation factor that may be developed in conjunction with USEPA/MDEQ periodic Site reviews, considering numerous factors including available air data, technical feasibility of achieving the proposed goals, relevant potential exposure pathways, criteria applicable at closure, and the availability and applicability of effective institutional controls to all or portions of the Site.

3.0 CORRECTIVE MEASURES OPTIONS

This CMP considers a no action option, institutional controls, and four engineered controls that can be applied to the Site. The four engineered controls are MNA, groundwater pump-and-treat, SSDPS, and ERD. Evaluating these controls includes a feasibility screening to assess the applicability and compatibility of the technology with Site and chemical characteristics. A particular technology or combination of technologies is retained for further evaluation if it can be used effectively to meet this CMP's goals. By properly applying these corrective measures, the risk associated with the COPCs at the Site can effectively be managed to meet CMP objectives, which include protecting human health and the environment.

This section provides general descriptions of corrective measures options. Please see Section 1.3 for descriptions of interim remedial measures that have been and are being implemented.

3.1 Corrective Measures Technology Screen

To determine the best corrective measures for the Site, this CMP evaluated several technologies and screened them against Site, chemical, and technology specific constraints. Each corrective measure screened in this CMP is summarized in the sub-sections below.

The Site characteristics considered during the technology screen were used to determine the applicability of the various technologies and include, but are not limited to, soil type, Site location, groundwater flow direction, depth to groundwater, groundwater discharge to surface water, and surrounding topography.

The COPC characteristics considered include the physical and chemical properties unique to the COPCs identified at the Site. The primary COPC at the Site is TCE in soil at the property and dissolved in the groundwater. TCE degradation compounds, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, 1,1-DCE and VC are also present. In addition to TCE and TCE degradation compounds, TCA and 1,1-dichloroethane are present in groundwater.

Known limitations of the various technologies were considered during the technology screen. The limitation types considered include system performance, operational history, expected remediation time, technology development and inherent construction, operation and maintenance (O&M).

3.1.1 No Action

The no action option would involve shutting down all treatment operations and ceasing all monitoring activities at the Site. This option would allow the natural groundwater flow pattern to re-establish, and migration of dissolved phase COPCs from the PRR property would be likely. The no-action option provides a baseline against which other options can be evaluated.

3.1.2 Institutional Controls

Institutional controls include legal deed restrictions or restrictive covenants, zoning ordinances and other methods to prevent or reduce exposure to areas that may result in risks for human health and the environment.

Deed restrictions in general are land and water use restrictions filed with the registrar of deeds for the local governing body. These restrictions can provide a means to make the current and future property owners aware of impacts present at the property and in the soil and groundwater. The restriction may, for example, indicate no water well will be installed on the property for consumption or irrigation purposes. Another example would include notifying the property has been used for industrial purposes, and contaminated soil may exist below grade; therefore, excavation restrictions and precautions are required.

Institutional controls alone will not prevent contaminated groundwater from migrating from the PRR property. However, institutional controls can effectively be used in conjunction with other options to meet the corrective measure goals. Therefore, using institutional controls as a corrective measure will be retained for further evaluation along with other treatment technologies. As described in Section 1.1, an existing Restrictive Covenant (provided in **Appendix B**) for the PRR property limits future uses to industrial, warehouse and commercial purposes, restricts groundwater extraction and surface water use, protects remediation activities and associated structures and equipment from interference (including, but not limited to SSDPS/SVE), and requires vapor intrusion protection for new structures.

Local ordinances may also be used in a manner similar to deed restrictions to limit exposures and risks to human health. For example, some communities (like Dowagiac) enact ordinances that require drinking water to be supplied by the community water system and regulate well installations to supply water.

For properties outside the limits of the City of Dowagiac and are not governed by any ordinance restricting groundwater use, individual deed restrictions can be placed on the properties to limit the use of groundwater and thereby protect against exposure to that medium.

3.1.3 Engineered Controls

Engineered controls include providing human or ecological exposure protection and remediation technologies that can be applied to the Site to physically and/or chemically treat the groundwater and soil.

3.1.3.1 Monitored Natural Attenuation (MNA)

MNA monitors naturally occurring processes that decrease COPC concentrations. Biodegradation is defined as materials degrading by biological processes, and may be the dominant attenuation mechanism at many sites. MNA also includes the non-biological processes of dilution, dispersion, adsorption and chemical transformation.

MNA differs from “no action” by including a pro-active groundwater monitoring program based on sound science and careful examination of hydrogeology, groundwater geochemistry, chemical mass and chemistry, and impacted groundwater plume stability.

The MNA feasibility considers the following evaluation factors:

- Time to attain final goals compared to no action and active remediation;
- Proximity of COPCs to nearest receptor;
- Stability of impacted groundwater area (will area of contamination expand?);
- Presence of non-aqueous phase liquids; and
- Presence of other sources or source controls.

The MNA option would require a carefully developed Site-specific groundwater monitoring plan. Developing a MNA plan at the Site would follow USEPA’s *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* (USEPA, 1998). The following are some important factors for a MNA monitoring plan:

- Presence of degradation daughter products;
- Concentration of TCE and daughter products over time;
- Geological characterization;
- Contaminant area morphology/stability; and
- Geochemistry.

MNA would not be effective to immediately stabilize contaminated groundwater migration from the PRR property; therefore, it would be best if paired with another source treatment and/or transport control option.

3.1.3.2 Groundwater Pump-and-Treat

Groundwater pump-and-treat system objectives are to remove contaminated groundwater and prevent further impacted groundwater migration. The extracted groundwater will pass through a treatment system, such as granular activated carbon (GAC) or an air stripper, where the COPCs are removed from the purged groundwater prior to discharge. Treated groundwater may be discharged to a nearby storm sewer, Publicly Owned Treatment Works, surface water or groundwater pursuant to an appropriate discharge permit.

A pump-and-treat system has been in place at the Site since 1984, and has been maintaining hydraulic control of the contaminated groundwater (see Section 1.3.2.1). The current system has nine extraction wells. The system captures approximately 1,800,000 gallons of groundwater per day. The extracted groundwater then passes through an air stripper for treatment. The treated groundwater is discharged to Pine Lake Drain pursuant to a National Pollutant Discharge Elimination System (NPDES) permit.

A groundwater pump-and-treat system is effective at stabilizing contaminated groundwater migration; however, the treatment time is indefinite and may be long until corrective measure goals for groundwater are achieved. Pump-and-treat systems are expensive to operate and require careful maintenance. Implementation of another treatment alternative while continuing to operate the pump-and-treat system could help reduce the overall time required to reach goals.

3.1.3.3 Enhanced Reductive De-chlorination (ERD)

ERD involves adding a nutrient supplement to the groundwater to enhance COPC degradation. Chlorinated VOCs such as TCE, biologically degrade via anaerobic degradation. Many common organic groundwater COPCs can be treated in place by enhanced anaerobic processes. These COPCs include chlorinated solvents like TCE. Anaerobic biodegradation uses hydrogen to chemically reduce the COPCs (replaces a chlorine atom with hydrogen on a chlorinated solvent molecule). Therefore, the process is referred to as “reductive de-chlorination.”

Redox Tech, LLC has developed a proprietary formula to promote anaerobic biodegradation of halogenated solvents in groundwater. The product, ABC®+, is a patented mixture with lactates, fatty acids, a phosphate buffer and ZVI. A pilot study using ABC®+ was performed at the Site, and has proven to be effective at reducing TCE concentrations in the groundwater (see Section 1.3.2.3). Since the pilot test using ABC®+ was proven to be effective, implementing a full-scale ERD option will be considered further in this CMP. The *Report of ABC®+ Pilot Test* (Mursch, 2011A) summarizes the pilot test results, and is provided as **Appendix D**.

ERD includes bio-augmentation (addition of appropriate bacteria) on an as-needed basis depending on monitoring results.

3.1.3.4 Sub-Slab Depressurization System (SSDPS)

A SSDPS vapor mitigation system addresses the risk associated with soil vapor intrusion to indoor air. A SSDPS uses a vapor collection system to capture vapors emanating from contaminated subsurface environmental media before entering a building.

Installing a SSDPS involves coring through the concrete basement floor and creating a “suction” pit to collect the vapors. Piping is then placed in the cored hole and attached to the concrete floor with caulk. The building wall is also cored through to allow access for a fan to be installed on the outside of the building. The fan is attached to the suction pit via additional piping, and is installed on the outside of the building; therefore, the piping joints will be under negative pressure for all piping inside the building in the event of a leak. The system can be connected to existing electrical outlets, and electric power is obtained from the building’s electric system.

SSDPS at the Site has already been installed at the 401 Louise Street residence. Indoor air sampling was done to verify the installed mitigation system was operating properly (see Section 1.3.3).

SSDPS is also operating as an interim remedial measure for the PRR building (see Section 1.3.3). The SSDPS functions both as an exposure control and as a long-term source reduction technology. The PRR building's SSDPS and its operation are described in **Appendix J**.

A SSDPS will not address the contaminated groundwater or soil at the Site; therefore, it would likely be used in conjunction with additional technologies.

3.1.3.5 Air Sparge (AS) with Soil Vapor Extraction (SVE)

AS is an *in situ* technology in which air is injected through a contaminated aquifer, the air travels horizontally and vertically through the soil column, creating underground stripping that removes COPCs from the groundwater. This injected air flushes the COPCs into the unsaturated zone where a SVE system removes the generated vapor phase COPCs from the vadose zone soils.

SVE is a technology used to collect off-gases generated during the AS process. A vacuum is applied to the soil to induce the controlled air flow and remove volatile and some semi-volatile COPCs from the soil. If necessary, the gas leaving the soil is then treated through GAC or other control technology.

AS/SVE was installed and operated at the Site and was effective at reducing TCE concentrations in the soils and shallow groundwater under the building and in the area west of Pine Lake. Sections 1.3.1.3 and 1.3.2.2 describe the AS/SVE system interim remedial measures. The AS/SVE systems were shut down in late 2008 and early 2009 because the systems were no longer recovering significant COPC mass.

Applying AS/SVE technology at the Site is not considered further in the CMP, because these systems were operated until they were no longer effective.

The SVE wells at the PRR building were converted for use as a sub-slab depressurization system in July 2012 (see Section 1.3.1.3 and **Appendix J**).

3.1.3.6 Excavation and Disposal

Excavation includes removing impacted soil from a contaminated area and subsequent treatment and/or disposal at a licensed disposal facility such as a landfill. Excavation removes source area soils and COPCs, thus limiting the potential for the soil to impact groundwater and direct human contact with the removed soil.

Soils have been excavated at the PRR property as part of initial remedial activities. Section 1.3 describes the excavated areas.

Additional soil excavation under or near the PRR building could not effectively be performed and is not necessary to protect human health or the environment. Other technologies can be (and have been) applied at the Site to reduce overall COPC mass and volume more effectively than excavation.

Metal concentrations in the FBRA/OBP area and near the API oil water separator exceed ecological screening criteria. However, the metals in the FBRA/OBP area are covered with clean soil, so ecological receptors are not exposed to the impacted soil. The extent of metals impact near the API oil water separator is small, and this area has very little habitat value. Additional excavation is not considered further in this CMP. The *Ecological Risk Assessment* (AECOM, 201) concluded that ecological risks were within acceptable ranges at the FBRA/OBP and API oil water separator area. Section 1.4.2 summarizes the *Ecological Risk Assessment*.

3.1.4 Barriers and Signs

This measure includes installing and maintaining fencing and/or other physical barriers in conjunction with warning signs to isolate known risk areas. Using this measure by itself does not prevent additional exposure pathways from being developed, such as VOCs migrating from the PRR property and subsequent exposure to impacted groundwater. This method does work well in conjunction with other measures and is retained for further evaluation.

The PRR property is already fenced, and access is controlled.

3.2 Corrective Measures Options

A corrective measures option is a technology or combination of different technologies applied to the Site as a final remedy. Four corrective measures options were evaluated using the technologies described in Section 3.1. All the corrective measures options, except no action, include the existing institutional controls and groundwater monitoring with a contingency plan that identifies responses to the groundwater data. The existing institutional controls are in **Appendix B**. The corrective measures options evaluated are:

- No-action;
- MNA and existing institutional controls;
- Pump-and-treat, MNA, SSDPS and existing institutional controls; and
- ERD, limited pump-and-treat, groundwater monitoring, SSDPS, and existing institutional controls.

After selecting a final remedy for the Site, PRR will submit a *Final Remedy Construction Work Plan* which will include operations, maintenance and monitoring.

3.2.1 Option 1: No Action

The no-action option does not include active treatment or monitoring. This option is presented as a baseline for comparison to other options. This option involves turning off the existing groundwater pump-and-treat system. Turning off the pump-and-treat system would allow natural groundwater flow conditions to resume, and impacted groundwater would migrate from the PRR property. It is possible some natural degradation and attenuation of COPCs would occur.

3.2.2 Option 2: Monitored Natural Attenuation (MNA)

Natural attenuation of VOC concentrations is occurring at the Site, as evidenced by the presence of degradation products, among other things. The MNA option includes developing a Site-specific MNA work plan, which will involve an initial Site model and groundwater monitoring. The initial Site model will evaluate impacted soil and groundwater concentrations, subsurface geochemistry, location of nearest receptors, mass balance of COPCs, and expected future groundwater conditions. If, as expected, the initial Site model indicates natural attenuation is still occurring, then groundwater monitoring will be conducted to verify the subsurface conditions at the Site continue to support natural attenuation. The monitoring parameters will include TCE and breakdown product concentrations, dissolved gas levels, and chloride concentrations in groundwater to confirm natural attenuation is occurring and the contaminated groundwater area is stable and/or decreasing. The initial Site model and groundwater monitoring plan will be developed using the USEPA's guidance document *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* (USEPA, 1998). Existing institutional controls will be maintained.

3.2.3 Option 3: Pump-and-Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems (SSDPS) and Institutional Controls

The Pump-and-Treat Option includes maintaining a pump-and-treat system to continue to treat the groundwater, continued groundwater monitoring, institutional controls, and operation of SSDPSs at one residential property and the PRR building (see **Appendix J**). Purge well locations are shown on **Figure 8**.

The institutional controls for this option would include the existing Restrictive Covenant for the PRR property, a City Ordinance regulating groundwater use in the impacted area and deed restrictions or other groundwater use controls for individual properties in Wayne Township.

A pump-and-treat system will remain active at the Site to maintain hydraulic control of the impacted groundwater and prevent contaminant area expansion. The system will include the existing purge wells with TCE concentrations greater than 200 ug/L. A groundwater monitoring program will be developed to include parameters for natural attenuation. MNA evaluation at the Site will be summarized in the groundwater monitoring reports. Based on the MNA evaluation results, modifications to the pump-and-treat system may be proposed. Such modifications may include extraction rate changes at purge wells, adding new purge wells or turning off individual purge wells. The purge wells will be turned off in accordance with the *Purge Well Shutdown Criteria* (**Appendix F**). The designated GSI compliance monitoring points are identified in **Appendix F**. Individual purge wells will be shut down when designated GSI compliance wells corresponding to the individual purge wells meet the interim goals in **Table 2A**.

Indoor inhalation exposures will continue to be mitigated by the SSDPSs at the 401 Louise Street residence and the PRR Building.

3.2.4 Option 4: Enhanced Reductive De-chlorination (ERD), Limited Pump-and-Treat, Groundwater Monitoring, Sub-Slab Depressurization Systems (SSDPSs), and Institutional Controls

This option includes using ABC®+ and ABC® as ERD in the remaining source areas coupled with using a pump-and-treat system, continued groundwater monitoring, existing institutional controls, and installing a SSDPS at one residence and the PRR building (see **Appendix J**.) The locations for the ERD purge wells for the pump-and-treat system and the residential SSDPS are shown in **Figure 9**. The locations of SSDPS components at the PRR building are in **Appendix J**.

The institutional controls for this option would include the existing Restrictive Covenant for the PRR property, a new or revised City Ordinance regulating groundwater use in the impacted area (to be developed in consultation with the MDEQ) and deed restrictions or other groundwater use controls for individual properties in Wayne Township appropriate to the circumstances.

A pump-and-treat system will be used to maintain hydraulic control of impacted groundwater. The ABC®+ injectate was tested at the Site in a pilot study and was found to be effective at reducing TCE concentrations in shallow groundwater. The pilot study using the ABC®+ injectate is summarized in the "Report of ABC®+ Pilot Test" (Mursch, 2011A) and is provided as **Appendix D**. Adding ABC® and ABC®+ will accelerate reductive de-chlorination of COPCs. The pilot study using ABC®+ was performed in the former OSSR source area. Full scale ABC® and ABC®+ application at the Site would include the other apparent source areas.

Full scale design for the ERD application at the Site will consider the results from the pilot study. A *Final Remedy Construction Work Plan* summarizing the number of injection points and their locations relative to the source areas, injection depth, injection rates and the approximate number of times the ERD application will be implemented will be submitted to the USEPA prior to implementation.

Continued groundwater monitoring will evaluate the ERD applications at the Site, in addition to the monitoring proposed in the CAMP (**Appendix E**). ERD parameters evaluated will include TCE, TCE degradation products, TCA, iron, arsenic, manganese and biological indicator parameters (such as *Dehalococcoides* bacteria). The ERD evaluation will be completed according to approved work plans and will be summarized in groundwater monitoring reports.

Groundwater monitoring will evaluate the treatment progress, and the flow from purge wells will be adjusted according to the monitoring data. It may be possible to reduce the number of purge wells in operation after ERD is implemented. Reducing operating purge wells will depend on the groundwater COPC concentrations. The purge wells will be turned off in accordance with the *Purge Well Shutdown Criteria* (**Appendix F**). The designated GSI compliance monitoring points are identified in **Appendix F**. Individual purge wells will be shut down when designated GSI compliance wells corresponding to the individual purge wells meet the interim goals in **Table 2A**.

PRR will continue to sample the designated GSI compliance wells in accordance with the CAMP (**Appendix E**).

4.0 EVALUATING CORRECTIVE MEASURES OPTIONS

Threshold criteria and balancing criteria will be used to determine the applicability of each option in relation to the specific circumstances of the impacts defined at the Site. Remedies attaining all four threshold criteria are then weighed against the balancing criteria. Specific criteria will be addressed within each main criteria section and are listed below and summarized in **Table 3**.

Threshold criteria

1. Overall protection of public health and the environment
2. Attain media cleanup standards (corrective measures goals)
3. Control hazardous substance sources and releases
4. Comply with standards for managing wastes

Balancing criteria

1. Long-term reliability and effectiveness
2. Reduce toxicity, mobility, or waste volume
3. Short-term effectiveness
4. Implementability (technical feasibility and availability of services and materials)
5. State and community acceptance
6. Cost

4.1 Threshold Criteria

The four corrective measures options are evaluated first with the threshold criteria to objectively assess how well each option meets project objectives. The four threshold criteria are described in the following subsections.

4.1.1 Overall Protection of Public Health and the Environment

This evaluation criterion assesses the extent to which each option achieves and maintains protection of public health and the environment. The option's ability to remove or minimize complete or potentially complete exposure pathways will also be assessed.

- Option 1, No Action, will not protect public health and the environment or address all potentially complete exposure pathways.

- Option 2, MNA with existing deed restriction, would not fully protect human health or address potentially complete exposure pathways. Even though the deed restriction would prevent exposure via groundwater ingestion or dermal contact at the PRR property, off-Site exposure risks to COPCs via indoor air inhalation is not mitigated with Option 2. Option 2 may not protect the environment. It is possible the area of COPCs in groundwater would expand without hydraulic controls operating. Elevated TCE and other COPC concentrations above the interim corrective measures goals could discharge into surface water bodies.

- Option 3, Pump-and-Treat, MNA, SSDPSs and Institutional controls, would protect human health and the environment and addresses potentially complete exposure pathways. Human and environmental exposure to impacted groundwater would be controlled by operating the pump-and-treat system. Indoor air exposure would be controlled with the SSDPSs at 401 Louise and the PRR building. Existing deed restrictions would prevent future exposure risks to soils and groundwater at the PRR property.

- Option 4, ERD, Pump-and-Treat, MNA, SSDPSs, and Institutional Controls would also protect human health and the environment and addresses potentially complete exposure pathways. Human and environmental exposure to impacted groundwater would be controlled by operating the pump-and-treat system. Indoor air exposure would be controlled with the SSDPSs at 401 Louise and the PRR building. The Institutional Control would prevent future exposure risks to soils and groundwater at the PRR property. Furthermore, ERD will reduce the clean-up time at the Site, and will, therefore, reduce the potential COPC exposure time to the public and the environment.

4.1.2 Attaining Media Cleanup Standards (Corrective Measures Goals)

This evaluation criterion assesses the extent to which each option can attain media-specific final corrective measures goals.

- Option 1, No Action, attaining final corrective measures goals is not expected.
- Option 2, MNA with Institutional Controls, attaining final corrective measures goals is not expected.
- Option 3, Pump-and-Treat, MNA, SSDPS and Institutional Controls, attaining final corrective measures goals is expected.
- Option 4, ERD, Pump-and-Treat, MNA, SSDPS and Institutional Controls, attaining final corrective measures goals is expected.

4.1.3 Control Hazardous Substances Sources and Releases

This evaluation criterion assesses the extent to which each option can control hazardous substances sources and releases. There are no continued operations at the PRR property using VOCs, and potential primary sources (e.g. USTs) have been removed and properly disposed. Therefore, there is no potential for future releases from primary sources or operations at the PRR property. All four corrective measures options meet the Control the Sources and Releases criterion. The remaining historical contaminant sources are soil and groundwater, which are secondary sources impacted by past releases from the primary sources.

4.1.4 Comply with Standards for Managing Wastes

Any waste derived from corrective measures implemented at the Site will be characterized and disposed in accordance with all applicable laws and regulations. All four technology options meet the Control of Sources and Releases evaluation criterion.

4.2 Balancing Criteria

The four corrective measures were evaluated and weighed first using the threshold criteria to assess how well each option meets project objectives. Corrective measures attaining all four threshold criteria are further weighed against the balancing criteria. Two corrective measures, Option 3 and Option 4, met all four threshold criteria and are discussed further using the balancing criteria in the following subsections.

4.2.1 Long Term Reliability and Effectiveness

4.2.1.1 Option 3 (Pump-and-Treat, MNA, SSDPSs and Institutional Controls

The long-term effectiveness at achieving final corrective measure goals for groundwater is unknown, but it is unlikely pump-and-treat by itself will reduce COPC concentrations to the final goals in a reasonable time. The Institutional Control will be effective for preventing human exposures at the PRR property. If the MNA monitoring program indicates MNA is occurring at the Site, then it will be an effective corrective measures option in the long term. The SSDPSs are able to effectively reduce COPC concentrations in indoor air at 401 Louise and the PRR building.

4.2.1.2 Option 4, ERD, pump-and-treat, MNA, SSDPSs and Institutional Controls

This option will have long term effectiveness. The ERD pilot study using ABC®+ has shown significant reduction in chemical mass; therefore, long term effectiveness for the option is expected. The Institutional Control will be effective for preventing human exposures to groundwater at the PRR property until final corrective measures goals are met. The SSDPSs are able to effectively reduce COPC concentrations in indoor air at 401 Louise and the PRR building.

4.2.2 Reduction of Toxicity, Mobility, and Volume of Waste

Option 3 (pump-and-treat, MNA, SSDPSs and Institutional Controls) would be moderately effective at reducing COPC mobility and volume through treatment. COPC's toxicity would not be affected. The pump-and-treat system currently operating has proven to be effective at controlling COPC mobility and reducing the overall COPC mass at the Site. However, the groundwater pump-and-treat system will not reduce the high TCE concentrations at secondary source areas within a reasonable timeframe.

Option 4 (ERD, pump-and-treat, MNA, SSDPSs and Institutional Controls) will be the most effective option at reducing the overall toxicity, mobility and volume through treatment. The ERD Pilot study has shown a significant reduction in contaminant mass at the pilot test area. Applying ERD Site-wide should reduce the overall COPC mass sooner than pump-and-treat alone.

4.2.3 Short-Term Effectiveness

Option 3 (pump-and-treat, MNA, SSDPSs and Institutional Controls) would be effective in the short term, as the existing pump-and-treat system will remain in operation and has been effective in controlling migration. The Institutional Control will be effective in the short term for preventing human exposures at the PRR property. If the MNA monitoring program indicates MNA is occurring at the Site, it will be an effective corrective measures option, but likely long term. The SSDPSs are able to effectively reduce COPC concentrations in indoor air at 401 Louise and the PRR building.

Option 4 (ERD, pump-and-treat, MNA, SSDPSs and Institutional Controls) will likely be effective in a shorter time than Option 3. A groundwater pump-and-treat system will remain effective for the short term performance of the proposed option. The pilot study using ERD has shown reduction in chemical mass; therefore, short term effectiveness of the option is expected. The Institutional Control will be effective in the short term for preventing human exposures at the PRR property. The SSDPSs are able to effectively reduce COPC concentrations in indoor air at 401 Louise and the PRR building.

4.2.4 Implementability

Option 3 (pump-and-treat, MNA, SSDPS and Institutional Controls) will not require any additional materials or equipment other than what is already routinely needed. A groundwater pump-and-treat system has been implemented. A more extensive groundwater monitoring plan may be required for this option's MNA component. The pump-and-treat system and SSDPSs will not require any additional services and/or materials other than routine maintenance. Option 3 is technically and administratively feasible. Existing or planned monitor wells will be used for groundwater monitoring. The SSDPS is technically feasible, and standard specifications are available (and the SSDPSs are already installed and operating).

Option 4 (ERD, pump-and-treat, MNA, SSDPSs and Institutional Controls) includes ERD in addition to continuing to operate the existing pump-and-treat system and monitoring program. The ABC®+ injectate is readily available through Redox Technologies, LLC. Applying the injectate will be via temporary injection wells that can be installed by a Geoprobe subcontractor. The existing pump-and-treat system and SSDPSs will not require any additional services and/or materials other than routine maintenance. Monitoring and analytical services are available. Option 4 is technically feasible, only the timing for completing the various system work plans and designs may be an issue. A design will need to be completed to evaluate the number of injection points and quantity of ABC®+ needed to be injected to reduce source area COPC concentrations to appropriate levels. Additional temporary and/or permanent well points may be needed to inject the ABC®+ injectate into the subsurface and to monitor ERD's effectiveness at the Site. Because the groundwater pump-and-treat system is already installed and has been running for years, it is technically feasible. The residential SSDPS has been installed and is in operation; therefore, it is technically and administratively feasible. The SSDPS at the PRR building is also operating and is feasible (see **Appendix J**.) A more detailed groundwater monitoring plan will be needed to monitor the ERD.

4.2.5 State and Community Acceptance

Option 3 (pump-and-treat, MNA, SSPDSs and Institutional Controls) will likely be accepted by the state and surrounding community because the existing hydraulic containment will remain in operation; however, it is likely the state and the community would like to see further secondary source area reduction in COPC mass and less time required to achieve final corrective measure goals for groundwater.

Option 4 (ERD, pump-and-treat, MNA, SSPDSs and Institutional Controls) will probably have the highest level of support by the state and community because of the faster reduction in COPC mass and concentrations in groundwater.

Option 4 may require a new MDEQ authorization for injecting ABC®+. This MDEQ permission was obtained for the pilot study, and obtaining a new authorization for full scale application is not expected to be difficult.

4.2.6 Cost

Cost will be evaluated for each option based on capital investment, annual O&M cost and overall net present value. This criterion is addressed in cost breakdown tables for Options 3 and 4. Each option's capital costs, annual O&M costs, and estimated net present value are presented. The net present value has been estimated using an assumed 2% inflation rate before taxes. For O&M activities that may continue over several decades, a 30-year maximum is assumed. The actual costs may be as much as 50% higher to 30% lower than the estimated costs; therefore, a 20% contingency factor for the each option's total capital cost is applied as an indirect cost to account for differences in approach that may be used during construction.

Option 3 (pump-and-treat, MNA, SSDPSs and Institutional Controls) includes the costs for MNA described in Option 2 and summarized in **Table 4A** and **Table 4B**. In addition to the MNA costs, Option 3 includes costs to continue operating the pump-and-treat system and the SSDPSs. The costs to continue operating the pump-and-treat system assume continued pumping at existing purge wells where VOC concentrations exceed Michigan Part 201 GSI criteria until the GSI criteria are met. This cost estimate assumes a TCE reduction of about 20% per year based on historical values. Based on the current TCE concentrations and the 20% TCE reduction per year, this cost estimate assumes purge wells PW-5, PW-9 and PW-10 will operate for about three years before they are below the interim corrective measure goals for groundwater (GSI criteria) and can be turned off, while PW-15 will operate for up to seven years prior to turning off.

The capital costs associated with the pump-and-treat, MNA, SSDPSs, and Institutional Controls option include developing a MNA work plan. Relatively small capital costs are associated with Option 3, since existing purge wells, monitor wells, SSDPSs, and the Institutional Control on the PRR property will be used. Once the groundwater concentrations and indoor air concentrations are below final corrective measure goals for indoor air, the SSDPSs will be shut down.

Capital and O&M costs for Option 3 are summarized in **Table 5A**. The capital costs for Option 3 are approximately $12,960. The O&M costs for years one through three are approximately $170,200 per year, for years four through seven approximately $111,400 per year, and for years eight through 30 are estimated to be $34,000 per year. The net present value for Option 3 is estimated to be $2,170,000 (**Table 5B**).

<u>Option 4</u> (ERD, pump-and-treat, MNA, SSDPSs and Institutional Controls) has higher capital cost than Option 3, but lower net present value. This option will shift the bulk of the remedial costs to a short term timeframe (one to five years) versus a long term timeframe (up to 30 years). O&M for Option 4 will be more intensive while implementing the ERD remedy (ABC®+); however, the injection phase will likely be completed over a one to two year period whereas the bulk of the O&M will occur to the groundwater pump-and-treat system currently operating.

The costs for MNA for Option 4 are the same as described in Option 3. In addition to the MNA, Option 4 includes costs to continue operating the SSDPSs, which are described in Option 3. Option 4 also includes injecting an ERD injectate (ABC®+) along with some continued groundwater pump-and-treat.

The pilot test demonstrated the ABC®+ formula is effective at reducing VOC concentrations at the injection area and stimulating MNA at and down-gradient of the injection area. Option 4 includes additional ABC®+ injection at the OSSR to create two ABC® reactive curtains down-gradient of the OSSR, and injecting ABC® without the ZVI to stimulate MNA in the area of the former retention lagoons, at the OBP, and near 83-23 off the northeast corner of the PRR property (**Figure 9**).

The estimated ABC®+ injection area at the OSSR will include at least two additional injection events with up to 30 injection borings in each event. A third injection event at the OSSR is included in the cost estimate as a contingency to address potential “rebound” of concentrations due in part to possible continued diffusion of COPCs from fine-grained soil. This cost estimate assumes 16,500 pounds of ABC®+ material will be injected at the OSSR area. The estimated ABC® (without the iron) injection area at the former retention pond area is approximately 36 feet by 150 feet, with about 20 injection borings in the area. At the OBP area, the cost estimate assumes that ABC® will be injected in two rectangular areas totaling about 10,000 square feet.

Based on quantity and time estimates from the ABC®+ contractor, Redox Tech LLC, it is assumed the cost to inject ABC®+ will be about $18 per square foot (surface area), and the ABC® without the iron will be about $8.50 per square foot. These estimates assume an average 25-foot thickness of the saturated zone targeted for treatment. The costs include mobilization, equipment, injection labor, health and safety management, cleanup and chemicals.

This cost estimate for Option 4 assumes continued pumping at existing purge wells where VOC concentrations exceed the interim corrective measure goals (GSI criteria) until the interim goals are met. Purge wells that will continue operating include PW-5, PW-9 and PW-10. Due to ABC® injection, PW-15 will have to be turned off. At the latest sampling event, the TCE concentrations in the purge wells outside the PRR property ranged from 230 - 260 µg/l. Assuming a TCE reduction of about 20% per year based on historical values, purge wells PW-5, PW-9 and PW-10 will operate for about three years before they are below the interim goals and can be turned off.

The total capital costs for Option 4 includes work plan development and applying ABC®+ and ABC® at the Site. **Table 6A** summarizes the capital costs. The capital costs for Option 4 are approximately $423,000. The O&M costs for Option 4 include annual costs associated with operating the pump-and-treat system for three additional years, and annual costs associated with MNA monitoring. The estimated O&M costs for years one through three is $210,200 per year, for years four through five the estimated annual costs are $48,000. The estimated annual cost for years six through 14 is $32,000. The estimated annual cost for years 15-30 is $7,000. Based on the total capital and O&M costs listed above, the net present value for Option 4 is estimated to be $1,690,000 (**Table 6B**).

5.0 RECOMMENDATIONS AND JUSTIFICATION FOR RECOMMENDED CORRECTIVE MEASURES

5.1 Selected Corrective Measures Option

The ERD, pump-and-treat, groundwater monitoring, SSDPSs and Institutional Controls (Option 4) option is the recommended corrective measures plan for the Site.

5.2 Justification for Selecting Corrective Measures

Option 4 is the recommended corrective measure because it is expected to meet the final corrective measure goals sooner than option 3. The ERD component has been shown to be practical, technically feasible, able to be completed with readily available materials/equipment, and effective from the ABC®+ pilot study. This option is also most likely to be the option favored by the surrounding community, as it will reach goals for the Site sooner than other options, but will be completed in a manner which is not intrusive to the community.

The groundwater pump-and-treat system is practical, technically feasible, and effective as can be shown by reviewing TCE in groundwater contaminant maps over the years. At some locations, TCE levels in groundwater have decreased over 90% based on data collected prior to starting the system.

The residential SSDPS has been installed in the basement of the house at 401 Louise, and has shown to be effective in mitigating TCE levels in indoor air; therefore, no other indoor air mitigation option has been proposed. SSDPS components are also in place and operating at the PRR building (see **Appendix J**).

While Option 4 is likely the most costly option in the short term and will include more regulatory requirements due to the MDEQ in-situ treatment authorization process, it will produce the best remedial results in the shortest timeframe.

5.3 Selected Corrective Measures and Issues Identified in the Risk Assessments

The *Human Health Risk Assessment and Screening Level Ecological Risk Assessment* (AECOM, 2009A) reviewed Site conditions in relation to various applicable criteria. The ERA was revised in 2011 (AECOM, 2011). The conclusions from the risk assessments are reviewed in Section 1.4. The proposed corrective measures address each applicable conclusion from the risk assessment. **Table 7** lists these conclusions and documents completed and proposed corrective measures that address each conclusion, as appropriate to the conclusion. Option 4 resolves any ecological risks in addition to the human health risks discussed above.

6.0 SCHEDULE

6.1 Construction

Minimal construction efforts would be required with Option 4. The residential SSDPS installation was completed in 2009 and the SSDPS in the PRR building was installed in 2012 and upgraded in January 2013. The additional monitors required for injection and monitoring will be installed within two months after the Final Decision has been issued by the USEPA. The ABC®+ injection will be completed within three months after an MDEQ permit has been received and the plan approved, weather permitting.

6.1 Implementation

The groundwater pump-and-treat system and SSDPS will continue to operate until the interim corrective measure goals in **Table 2A** are met. Once the Final Decision has been issued by the USEPA and any public comments have been resolved, the remaining Option 4 components will be implemented at the Site. A *Final Remedy Construction Work Plan* summarizing the number of injection points, locations, depths, approximate ERD application rates will be submitted to the USEPA for approval. Once the USEPA approves the Work Plan, full scale ERD will be applied to the Site.

6.2 Final Construction Completion Report

The *Final Construction Completion Report* will be completed when two relevant monitoring events have occurred after completing the ABC®+ injection so reduction levels can be compared.

6.3 Operation and Maintenance (O&M) Plan

An O&M plan will be written to include the groundwater pump-and-treat and ABC®+ injections. The residential SSDPS will not be included in the O&M plan, as previous discussions with the USEPA determined the SSDPS to be the resident's responsibility after two rounds of indoor air sampling have shown the levels to be below the USEPA's regional screening levels for residential air.

6.4 Monitoring Plan

A CAMP is presented in **Appendix E**. The CAMP describes a program of routine corrective action monitoring. The plan includes:

- Sampling groundwater at GSI compliance wells for VOCs on a quarterly basis to check for compliance and to determine if purge wells may be shut down;
- Sampling groundwater at monitor wells throughout the upper aquifer on a semi-annual basis to monitor MNA progress;
- Sampling soil vapor at shallow vapor monitoring points (VMPs) in residential areas on quarterly to semi-annual frequency to monitor for possible residential volatilization to indoor air issues;
- Sampling indoor air any sub-slab soil vapors in the PRR building to evaluate volatilization to indoor air issues;
- Sampling groundwater from deep wells at secondary residual source areas on a bi-annual basis to check for possible future increased migration of contaminated groundwater into/from the deep aquifer.

In conjunction with the semi-annual sampling, the CAMP includes measuring potentiometric levels at monitor wells; purge wells and staff gauges, and documenting O&M for the remedial systems.

PRR may perform supplemental groundwater sampling and analyses from time to time as required by Site activities. In particular, PRR will sample and analyze groundwater to evaluate ABC®+ injections or other selected corrective measures as appropriate. Such supplemental sampling will be described in supplemental monitoring work plans submitted for the specific activities.

7.0 REFERENCES

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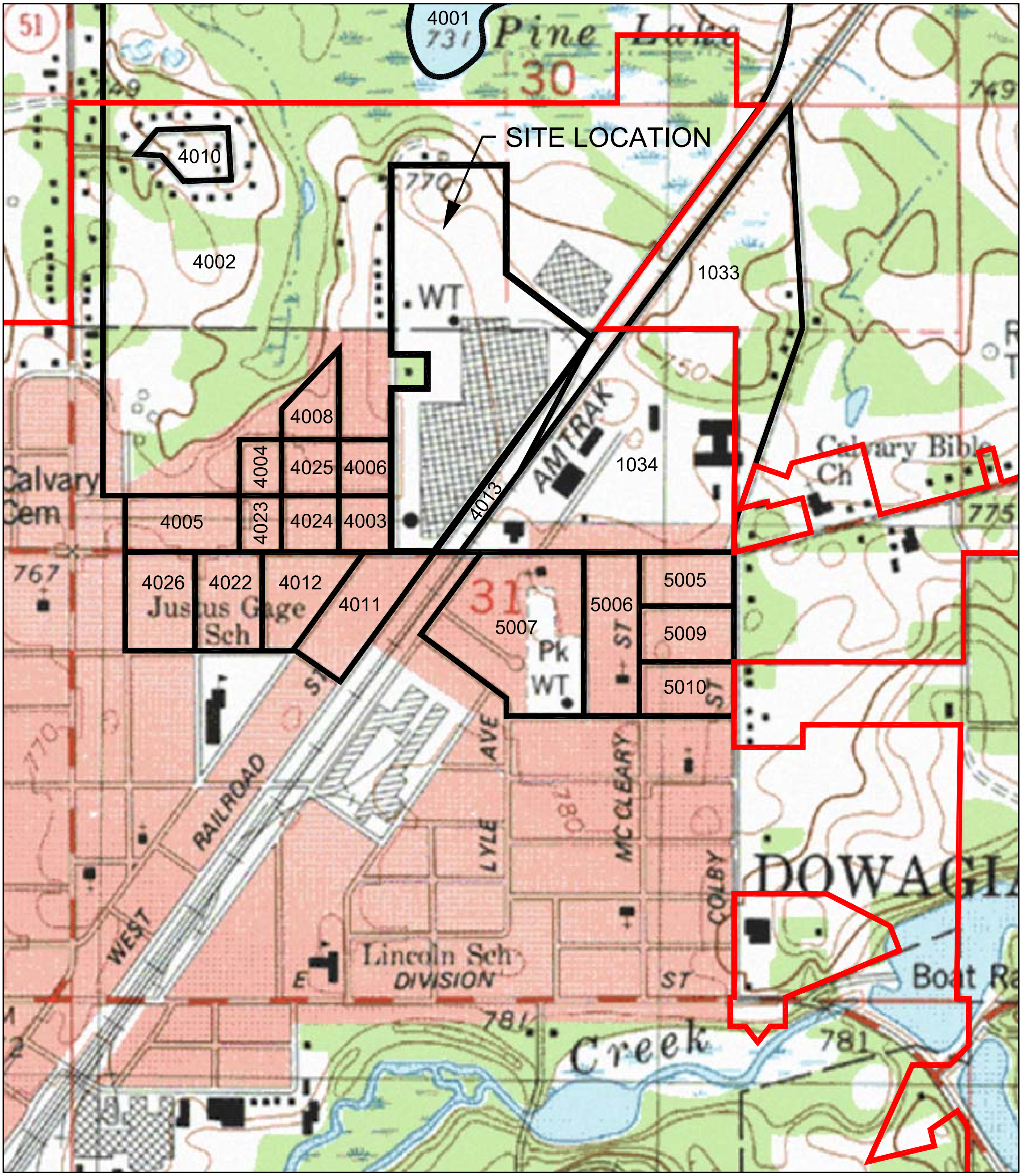
Figures



NO SCALE

LEGEND:

4010	2010 CENSUS BLOCK DELINEATION
(red line)	APPROXIMATE CITY LIMITS

Figure 1

SITE LOCATION MAP

FOR:
PRAIRIE RONDE REALTY
415 East Prairie Ronde, Dowagiac, Michigan 49047

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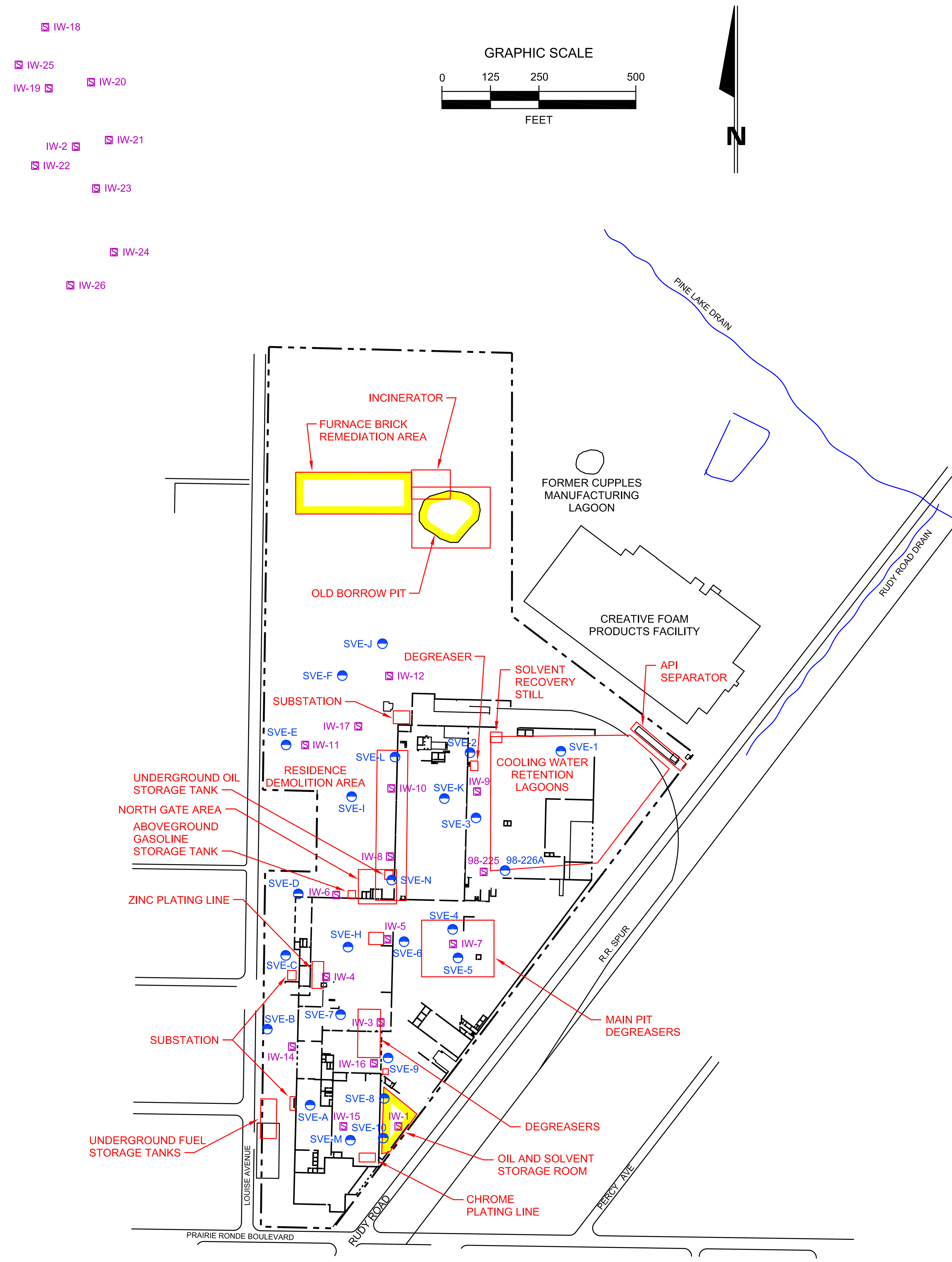

LEGEND:

- PRAIRIE RONDE REALTY PROPERTY LINE
- POTENTIAL SOURCE AREA
- APPROXIMATE HISTORICAL EXCAVATION BOUNDARY
- AIR SPARGE WELL
- SVE WELL

Figure 2

POTENTIAL SOURCE AREAS

FOR:
PRAIRIE RONDE REALTY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Plotted By: wilzbachern
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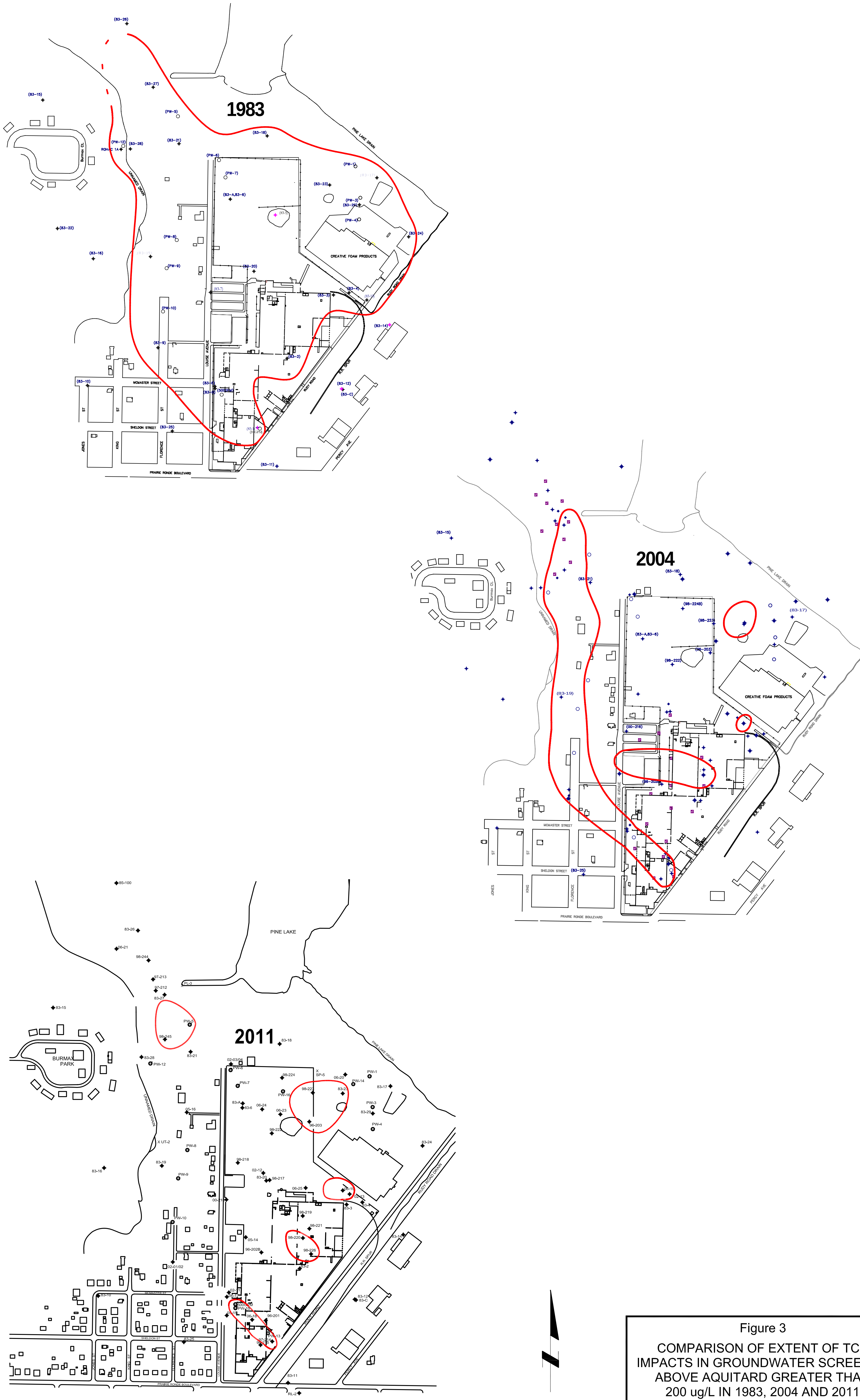

Figure 3

COMPARISON OF EXTENT OF TCE IMPACTS IN GROUNDWATER SCREENED ABOVE AQUITARD GREATER THAN 200 ug/L IN 1983, 2004 AND 2011

FOR:

PRAIRIE RONDE REALTY

415 East Prairie Ronde, Dowagiac, Michigan 49047

Plotted By: wilzbachern
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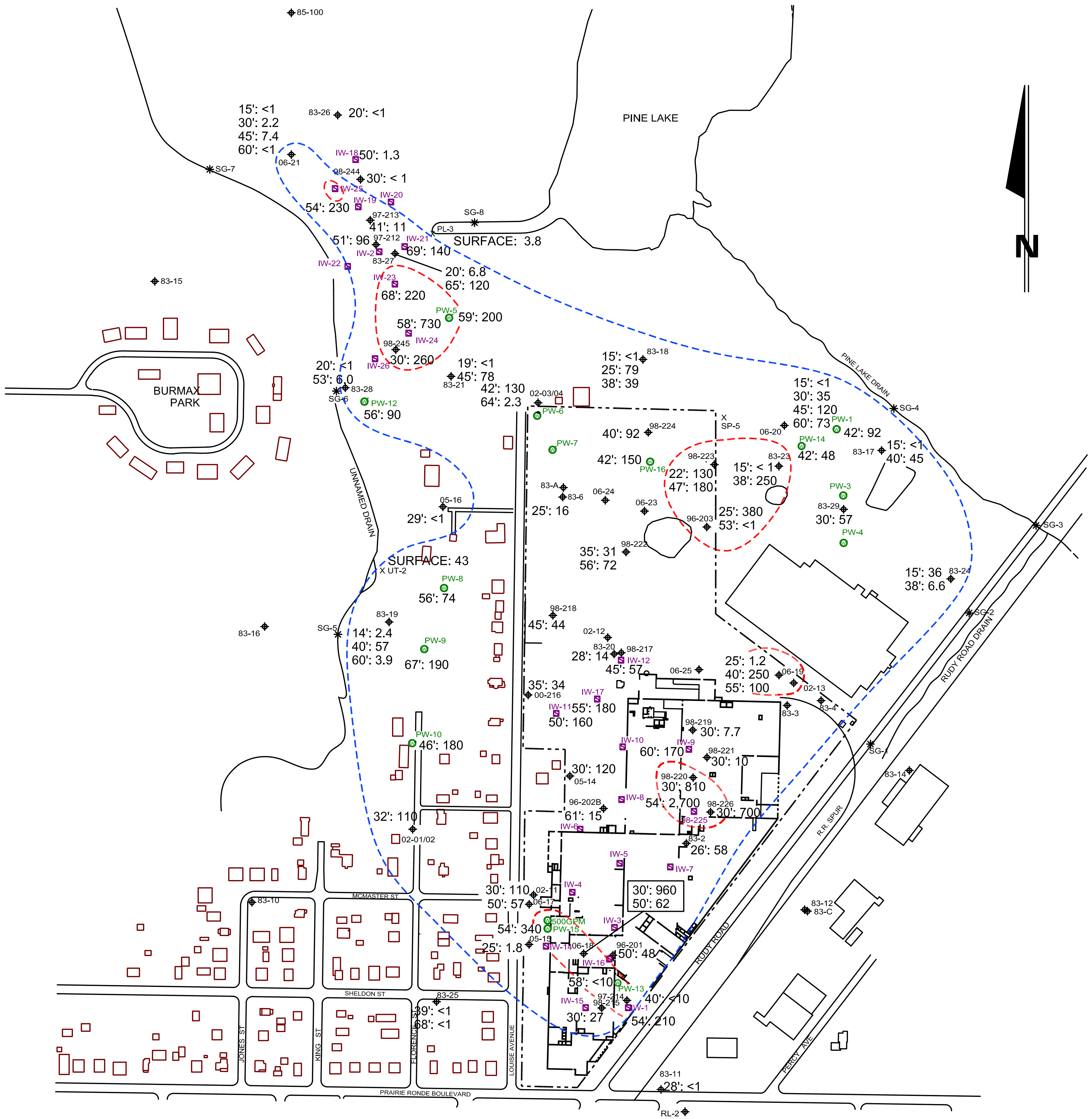

LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

ESTIMATED LIMITS OF TRICHLOROETHENE CONCENTRATIONS IN GROUNDWATER ABOVE 5 ug/L

ESTIMATED LIMITS OF TRICHLOROETHENE CONCENTRATIONS IN GROUNDWATER ABOVE 200 ug/L

PURGE WELLS (PW-NO.)

AIR SPARGE INJECTION WELLS (IW-N0.)

STAFF GAUGE (SG-NO.)

MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS (NO.)

55 @ 100' TRICHLOROETHENE CONCENTRATION, MICROGRAMS PER LITER @ WELL DEPTH IN FEET; < = LESS THAN

GRAPHIC SCALE

0 200 400 800

FEET

Figure 4

TCE CONCENTRATION IN GROUNDWATER SCREENED ABOVE AQUITARD

SEPTEMBER, 2011

FOR:

PRAIRIE RONDE REALTY

415 East Prairie Ronde, Dowagiac, Michigan 49047

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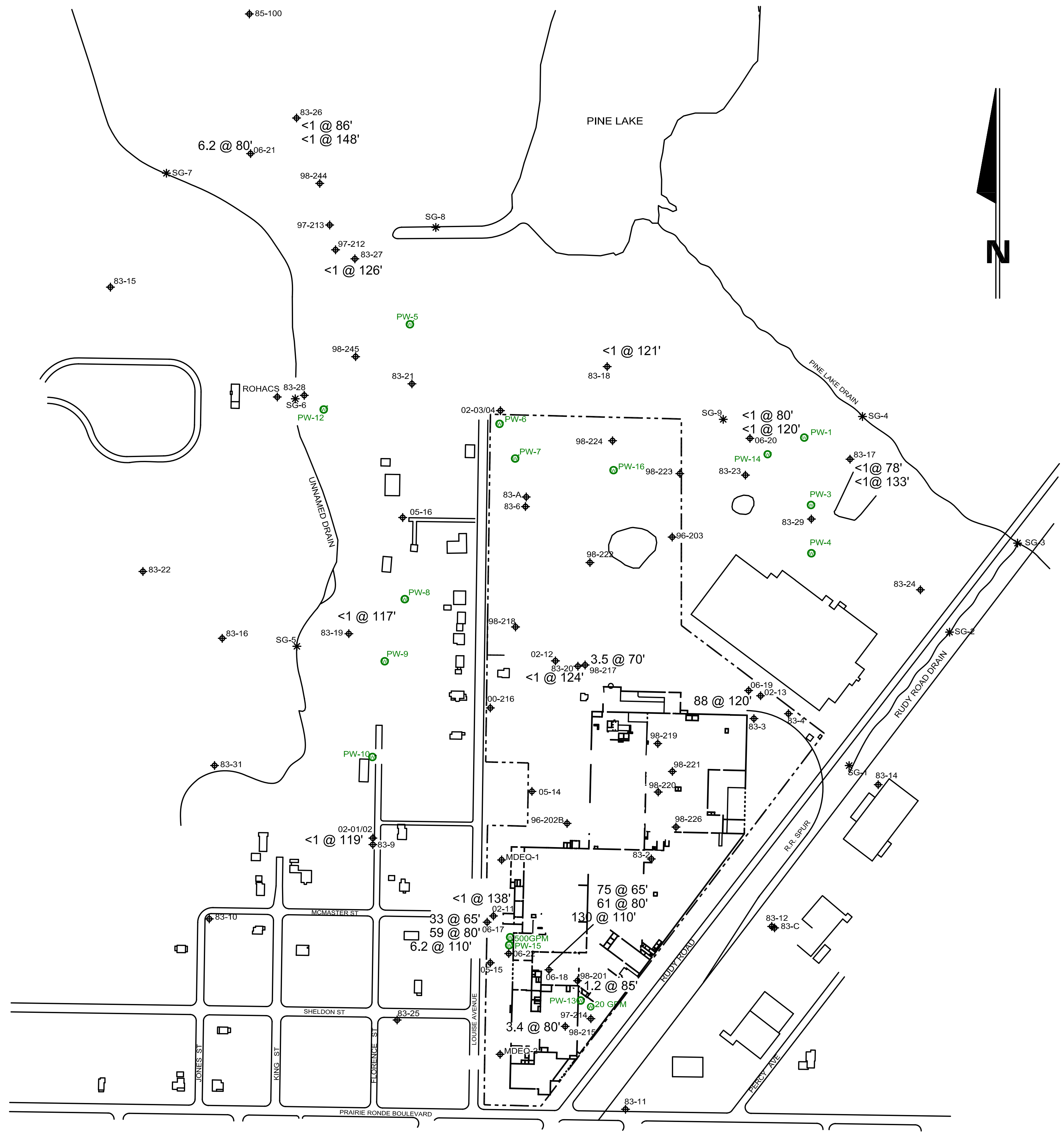

LEGEND:

- PRAIRIE RONDE REALTY PROPERTY LINE
- PURGE WELLS (PW-NO.)
- STAFF GAUGE (SG-NO.)
- MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS (NO.)
- 55 @ 100' TRICHLOROETHENE CONCENTRATION, MICROGRAMS PER LITER @ WELL DEPTH IN FEET

GRAPHIC SCALE

0 200 400 800

FEET

Figure 5

TRICHLOROETHENE IN WELLS
SCREENED IN DEEP AQUIFER
SEPTEMBER, 2011

FOR:

PRAIRIE RONDE REALTY

415 East Prairie Ronde, Dowagiac, Michigan 49047

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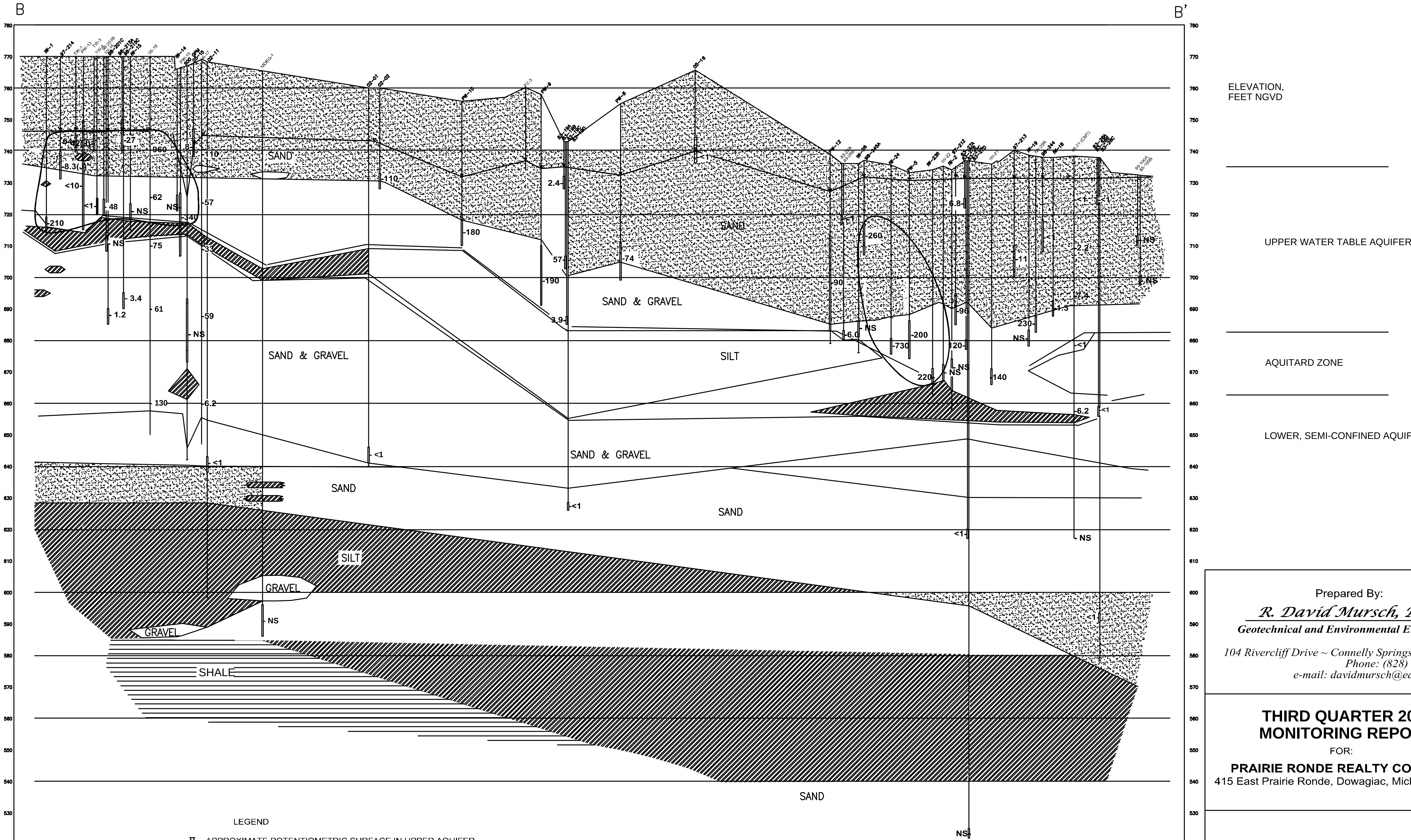

LEGEND

APPROXIMATE POTENTIOMETRIC SURFACE IN UPPER AQUIFER

100 TRICHLOROETHENE CONCENTRATION IN MICROGRAMS PER LITER

NS NOT SAMPLED

ESTIMATED LIMITS OF TCE IMPACT ABOVE 200 MICROGRAMS PER LITER

NOTE: BASE CROSS SECTION IS FROM
PHASE II REMEDIAL INVESTIGATION REPORT
DATED DECEMBER 2002 BY SECOR INTERNATIONAL INC.

Prepared By:
R. David Mursch, P.E.
Geotechnical and Environmental Engineer
104 Rivercliff Drive ~ Connelly Springs, NC 28612
Phone: (828) 234-5906
e-mail: davidmursch@earthlink.net

THIRD QUARTER 2011
MONITORING REPORT
FOR:
PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 6

CROSS SECTION B-B'

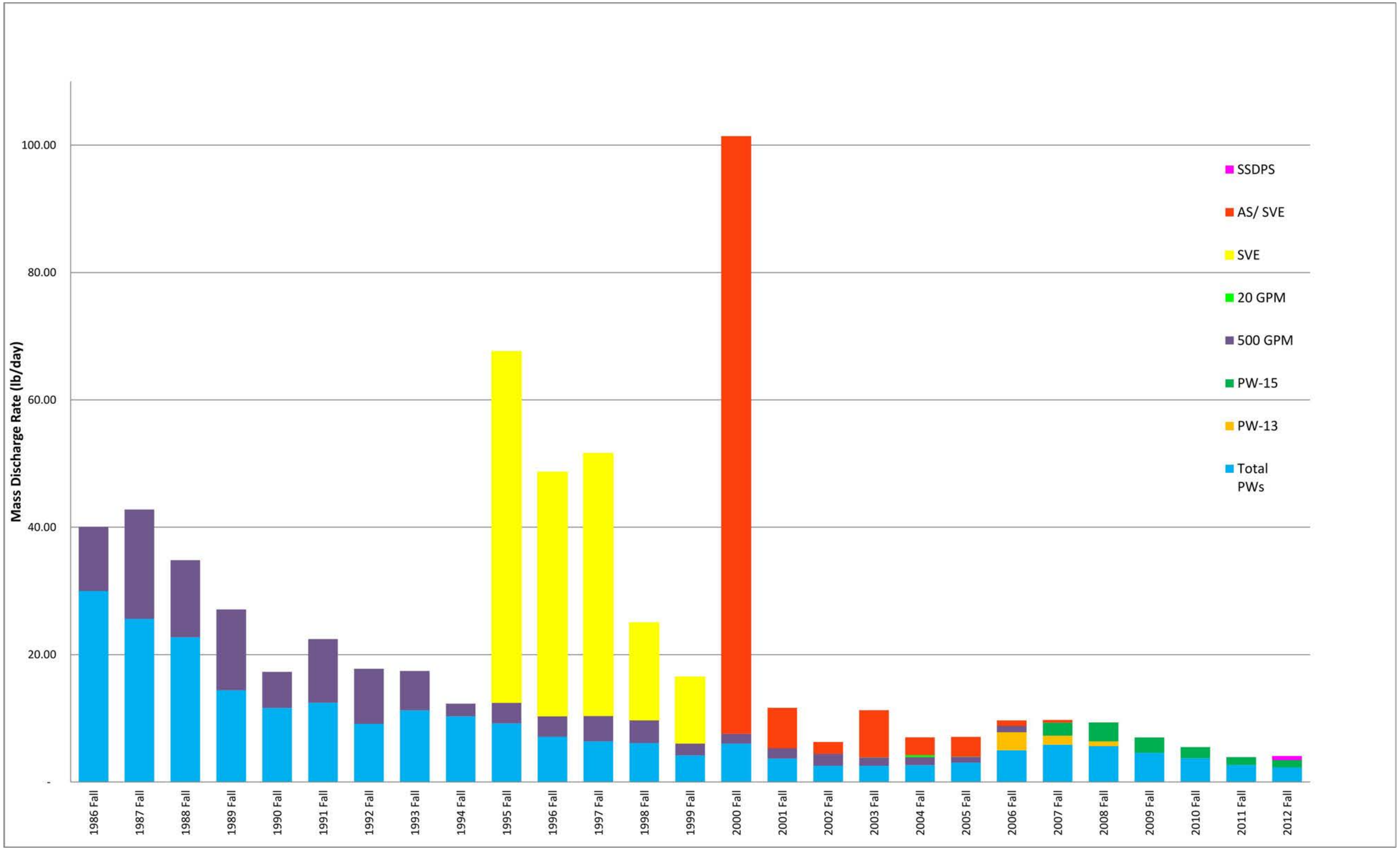

Figure 7

TCE REMOVAL RATES BY INTERIM RESPONSE MEASURES

FOR:

PRAIRIE RONDE REALTY

415 East Prairie Ronde, Dowagiac, Michigan 49047

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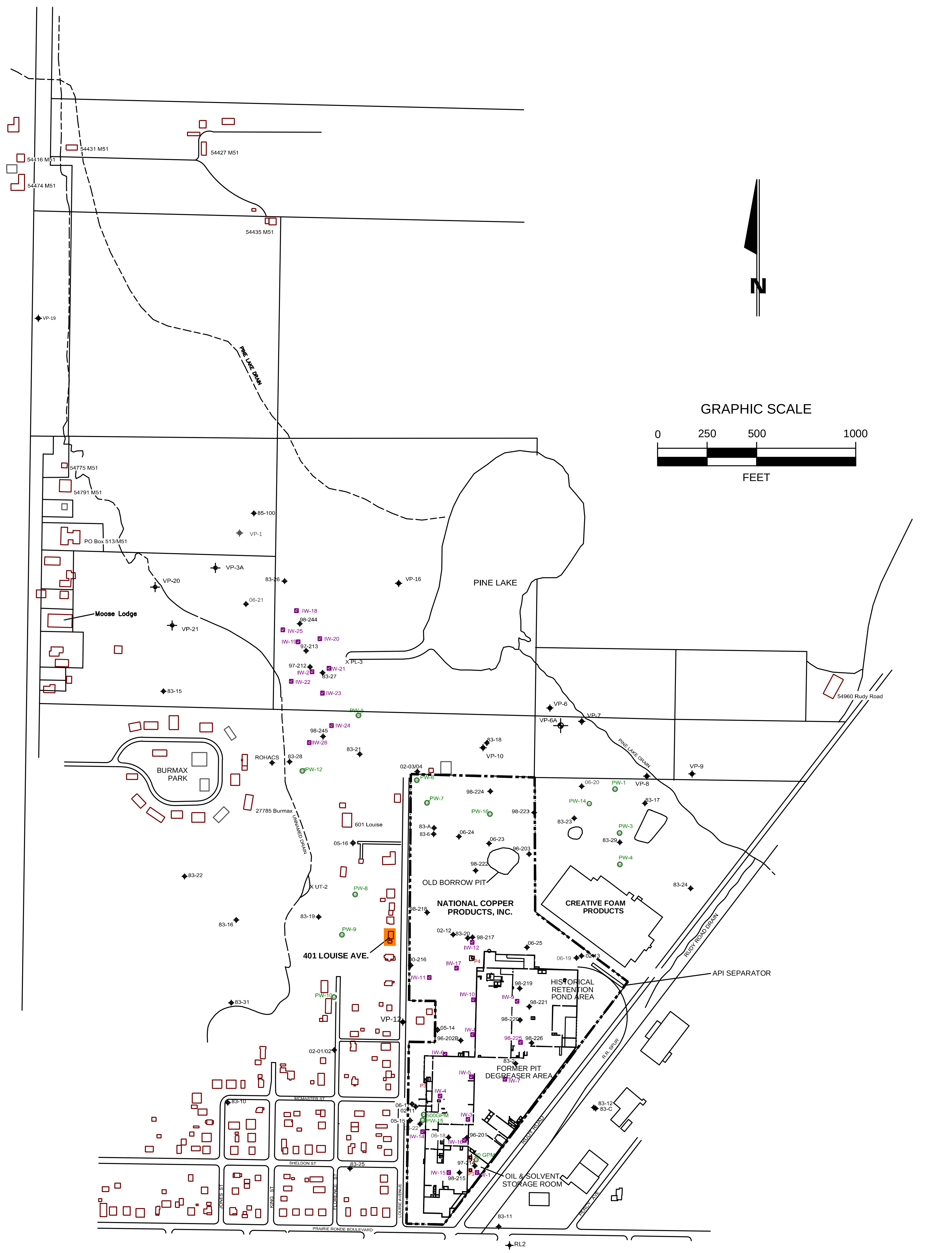

LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

GROUNDWATER REMEDIATION WELLS

MONITORING WELLS

AIR SPARGE INJECTION WELLS

VERTICAL PROFILE BORINGS

LOCATION OF SSDPS

Figure 8

OPTION 3:
PUMP & TREAT, MNA, SSDPS
AND INSTITUTIONAL CONTROLS

FOR:
PRAIRIE RONDE REALTY
415 East Prairie Ronde, Dowagiac, Michigan 49047

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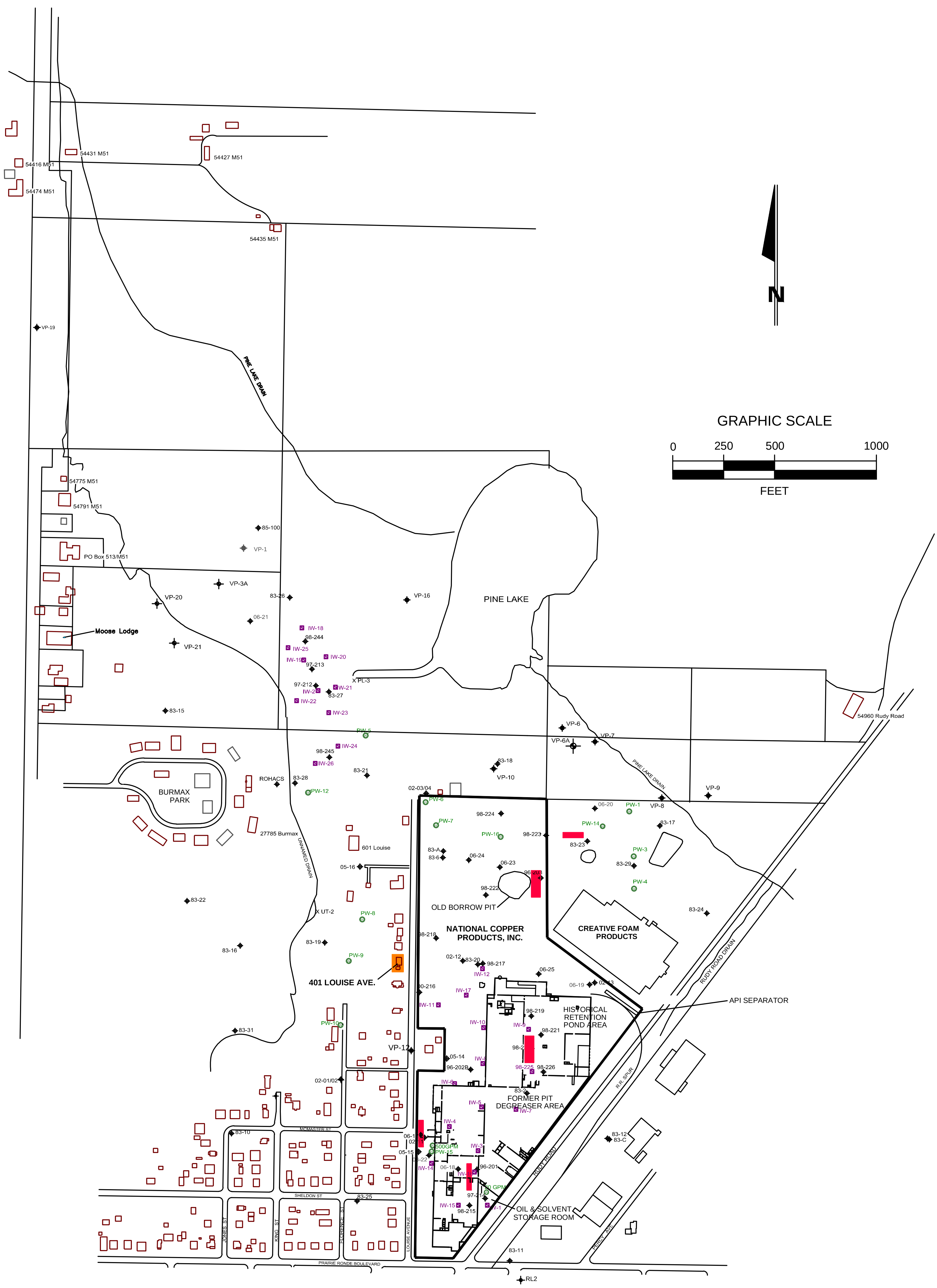

LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE
GROUNDWATER REMEDIATION WELLS
MONITORING WELLS
AIR SPARGE INJECTION WELLS
VERTICAL PROFILE BORINGS
LOCATION OF SSDPS
AREAS FOR ERD APPLICATION

Figure 9

OPTION 4:
ERD, REDUCED PUMP & TREAT,
MNA, SSDPS AND
INSTITUTIONAL CONTROLS

FOR:
PRAIRIE RONDE REALTY
415 East Prairie Ronde, Dowagiac, Michigan 49047

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Tables

Table 1
Summary of Potential Source Areas and Primary Soil Assessments
Prairie Ronde Realty, Inc.
Dowagiac, Michigan

Potential Source Area	COPCs	Soil Assessments (by Reference Number)[1]
Oil and Solvent Storage Room	VOCs, Metals, SVOCs	1, 2, 3, 8, 9, 11, 18
Chrome Plating Line	VOCs, Metals	2, 3
Zinc Plating Line	VOCs, Metals	2, 3
Underground Fuel Storage Tanks	VOCs, SVOCs	2, 3
Electrical Substations (three)	PCBs, SVOCs	3
Pit Degreasers	VOCs, Metals	1, 2, 3, 7, 8, 9, 11, 18
Degreasers	VOCs, Metals	1, 2, 8, 9, 11, 17
Above Ground Gasoline Tank	VOCs	2, 3
Underground Oil Storage Tank	VOCs, SVOCs	2, 3
Residence Demolition Area	VOCs	2, 3
North Gate Area	VOCs	1, 2, 3
Cooling Water Retention Ponds	VOCs, Metals	1, 2, 3, 5, 8, 9, 11, 18
API Separator	VOCs	1, 2, 3, 5, 8, 9
Solvent Recovery Still	VOCs, Metals	1, 2, 3
Old Borrow Pit	VOCs, Metals, SVOCs	1, 2, 3
Incinerator	Metals, SVOCs	2, 3
Furnace Brick Disposal Area	Copper	3, 4

[1] *See Appendix K of the Final Corrective Measures Proposal for the Soil Assessment Reference by number.*

Table 2A
Interim and Final Corrective Measure Goals for Groundwater
Prairie Ronde Realty, Inc.
Dowagiac, Michigan
(ug/L)

Chemical	Interim Corrective Measures Goal (1)	Final Corrective Measures Goal (2)
1,1,1-Trichloroethane	89	89
1,1-Dichlorethane	740	740
Chloroethane	1,100	430
Tetrachloroethene	60	5
Trichloroethene	200	5
Cis-1,2-Dichloroethene	620	70
Trans-1,2-Dichloroethene	1500	100
1,1-dichloroethene	130	7
Vinyl chloride	13	2

(1) Interim corrective measure goals for groundwater are Part 201 Groundwater Surface Water Interface (GSI) criteria and apply to groundwater at groundwater surface water interface wells.

(2) Final goals are lower of Part 201 residential drinking water criteria and groundwater surface water interface criteria. The Part 201 residential criteria include Federal and State Maximum Contaminant Levels (MCLs).

Source: MDEQ, 2004 (September 28, 2012 update).

Table 2B
Final Corrective Measure Goals for Indoor Air and Soil Gas
Prairie Ronde Realty, Inc.
Dowagiac, Michigan
(ug/m^3)

Chemical	Residential Indoor Air (1)	Industrial Indoor Air (1)	Residential Soil Gas (2)	Industrial Soil Gas (2)	MIOHS TWA (3)	MIOHS STEL (3)
1,1,1-Trichloroethane	5,200	22,000	173,333	733,333	1,900,000	2,450,000
1,1-Dichlorethane	15	77	500	2,567	400,000	NA
Chloroethane	10,000	44,000	333,333	1,466,667	NA	NA
Tetrachloroethene	42	180	1,400	6000	170,000	NA
Trichloroethene	2.1	8.8	70	293	270,000	1,080,000
cis-1,2-Dichloroethene (4)	63	260	2,100	8,667	790,000	NA
trans-1,2-Dichloroethene	63	260	2,100	8,667	790,000	NA
1,1-Dichloroethene	210	880	7,000	29,333	4,000	NA
Vinyl chloride	1.6	28	53	933	2,500	12,800

(1) Source: USEPA Regional Screening Levels (RSLs), updated November 2012 (www.epa.gov/region9/superfund/prg/index.html). RSLs have been adjusted so that the value presented is the lower of the RSL based on a target risk level of $1x10^{-5}$ and target hazard quotient of 1.

(2) Soil Gas Goals are residential or industrial indoor air goals divided by 0.03 attenuation factor.

(3) Source: Michigan Administrative Code, Rule 325.51101-325.51108.

(4) RSLs for cis-1,2-dichloroethene not available, RSLs for trans-1,2-dichloroethene used as surrogates.

NA: Not available

MIOHS: Michigan Occupational Health Standards for Air Contaminants

TWA: Time-weighted Average (8-hour)

STEL: Short-Term Exposure Limit

Table 3
Threshold and Balancing Criteria Evaluation
Prairie Ronde Realty, Inc.
Dowagiac, Michigan

Threshold Criteria	Option 1 (No Action)	Option 2 (MNA with Deed Restrictions)	Option 3 (P&T, MNA, SSDPS, & Deed Restrictions)	Option 4 (ERD, P&T, MNA, SSDPS, & Deed Restrictions)
Overall Protection of Public Health and the Environment	Not Protective of public health and the environment.	Not Protective of public health and the environment.	Protective of public health and the environment.	Protective of public health and the environment.
Attainment of Media Cleanup Standards (Corrective Measure Goals)	Attainment of corrective measure goals is not expected	Attainment of corrective measure goals is not expected	Attainment of corrective measure goals is expected	Attainment of corrective measure goals is expected
Control the Sources and Releases	Controls primary sources. Does not control secondary sources	Controls primary sources. Does not control secondary sources	Controls primary and secondary sources and releases.	Controls primary and secondary sources and releases.
Comply with Standards for Management of Wastes	Complies with all standards.	Complies with all standards.	Complies with all standards.	Complies with all standards.
Balancing Criteria	**Option 1 (No Action)**	**Option 2 (MNA with Deed Restrictions)**	**Option 3 (P&T, MNA, SSDPS, & Deed Restrictions)**	**Option 4 (ERD, P&T, MNA, SSDPS, & Deed Restrictions)**
Long-Term Reliability and Effectiveness	Not evaluated further.	Not evaluated further.	Option 3 will be effective and reliable in the long term; however, operation of the P&T system will be for indefinite time.	Option 4 will be effective and reliable in the long term. The addition of ERD will reduce the time needed for P&T system.
Reduction of toxicity, mobility, or volume of waste	Not evaluated further.	Not evaluated further.	Option 3 will be moderately effective at reducing the mobility of COPCs, will not reduce volume or toxicity of COPCs.	Option 4 will be most effective at reducing the overall mobility, mass and volume through treatment. Also reduces toxicity of COPCs by biodegradation.
Short-term effectiveness	Not evaluated further.	Not evaluated further.	Option 3 will be effective in the short containing the impacted groundwater, mitigating indoor air exposures.	Option 4 will be effective in the short containing the impacted groundwater, mitigating indoor air exposures.
Implementability	Not evaluated further.	Not evaluated further.	Option 3 will not require any additional materials or equipment. A more extensive groundwater monitoring plan and legal services for institutional controls will be needed.	Option 4 requires additional materials or equipment for ABC+ injection and injection wells. A more extensive groundwater monitoring plan and legal services for institutional controls will be needed. Materials and equipment are available.
State and community acceptance	Not evaluated further.	Not evaluated further.	Option 3 will likely be accepted by the State and community	Option 4 will probably have the highest level of support by the State and community because of the faster reduction in COPC mass and concentrations.
Cost	Not evaluated further.	Not evaluated further.	NPV cost $2,170,000	NPV cost $1,690,000.

Table 4A
Cost Summary for Option 2
Monitored Natural Attenuation and Institutional Controls

MNA Sampling

ITEM #		Est. Quantity	Units	Labor Price/Unit	Labor Price	Est. Quantity	Units	Unit Rate	Total
Capital Cost									
1	MNA and Deed Restrictions Work Plan Development	120	Hours	$90.00	10,800.00				$10,800.00
								Total Capital Cost	$10,800.00
								Total Capital Cost with 20% contingency	**$12,960.00**
Operation and Maintenance/Monitoring									
1	Sampling (field labor, per diem, equipment)	3	Day	$800.00	2,400.00				$2,400.00
2	Laboratory Analysis of GW samples[1]	42	EA	$150.00	6,300.00				$6,300.00
3	Reporting	1	Event	$1,200.00	1,200.00				$1,200.00
								Annual O&M (	**$9,900.00**

[1] Costs were provided to AECOM by R. David Mursh.

The purpose of this table is to compare costs of remedial alternatives to evaluate relative feasibility. These costs are not intended for actual budgeting or financial assurance calculations.

Table 4B

Net Present Value for Option 2 Monitored Natural Attenuation and Institutional Controls

Input Data		**Results**	
Inflation Rate (%): 2		NPV	**($410,000)**

Year	**Investment**	**Expenses**	**Cash Flow**
0	$12,960	$0	($12,960)
1	$0	$9,900	($9,900)
2	$0	$10,098	($10,098)
3	$0	$10,300	($10,300)
4	$0	$10,506	($10,506)
5	$0	$10,716	($10,716)
6	$0	$10,930	($10,930)
7	$0	$11,149	($11,149)
8	$0	$11,372	($11,372)
9	$0	$11,599	($11,599)
10	$0	$11,831	($11,831)
11	$0	$12,068	($12,068)
12	$0	$12,309	($12,309)
13	$0	$12,556	($12,556)
14	$0	$12,807	($12,807)
15	$0	$13,063	($13,063)
16	$0	$13,324	($13,324)
17	$0	$13,591	($13,591)
18	$0	$13,862	($13,862)
19	$0	$14,140	($14,140)
20	$0	$14,422	($14,422)
21	$0	$14,711	($14,711)
22	$0	$15,005	($15,005)
23	$0	$15,305	($15,305)
24	$0	$15,611	($15,611)
25	$0	$15,924	($15,924)
26	$0	$16,242	($16,242)
27	$0	$16,567	($16,567)
28	$0	$16,898	($16,898)
29	$0	$17,236	($17,236)
30	$0	$17,581	($17,581)
Totals:	$12,960	$401,624	($414,584)

The purpose of this table is to compare costs of remedial alternatives to evaluate relative feasibility. These costs are not intended for actual budgeting or financial assurance calculations.

Table 5A
Cost Summary for Option 3
Pump and Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems (SSDPSs) and Institutional Controls

ITEM #		Est. Quantity	Units	Labor Price/Unit	Labor Price	Est. Quantity	Units	Unit Rate	Total
Capital Costs									
1	MNA and Institutional Control Work Plan Development	120	Hours	$90.00	10,800.00				$10,800.00
								Subtotal	$10,800.00
					Total Capital Cost with 20% contingency				**$12,960.00**
Operation and Maintenance Costs (for years 1-3, four purge wells operating)									
1	Reporting & Sampling (field labor, per diem, equipment)(1,2)					1	Year	$30,000.00	30,000.00
2	Laboratory Analysis of GW samples(2)					120	Each	$100.00	12,000.00
3	Electric (2)					12	Month	$5,500.00	66,000.00
4	Routine Well maintenance (performed by Peerless Midwest)(2)					12	Month	$600.00	7,200.00
5	Air stripper maintenance (1,2)					12	Month	$1,000.00	$12,000.00
6	Indoor air and sub-slab soil vapor sampling and reporting (2)					4	QTR	$3,500.00	$14,000.00
7	NPDES Sampling and Reporting (2)					4	QTR	$2,250.00	$9,000.00
8	Residential Vapor Intrusion Monitoring(2)					4	Event	$4,500.00	$18,000.00
9	SSDPS Maintenance(2)					1	Year	$2,000.00	$2,000.00
					Years 1-3 Annual O&M Cost (four purge wells operating)				**$170,200.00**

Table 5A
Cost Summary for Option 3
Pump and Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems (SSDPSs) and Institutional Controls

ITEM #		Est. Quantity	Units	Labor Price/Unit	Labor Price	Est. Quantity	Units	Unit Rate	Total
Operation and Maintenance Costs (for years 4-7, one purge well operating)									
1	Reporting & Sampling (field labor, per diem, equipment)[1,2]					1	Year	$30,000.00	30,000.00
2	Laboratory Analysis of GW samples[2]					120	Each	$100.00	12,000.00
3	Electric [2]					12	Month	$2,500.00	30,000.00
4	Routine Well maintenance (performed by Peerless Midwest)[2]					12	Month	$200.00	2,400.00
5	Air stripper maintenance [1]					12	Month	$1,000.00	$12,000.00
6	Indoor air and sub-slab soil vapor sampling and reporting [2]					4	QTR	$3,500.00	$14,000.00
7	NPDES Sampling and Reporting [2]					4	QTR	$2,250.00	$9,000.00
8	SSDPS Maintenance [2]					1	Year	$2,000.00	$2,000.00
	Years 4-7 Annual O&M Cost (one purge well operating)								**$111,400.00**
Operation and Maintenance Costs (for years 8-30, no purge wells operating)									
1	Reporting & Sampling (field labor, per diem, equipment)[1,2]					1	Year	$20,000.00	20,000.00
2	Laboratory Analysis of GW samples [2]					120	Each	$100.00	12,000.00
3	SSDPS Maintenance [2]					1	Year	$2,000.00	$2,000.00
	Years 8-30 Annual O&M Cost (no purge wells operating)								**$34,000.00**

[1] *The Sampling (field labor, per diem, equipment) item under the Operation and Maintenance cost does not include the initial MNA monitoring.*

[2] Costs were provided to AECOM by R. David Mursh.

The purpose of this table is to compare costs of remedial alternatives to evaluate relative feasibility. These costs are not intended for actual budgeting or financial assurance calculations.

Table 5B
Net Present Value for Option 3
Pump and Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems (SSDPSs) and Institutional Controls

Input Data			**Results**
Inflation Rate (%):	2	NPV	**($2,170,000)**

Year	Investment	Expenses	Cash Flow
0	$12,960	$0	($12,960)
1	$0	$170,200	($170,200)
2	$0	$173,604	($173,604)
3	$0	$177,076	($177,076)
4	$0	$120,312	($120,312)
5	$0	$122,718	($122,718)
6	$0	$125,173	($125,173)
7	$0	$127,676	($127,676)
8	$0	$39,440	($39,440)
9	$0	$40,229	($40,229)
10	$0	$41,033	($41,033)
11	$0	$41,854	($41,854)
12	$0	$42,691	($42,691)
13	$0	$43,545	($43,545)
14	$0	$44,416	($44,416)
15	$0	$45,304	($45,304)
16	$0	$46,210	($46,210)
17	$0	$47,134	($47,134)
18	$0	$48,077	($48,077)
19	$0	$49,039	($49,039)
20	$0	$50,019	($50,019)
21	$0	$51,020	($51,020)
22	$0	$52,040	($52,040)
23	$0	$53,081	($53,081)
24	$0	$54,143	($54,143)
25	$0	$55,226	($55,226)
26	$0	$56,330	($56,330)
27	$0	$57,457	($57,457)
28	$0	$58,606	($58,606)
29	$0	$59,778	($59,778)
30	$0	$60,973	($60,973)
Totals:	$12,960	$2,154,404	($2,167,364)

The purpose of this table is to compare costs of remedial alternatives to evaluate relative feasibility. These costs are not intended for actual budgeting or financial assurance calculations.

Table 6A
Cost Summary for Option 4
Enhanced Reductive Dechlorination (ERD), Pump and Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems (SSDPSs), and Institutional Controls

ITEM #		Est. Quantity	Units	Labor Price/Unit	Labor Price	Est. Quantity	Units	Unit Rate	Total
Capital Costs									
1	MNA and Institutional Controls Work Plan Development	120	Hours	$90.00	10,800.00				$10,800.00
2	ABC+ Application (includes materials and injection wells)(2)					5,000	SF	$18.00	$90,000.00
3	ABC Application (includes materials and injection wells)(2)					15,400	SF	$8.50	$130,900.00
4	ABC Work Plan and Approval(2)	120	Hours	$90.00	10,800.00				$10,800.00
5	Installation of New Monitoring Well(2)					1	LS	$8,000.00	$8,000.00
6	Purge Well Abandonment(2)					1	LS	$60,000.00	$60,000.00
7	Monitoring Well Abandonment(2)					60	EA	$700.00	$42,000.00
								Subtotal	$352,500.00
					Total Capital Cost with 20% contingency				**$423,000.00**
Operation and Maintenance Costs (for years 1-3, three purge wells operating)									
1	Reporting & Sampling (field labor, per diem, equipment)(1,2)					1	Year	$30,000.00	30,000.00
2	Laboratory Analysis of GW samples(2)					120	Each	$100.00	12,000.00
3	Quarterly GSI Wells(2)					40	Each	$100.00	4,000.00
4	Electric (2)					12	Month	$5,500.00	66,000.00
5	Routine Well maintenance (performed by Peerless Midwest)(2)					12	Month	$600.00	7,200.00
7	Air stripper maintenance (1)					12	Month	$1,000.00	$12,000.00
8	Indoor air and sub-slab soil vapor sampling and reporting					4	QTR	$3,500.00	$14,000.00
9	NPDES Sampling and Reporting (2)					4	QTR	$2,250.00	$9,000.00
12	Residential Vapor Intrusion Monitoring(2)					2	Event	$4,500.00	$9,000.00
13	SSDPS Maintenance (2)					1	Year	$2,000.00	$2,000.00
14	ABC+ Injection (contigency for potential rebound)					2,500	SF	$18.00	$45,000.00
					Years 1-3 Annual O&M Cost (3 purge wells operating)				**$210,200.00** per year

Table 6A
Cost Summary for Option 4
Enhanced Reductive Dechlorination (ERD), Pump and Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems (SSDPSs), and Institutional Controls

ITEM #		Est. Quantity	Units	Labor Price/Unit	Labor Price	Est. Quantity	Units	Unit Rate	Total	
Operation and Maintenance Costs (for years 4-5, no purge wells operating)										
1	Reporting & Sampling (field labor, per diem, equipment)[1,2]					1	Year	$30,000.00	30,000.00	
2	Laboratory Analysis of GW samples[2]					120	Each	$100.00	12,000.00	
3	Quarterly GSI Wells[2]					40	Each	$100.00	4,000.00	
4	SSDPS Maintenance[2]					1	Year	$2,000.00	$2,000.00	
	Years 4-5 Annual O&M Cost (no purge wells operating and GSI monitoring)								**$48,000.00**	per year
Operation and Maintenance Costs (for years 6-14)										
1	Reporting & Sampling (field labor, per diem, equipment)[1,2]					1	Year	$20,000.00	20,000.00	
2	Laboratory Analysis of GW samples[2]					120	Each	$100.00	12,000.00	
	Years 6-14 Annual O&M Cost (no purge wells operating and no GSI monitoring)								**$32,000.00**	per year
Operation and Maintenance Costs (for years 15-30)										
1	Reporting & Sampling (field labor, per diem, equipment)[1,2]					1	Year	$4,000.00	4,000.00	
2	Laboratory Analysis of GW samples[2]					30	Each	$100.00	3,000.00	
	Years 15-30 Annual O&M Cost (no purge wells operating and no GSI monitoring)								**$7,000.00**	per year

[1] *The Sampling (field labor, per diem, equipment) item under the Operation and Maintenance cost does not include the initial MNA monitoring.*

[2] Costs were provided to AECOM by R. David Mursh.

The purpose of this table is to compare costs of remedial alternatives to evaluate relative feasibility. These costs are not intended for actual budgeting or financial assurance calculations.

Table 6B
Net Present Value for Option 4
Enhanced Reductive Dechlorination (ERD), Pump and Treat, Monitored Natural Attenuation (MNA), Sub-Slab Depressurization Systems

Input Data			Results
Inflation Rate (%): 2		NPV	**($1,690,000)**

Year	Investment	Expenses	Cash Flow
0	$423,000	$0	($423,000)
1	$0	$210,200	($210,200)
2	$0	$214,404	($214,404)
3	$0	$218,692	($218,692)
4	$0	$51,840	($51,840)
5	$0	$52,877	($52,877)
6	$0	$35,840	($35,840)
7	$0	$36,557	($36,557)
8	$0	$37,288	($37,288)
9	$0	$38,034	($38,034)
10	$0	$38,794	($38,794)
11	$0	$39,570	($39,570)
12	$0	$40,362	($40,362)
13	$0	$41,169	($41,169)
14	$0	$41,992	($41,992)
15	$0	$9,100	($9,100)
16	$0	$9,282	($9,282)
17	$0	$9,468	($9,468)
18	$0	$9,657	($9,657)
19	$0	$9,850	($9,850)
20	$0	$10,047	($10,047)
21	$0	$10,248	($10,248)
22	$0	$10,453	($10,453)
23	$0	$10,662	($10,662)
24	$0	$10,875	($10,875)
25	$0	$11,093	($11,093)
26	$0	$11,315	($11,315)
27	$0	$11,541	($11,541)
28	$0	$11,772	($11,772)
29	$0	$12,007	($12,007)
30	$0	$12,247	($12,247)
Totals:	$423,000	$1,267,236	($1,690,236)

The purpose of this table is to compare costs of remedial alternatives to evaluate relative feasibility. These costs are not intended for actual budgeting or financial assurance calculations.

Table 7
How Does the Preferred Corrective Measure Option Address Conclusions of Risk Assessments?
Prairie Ronde Realty Inc.
Dowagiac, Michigan

Human Health Risk Assessment Conclusion	Completed Corrective Measures	Proposed Additional Corrective Measures
1. Soil protection of groundwater. Certain soil samples, primarily under the PRR building and at the former FRBA and OBP areas, had COPC concentrations that exceed the MDEQ Part 201 residential groundwater protection criteria for soil. This exposure route is not currently complete because impacted groundwater is not used for drinking water.	• Excavation completed to extent practical to protect building • SVE • Restrictive Covenant for PRR Property	• Groundwater collection and treatment • ERD • MNA
2. Residential ingestion of groundwater outside of PRR property. COPC concentrations in groundwater exceed MDEQ Part 201 drinking water criteria and Maximum Contaminant Levels. Impacted groundwater is not currently used for drinking water.	• Groundwater Collection and treatment • Air Sparge	• Groundwater collection and treatment • ERD, • MNA • Off-PRR property Institutional Controls
3. Residential ingestion of groundwater on the PRR property. COPC concentrations in groundwater exceed MDEQ Part 201 drinking water criteria and Maximum Contaminant Levels. Impacted groundwater is not currently used for drinking water.	• Groundwater Collection and treatment • Air Sparge • Restrictive covenant (PRR property)	• Groundwater collection and treatment • ERD, • MNA
4. Groundwater Dermal Contact (residential and industrial). COPC concentrations are less than MDEQ Part 201 residential and industrial groundwater dermal contact. This exposure pathway/route is presently incomplete.	• Groundwater Collection and treatment • Air Sparge • Restrictive covenant	• • No additional measures necessary
5. Soil direct contact. One sample (02-254) under the PRR building had a concentration of arsenic that slightly exceeded the industrial criterion for direct soil contact. The upper 95 percent confidence limit of the mean arsenic concentration in this area was less than the direct soil contact criterion.	• Excavation completed to extent practical to protect building. •	• No additional measures necessary
6. Surface water ingestion and direct contact. The vinyl chloride concentration at SP-5, slightly exceeded the MDEQ Part 31 water quality value for human health based on recreational exposure. The physical character and location of SP-5 preclude recreational exposure that is basis for criterion	• Excavation completed to extent practical under building • Groundwater collection and treatment • AS	• Groundwater collection and treatment, • ERD • MNA
7. Soil vapor to indoor air at PRR building. Indoor and sub slab samples were collected in March 2012. Concentrations of TCE in the PRR building exceeded USEPA's regional screening levels.	• Excavation • SVE • Increased ventilation • SSDPS	• Groundwater collection and treatment, • ERD • MNA • SSDPS • Monitor indoor air at PRR building

Table 7 (continued)
How Does the Preferred Corrective Measure Option Address Conclusions of Risk Assessments?
Prairie Ronde Realty Inc.
Dowagiac, Michigan

Human Health Risk Assessment Conclusion	Completed Corrective Measures	Proposed Additional Corrective Measures
8. Groundwater soil vapor to indoor air off-site. TCE concentrations in indoor air at one home exceeded USEPA regional screening levels for indoor air.	Sub slab depressurization system installed	• Monitoring soil vapor • No further measures unless indicated by monitoring
9.The groundwater is used for rearing bait minnows. The estimated concentrations of COPCs in indoor air were less than USEPA regional screening levels for residential indoor air.	• Groundwater Collection and treatment • Air Sparge	• No additional measures necessary
10.The groundwater is used for flushing toilets and wash water at one house. The estimated concentrations of COPCs in indoor air were less than USEPA regional screening levels for residential indoor air (Appendix G).	• Groundwater Collection and treatment • Air Sparge	• No additional measures necessary

Screening Level Ecological Risk Assessment Conclusions	Completed Corrective Measures	Proposed Additional Corrective Measures
1. Ecological risk to biota resident in water bodies and wetlands located north and west of the Site is currently acceptable.	• Excavation completed to extent practical to protect building • Excavation and cover at FBRA • Groundwater collection and treatment • SVE and AS	• No additional measures necessary
2. In the wetlands/fens north of the Site, as well as in the lake and associated drains, there is no unacceptable ecological risk from the discharge of impacted groundwater. Higher concentrations of TCE present in deeper layers of the surface aquifer are overlain by water with lower concentrations and the higher concentrations of TCE are not discharging to surface water bodies or wetlands.	• Excavation completed to extent practical to protect building • Excavation and cover at FBRA • Groundwater collection and treatment • SVE and AS	• No additional measures necessary
3. Unacceptable risk from surface water exposures to TCE (in the Unnamed Drain) and mercury (in Pine Lake) is not expected based on the toxicity evaluation conducted in the ERA.	• Excavation completed to extent practical to protect building • Excavation and cover at FBRA • Groundwater collection and treatment • SVE and AS	• No additional measures necessary

Table 7 (continued)
How Does the Preferred Corrective Measure Option Address Conclusions of Risk Assessments?
Prairie Ronde Realty Inc.
Dowagiac, Michigan

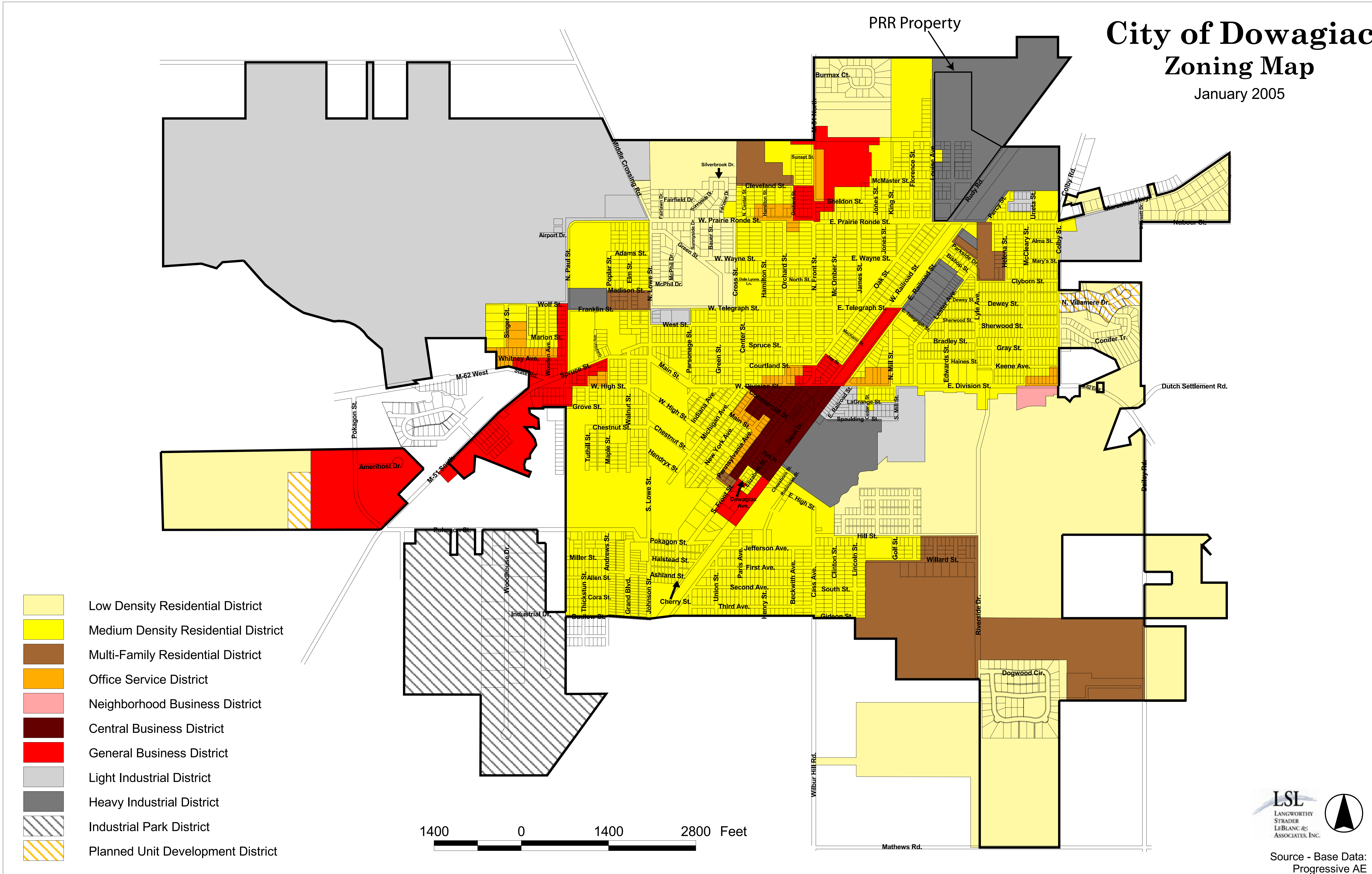
Screening Level Ecological Risk Assessment Conclusions	Completed Corrective Measures	Proposed Additional Corrective Measures
4. No organic chemicals were detected in the lake sediment with concentrations above the threshold effects levels. Metals concentrations observed in the sediment are not attributed to any impact from the facility.	• Excavation completed to extent practical to protect building • Excavation and cover at FBRA • Groundwater collection and treatment • SVE and AS	• No additional measures necessary
5. Sensitive receptors (amphibians and Mitchell's satyr butterfly). Concentrations are less than screening criteria and impacts not expected.	• Excavation completed to extent practical to protect building • Excavation and cover at FBRA • Groundwater collection and treatment • SVE and AS	• No additional measures necessary
6. Vinyl chloride concentration at seep (SP-5) exceeded GSI criterion for human health, less than GSI criterion for aquatic life	• Excavation completed to extent practical to protect building • Excavation and cover at FBRA • Groundwater collection and treatment • SVE and AS	• Groundwater collection and treatment, • ERD • MNA

Note: the numbered conclusions correspond to risk assessment conclusions presented in Section 1.4.

AS = Air sparge
ERD = Enhanced Reductive Dechlorination
FBRA = Furnace Brick Remediation Area
MDEQ = Michigan Department of Environmental Quality
MNA = Monitored natural attenuation
OBP = Old Burn Pit
PRR = Prairie Ronde Realty
SVE = Soil vapor extraction

Appendix A

Zoning


City of Dowagiac
Zoning Map
January 2005
PRR Property
Low Density Residential District
Medium Density Residential District
Multi-Family Residential District
Office Service District
Neighborhood Business District
Central Business District
General Business District
Light Industrial District
Heavy Industrial District
Industrial Park District
Planned Unit Development District
1400 0 1400 2800 Feet
LSL
Langworthy Strader LeBlanc & Associates, Inc.
Source - Base Data: Progressive AE
Middle Crossing Rd.
Airport Dr.
M-62 West
M-51 South
Pokagon St.
Amerihost Dr.
Woodhouse Dr.
Industrial Dr.
Burmax Ct.
Silverbrook Dr.
Cleveland St.
Sheldon St.
W. Prairie Ronde St.
E. Prairie Ronde St.
W. Wayne St.
E. Wayne St.
W. Telegraph St.
E. Telegraph St.
W. Division St.
E. Division St.
Dutch Settlement Rd.
Rudy Rd.
Colby Rd.
Nubour St.
Conifer Tr.
Bailey Rd.
Riverside Dr.
Dogwood Cir.
Wilbur Hill Rd.
Mathews Rd.
Willard St.
Hill St.
Jefferson Ave.
First Ave.
Second Ave.
Third Ave.
Gideon St.
Pokagon St.
Halstead St.
Ashland St.
Cherry St.
Miller St.
Allen St.
Cora St.
Dudley St.
Grand Blvd.
S. Lowe St.
N. Lowe St.
N. Paul St.
Adams St.
Madison St.
Franklin St.
Wolf St.
Marion St.
Whitney Ave.
Spruce St.
W. High St.
Grove St.
Chestnut St.
Main St.
Spruce St.
Courtland St.
Clyborn St.
Dewey St.
Sherwood St.
Bradley St.
Gray St.
Keene Ave.
LaGrange St.
Spaulding St.
E. High St.
Dowagiac Ave.

CHAPTER 13
I-2 HEAVY INDUSTRIAL DISTRICT

SECTION 13.1 INTENT

The I-2 General Industrial Districts are established primarily for manufacturing, assembling, and fabrication activities including large scale or specialized industrial operations whose external physical effects may be felt to some degree by surrounding districts. The I-2 District is so structured as to permit, in addition to I-1 Light Industrial District uses, the manufacturing, processing and compounding of semi finished or finished products from raw materials.

SECTION 13.2 PERMITTED USES

No land and/or buildings in the I-2 District shall be used, erected, altered or converted, in whole or in part, except for the following purposes by right:

A. All permitted uses in the I-1 district.

B. Lumber and planing mills.

C. Metal plating, buffing, and polishing.

D. Commercial storage warehouses.

E. The manufacture, compounding, processing, packaging, or treatment of products requiring stamping or punch press operations.

F. Veterinary clinics and kennels.

G. Accessory buildings, structures, and uses.

SECTION 13.3 SPECIAL LAND USES

Land and/or buildings in the I-2 District may be used for the following purposes when approved by the Planning Commission in accordance with the requirements of Chapter 20:

A. Vehicle repair.

B. Recycling centers.

C. Salvage yards.

D. Sexually-oriented businesses.

E. Truck terminals.

F. Outdoor storage, display area, and sale of farm implements and commercial construction equipment.

G. Manufacture of corrosive acid or alkali, cement, lime, gypsum, or plaster of Paris.

H. Production, refining, or storage of petroleum or other flammable liquids.

I. Municipal water and wastewater treatment facilities.

J. Outdoor storage yards.

K. Manufacture and processing of leather goods, including tanneries.

L. Wireless communication towers.

M. Billboards

SECTION 13.4 SITE DEVELOPMENT REQUIREMENTS

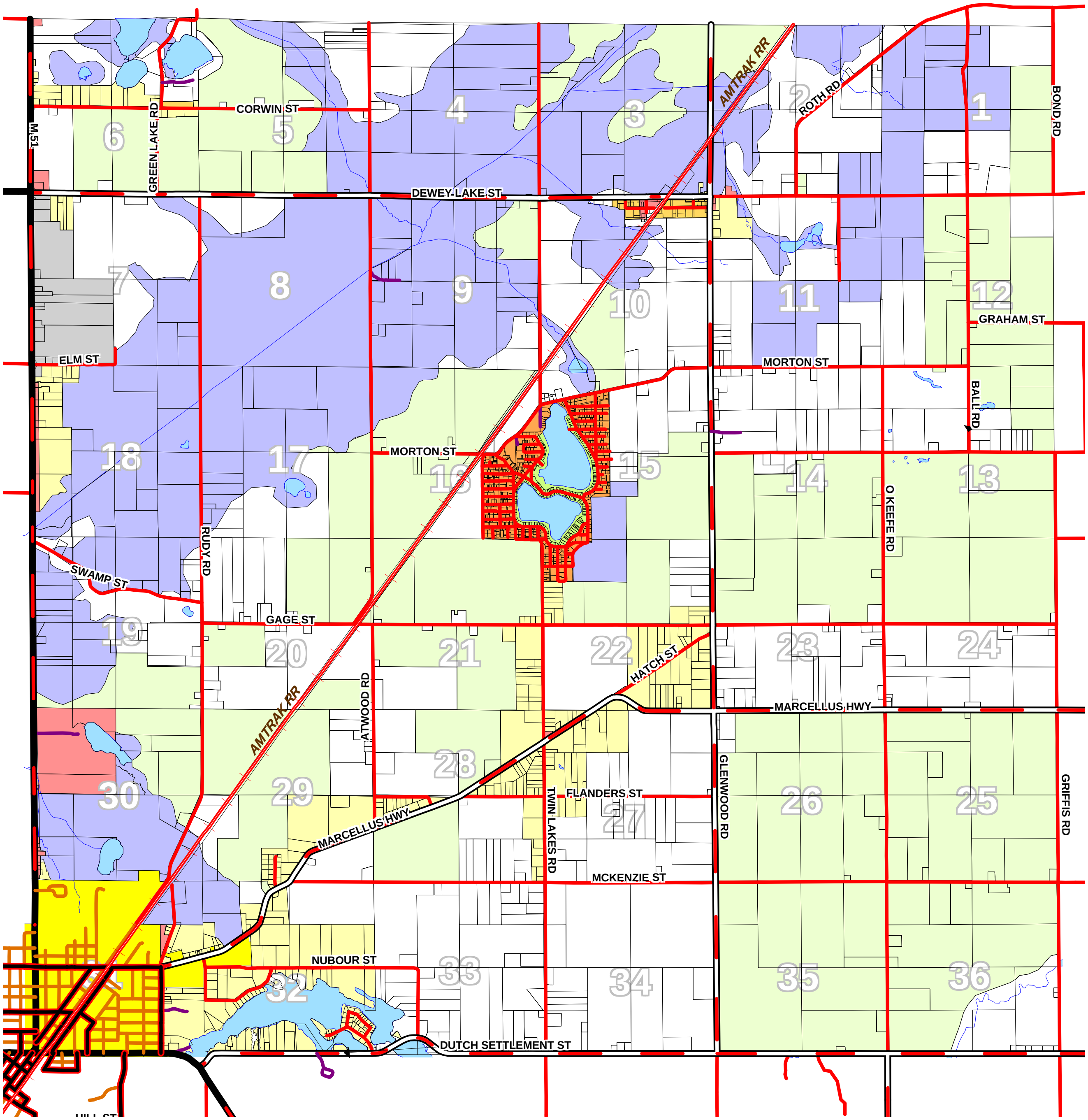
All Permitted Uses and Special Land Uses are subject to the following Site Development Requirements:

A. Supplemental Regulations

Setbacks, Height, Area, & Lot Dimension Requirements	See Chapter 17
Special Land Uses, Site Plan Review	See Chapter 19, Section 19.1
Landscaping	See Chapter 19, Section 19.2
Parking	See Chapter 19, Section 19.3
Signs	See Chapter 19, Section 19.4

B. Sidewalks may be required on all sides of the property abutting a public street, in accordance with City standards.

C. All lots or parcels shall be served by public water and sewer.



WAYNE TOWNSHIP

ZONING MAP

Adopted July 1996
Updated 2005

Zoning Legend

- A-1 Prime Agricultural
- A-2 General Agricultural
- C-1 Neighborhood Commercial
- L-1 Light Industrial
- LR-1 Low Density Lake Residential
- LR-2 Medium Density Lake Residential
- OSR Open Space & Recreation
- R-1 Single Family Residential
- R-2 Medium Density Residential

Scale: 1 inch equals 4,850 feet

Information contained herein is provided for reference purposes only and should be confirmed with the appropriate local agency. Cass County assumes no responsibility for errors and/or omissions.

Cass County
Information Systems
Kerry Collins, Director
(269) 445-4432

Appendix B

Grant and Declaration of Easement and Restrictive Covenant

37981 Pages: 46 L: 991 P: 446
RECORDED Cass County, Michigan
Barbara Runyon, Register of Deeds
03/16/2009 01:06 PM
Receipt #27015 Fee: $149.00 ERW

REC'D CASS CO. ROD
2009 MAR 16 PM 12: 59

GRANT AND DECLARATION OF EASEMENT AND RESTRICTIVE COVENANT

This Grant and Declaration of Easement and Restrictive Covenant ("Grant and Declaration") is made and shall be recorded in the records of the Cass County Register of Deeds for the purpose of providing for the protection of public health, safety and welfare, and the environment by restricting the uses of the subject property and providing access for performing environmental investigation, remediation and monitoring activities.

WHEREAS, **Prairie Ronde Realty Company**, with an address of Prairie Ronde Realty Company, c/o National Tube Holding Co., Inc., 303 Massey Building, 2025 Third Avenue North, Birmingham, Alabama 35203 ("Grantor") is the owner of certain property located at 415 East Prairie Ronde Street, Dowagiac Michigan, more particularly described in Exhibit A attached hereto and made a part hereof (the "Property");

WHEREAS, the Property and the improvements thereon (the "Site") were formerly used for or associated with manufacturing operations, and the Site has been identified as a "facility", as that term is defined in Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, MCL 324. 20102 et seq. ("NREPA");

WHEREAS, the Site is subject to both (i) a 2006 United States Environmental Protection Agency ("EPA") Administrative Order on Consent (AOC), U.S. EPA Docket No. RCRA-05-2006-0011, under Section 3008(h) of the Solid Waste Disposal Act, as amended, commonly referred to as the Resource Conservation and Recovery Act of 1976 or RCRA, a copy of which is attached hereto as Exhibit B, and (ii) a Michigan Department of Environmental Quality ("MDEQ") Consent Judgment that requires remediation activities at the Site, Case No. 83-10349-CE, In the Circuit Court for the County of Cass, "Kelley v. Sundstrand Heat Transfer, Inc.", dated 12-7-1987, a copy of which is attached hereto as Exhibit C, (together, the "Remediation Orders");

WHEREAS, Grantor is obligated to perform remediation activities and operation and maintenance of the Operating System (defined herein) under the Remediation Orders ("Remediation Activities"), and information pertaining to such Remediation Activities is on file with the EPA Region 5 and with the MDEQ;

STATE OF MICHIGAN,
County of Cass, } ss

I, Barbara Runyon, Cass Co. Clerk/Register, do hereby certify that the same is an exact copy of an instrument recorded in this office in Liber 991 of Cass County Register of deeds Records Page 446-491 and of the whole of such record as the same appears in this office.

In Testimony Whereof, I hereunto set my hand and affix the seal of said office, at Cassopolis, Michigan, this 16 day of March 2009

Barbara Runyon/rg
Clerk/Register
Cass County, Michigan

UTCL1 - 104962

WHEREAS, Hamilton Sundstrand Dowagiac, Inc., formerly known as Sundstrand Dowagiac, Inc., ("Hamilton Dowagiac"), a subsidiary of Hamilton Sundstrand Corporation, formerly known as Sundstrand Corporation, ("Hamilton"), which is itself a subsidiary of United Technologies Corporation ("UTC"), is a former owner of the Site and a party to the MDEQ Consent Judgment;

WHEREAS, Grantor has executed and delivered this Grant and Declaration to provide assurances to Hamilton Dowagiac, Hamilton and UTC that the Property will be used and managed with due regard to protection of public health, safety and welfare, and the environment and of the performance by the *Grantor* of Remediation Activities which the Grantor is obligated to perform; and

WHEREAS, Grantor supplied to Hamilton Dowagiac, pursuant to the terms of certain Real Estate Sales Contract and Agreement on Environmental Matters dated as of September 26, 1995 (the "Contract"), a copy of which is recorded with the Cass County Register of Deeds in Liber 597 at Page 815, a letter of credit to secure the performance of Grantor's obligations under said Contract, and Hamilton Dowagiac is willing to release said letter of credit provided that Grantor gives this Grant and Declaration.

NOW THEREFORE, to implement the purpose and intent of this Grant and Declaration, Grantor, in consideration of the premises and other good and valuable considerations including release of the above-mentioned letter of credit, hereby gives and grants to:

Hamilton Sundstrand Dowagiac, Inc., , a Delaware corporation, with an office and place of business at One Hamilton Road, Windsor Locks, Connecticut 06096-1010;

Hamilton Sundstrand Corporation, a Delaware corporation, with an office and place of business at One Hamilton Road, Windsor Locks, Connecticut 06096-1010, and

United Technologies Corporation, a Delaware corporation, with an office and place of business at One Financial Plaza, Hartford, CT 06101 (collectively, the Grantees")

and their respective successors and assigns, the following easements and restrictive covenants and declares that the Property as described in Exhibit A shall hereinafter be bound by, held, sold and conveyed subject to the restrictions, which shall run with the Property in perpetuity in favor of Grantees and their respective successors and assigns, and be binding on Grantor and all parties having any right, title or interest in the Property, or any part thereof, their heirs, successor and assigns and any persons leasing, occupying or using the Property:

1. Restrictions on Use and Occupancy.

(a) The Property shall not be used for any purpose other than industrial, warehouse and commercial purposes that under applicable law do not require the Property to meet environmental clean-up or remediation standards for residential uses. Without limiting the generality of the foregoing, the Property shall not be used for any of the following uses: single or multi-family residential, school, daycare, group home, nursing home, hospital, meeting hall, church or other place of congregation or worship, hotel, motel or lodging, playground or other residential use.

(b) Except to the extent allowed or required under groundwater remediation and monitoring plans that have been approved by Governmental Authority (as herein defined) having jurisdiction and except for use for non-contact cooling and other uses approved by Governmental Authority having jurisdiction, no surface water at, on, or under the Property and no subsurface water shall be used for human consumption, irrigation or any other purpose that might bring it into contact with humans or animals.

(c) No underground storage tanks or piping for petroleum or other hazardous substances or compounds shall be maintained, used or installed in, at on or under the Property.

(d) There shall be no use at or on the Property of any chlorinated solvents or any other chemicals or compounds that have breakdown products similar to breakdown products of chlorinated solvents.

(e) No new building or other structure shall be placed on the Property unless constructed with vapor intrusion protection that shall be protective from intrusion of soil and groundwater vapors ("Vapor Protection System") of the occupants who could be expected to utilize such building or structure in light of the contemplated use of such building or other structure and in accordance with a Vapor Protection System design which shall have been approved in writing by UTC, such design approval not to be unreasonably withheld or delayed.

(f) All use of and activities on the Property and in and about the buildings and structures thereon shall be conducted so that there shall be no material interference with Remediation Activities then being conducted or reasonably anticipated to be conducted at the Property. In particular, and without limiting the generality of the foregoing, no buildings or other structures or improvements or alterations thereof shall be constructed, erected or maintained on the Property and no activities, use, operation or occupancy of the Property shall be conducted in such a way as to materially interfere with the operation of the "Remediation Operating System", as defined herein. For the purposes of this Grant and Declaration, the term "Remediation Operating System" means all soil vapor extraction wells and related equipment, purge wells and related equipment, all groundwater wells, monitoring wells, or other environmental wells, groundwater pump and treatment system, and groundwater and/or soil remediation facilities, including without limitation, any collection trenches, subsurface pipes, equipment buildings, air strippers, groundwater and wastewater ponds and aeration weirs, or other environmental remediation facilities, structures or equipment required for the purpose of conducting the Remediation Activities so long as required by the Remediation Orders, as the same may be amended or supplemented, or as otherwise required by Governmental Authority.

(g) In response to a request from the then owner of the Property, Grantees may, in their sole discretion and on such terms and conditions as Grantees deem necessary or appropriate, agree to allow portions of the Remediation Operating System to be relocated or modified to accommodate the operations or activities at the Property of the then owner of the Property. Without limiting the discretion of the Grantees as provided in the preceding sentence, Grantee may condition such agreement on the prior written consent to the relocation or modification from the EPA, MDEQ and/or other governmental authorities having jurisdiction, on the then owner reimbursing all costs incurred by the Grantees in considering, obtaining approval for and administering and supervising and implementing the relocation or modification, on the relocation or modification being done in accordance with detailed plans that shall have first been approved by the Grantees in writing, and, if so required by Grantees, that the then owner shall have first deposited with Grantees the costs to be reimbursed to Grantees hereunder as a condition of the giving of the approval of Grantees to the relocation or modification. This provision does not modify the existing environmental cost-sharing agreement between Grantor and Grantees as provided in that certain Confidential Settlement Agreement and Release, dated June 2, 2006.

(h) Attached hereto as Exhibit D and made a part hereof is a survey showing the Property that is subject to this Grant and Declaration.

2. Undertakings of Grantor and Successors in Title.

(a) Grantor and its successors in title and any and all occupants of the Property shall cooperate with Grantees, as Grantees may reasonably designate, in connection with any Remediation Activities that the Grantees, or either of them, or their designees may undertake at the Property.

(b) If deemed necessary or appropriate by the Grantees in order to accomplish the goals of the Remediation Orders, as the same may be amended or modified, the Grantor and its successors in title shall grant to EPA and/or MDEQ such restrictive covenants and other institutional controls of such form and substance as the applicable agency may require or as shall be designated by Grantees and obtain such subordinations and/or releases to the grant of such restrictive covenants of those having an interest in the Property as EPA and/or MDEQ and/or Grantees may require. Grantor hereby irrevocably appoints Grantees as Grantor's attorney-in-fact, coupled with an interest, to act on behalf of Grantor to execute and record any such grant of restrictive covenant or other institutional control and take any action to implement the same, in the event Grantor or any successor in title shall fail or refuse to comply with the requirements of this subparagraph.

(c) Any and all soil, soil cuttings, soil moisture, surface water, groundwater, and/or other potentially contaminated construction debris or materials discovered, identified and/or generated by construction or other activities on the Property shall be properly handled, characterized, segregated, stored, managed and disposed of in accordance with all applicable environmental laws, all at the sole cost and expense of the then owner of the Property and in accordance with the requirements and direction of the Grantees. This provision does not modify the existing environmental cost-sharing agreement between Grantor and Grantees as provided in that certain Confidential Settlement Agreement and Release, dated June 2, 2006.

(d) Except to the extent necessary for Grantor or its affiliates to comply with the Remediation Orders, Grantor, its successors and assigns in title and its and their respective successors and assigns shall refrain from communicating with any Governmental Authority (as hereinafter defined) regarding or concerning, or that may affect, any Remediation Activities at, on, near or under the Property. All correspondence, discussions and negotiations with, and submissions to, any Governmental Authority concerning, or that may affect, the Remediation Activities shall be controlled by and coordinated with the Grantees. Notwithstanding the foregoing, nothing in this Restrictive Covenant shall preclude the then owner from making any filing or other communication necessary to satisfy a legal obligation. As used in this Grant and Declaration, the term "Governmental Authority" means all federal, state or local governmental bodies, instrumentalities or agencies, including all political subdivisions of the State of Michigan having jurisdiction over environmental matters and/or Remediation Activities.

(e) Grantor and its successors in title shall be responsible for any damage or injury to the Remediation Operating System, whether caused by or resulting from any act or omission of the then owner of the Property or any occupant or any other person, but not if resulting solely from an act or omission of any or all of the Grantees.

3. Ownership of Remediation Operating System.

At least thirty (30) days prior to any transfer of ownership of the Property, the transferor shall give written notice to the Grantees, which notice shall identify the proposed transferee and describe with reasonable specificity the arrangements between the transferor and the proposed transferee for accomplishment of the Remediation Activities. Grantees, at their option in their sole discretion, shall have the right to require that title and ownership of the Remediation Operating System be transferred to Grantees, free and clear of all liens, encumbrances and security interests, although Grantees may allow the transferor and/or the transferee to continue to use and operate the Remediation Operating System on such terms and conditions as shall be specified by Grantees in their sole discretion.

4. Easement and Right of Access.

(a) Grantees and their successors and assigns are hereby granted an easement and right of entry into and on the Property for themselves and their employees, contractors, agents, consultants, upon reasonable notice and at reasonable times (in light of the purpose of the entry), for the purpose of determining compliance with the terms of this Grant and Declaration, to perform any Remediation Activities that Grantees may be obligated to perform or may, in their sole discretion, choose to perform and, for such purposes, to utilize the Remediation Operating System and to make and maintain other installations on the Property, provided, however, that such access shall not unreasonably disrupt or interfere with the lawful use and operation of the Property by the occupants thereof.

(b) The EPA and the MDEQ are hereby granted an easement and right of entry into and on the Property for themselves and their employees, contractors, agents, consultants, upon reasonable notice and at reasonable times (in light of the purpose of the entry), for the purpose of determining compliance with the terms of this Grant and Declaration.

5. Enforcement.

(a) The rights herein granted may be enforced jointly or separately by the Grantees and their respective corporate successors and assigns. In any such action, the prevailing party shall be entitled to recover its costs and reasonable attorney's fees as may be awarded by the Court. Grantor and its successors and assigns shall indemnify and hold Grantees harmless from any loss or damage on account of any violation of or default under the provisions hereof.

(b) The State of Michigan through the MDEQ may enforce the restrictions set forth in this Grant and Declaration by legal action in a court of competent jurisdiction.

6. Limitation of Liability.

The acceptance by Grantees of the rights and benefits granted herein and the retention of a right to do one or more activities does not imply, and is not to be construed, as imposing any liability on the Grantees or, except as expressly provided herein, any duty on the part of Grantees or their respective successors and assigns to perform any such activity.

7. Assignment.

Each of the Grantees and their respective corporate successors and assigns shall have the right to assign some or all of the rights and benefits herein granted to a Governmental Authority to the extent set forth in a written instrument executed by the assignor and recorded with the Cass County Register of Deeds. In connection with any such assignment, the assignor shall give written notice of the assignment (including a copy of the assignment document) to both (i) the then owner of the Property as indicated on the records of the tax assessing authority and at the address for such owner shown in such records and (ii) Prairie Ronde Realty Company.

8. Severability.

If any court of competent jurisdiction determines that any provision of this instrument is invalid or unenforceable, such provision shall be deemed to have been modified automatically to conform to the requirements for validity and enforceability as determined by such court. In the event that the provision invalidated is of such nature that it cannot be so modified, the provision shall be deemed deleted from this instrument as though it had never been included herein. In either case, the invalidity of such provision shall not affect the validity of any other provisions hereof, and all such other provisions shall continue unimpaired and in full force and effect.

9. Amendment or Termination.

This Grant and Declaration may be amended or terminated only with the consent of the Grantees or their corporate successors and assigns having at the relevant time the benefits of the rights herein granted. Provided, however, that, except to the extent otherwise provided in the instrument of assignment, if any rights shall be assigned to a Governmental Authority, no amendment of termination shall be effective unless consented to in writing by the Grantees or their corporate successors.

10. Notices.

(a) Except as otherwise required or allowed herein, any required notice from one party to another under this Grant and Declaration shall be sufficient if such notice is in writing and shall be deemed to have been duly given or sent (a) when received, if dispatched by registered or certified mail (return receipt requested), (b) when received, if delivered in hand, or (c) on the following business day, if dispatched by a reputable overnight courier which requires a signature of the receiving party, in each case to the party intended at its address as follows:

If to any of Grantees, including Hamilton Sundstrand Dowagiac, Inc., Hamilton Sundstrand Corporation, or United Technologies Corporation:

Office of the General Counsel
United Technologies Corporation
One Financial Plaza, Mailstop 524-Legal
Hartford Connecticut 06101

If to Grantor, Prairie Ronde Realty Company:

The President
National Tube Holding Co., Inc.
303 Massey Building
2025 Third Avenue North
Birmingham Alabama 35203

(b) Any of the parties may change the address to which notices may be sent by written notice to the other party, provided, however, that no such change of address shall be binding unless notice thereof has been recorded in the same land records as this Grant and Declaration.

11. Authority to Execute Grant and Declaration.

The undersigned person executing this Grant and Declaration represents and certifies that he or she is duly authorized and has been empowered to execute and deliver this Grant and Declaration on behalf of the Grantor.

12. Binding Effect.

It is the intention of the Grantor that this Grant and Declaration shall touch and concern the Property, run with the land and with the title to the Property, and shall apply to and be binding upon and inure to the benefit of Grantor and Grantees and to any and all parties hereafter having any right, title or interest in the Property or any part thereof. This Grant and Declaration shall continue in perpetuity, unless otherwise modified in writing by the Grantees.

IN WITNESS WHEREOF, Grantor acting by and through THOMAS H. FOX JR, its CHAIRMAN & CEO has caused this Grant and Declaration to be executed on this 10th day of March, 2009.

Signed in the presence of:

Virginia J. Matson

Prairie Ronde Realty Company

By: [signature]

Its CHAIRMAN & CEO

State of ALABAMA)
) ss: BIRMINGHAM
County of JEFFERSON)

The foregoing instrument was acknowledged before me this 10th day of MARCH, 2009 by THOMAS H. FOX JR., chairman and ceo (name of officer or agent, title or officer or agent) of Prairie Ronde Realty Company, a MICHIGAN (state or place of incorporation) corporation, on behalf of the corporation.

Notary Public

Jefferson County, Alabama

Commission Expires: 8-14-2012

Acceptance

Hamilton Sundstrand Dowagiac, Inc. hereby accepts the rights and benefits herein granted.

Signed in the presence of:

Beverly Holt

Kathleen M. McFadden

Hamilton Sundstrand Dowagiac, Inc.

By: Peter F. Longo
Peter F. Longo
Its President & Treasurer

State of Connecticut)
) ss: Windsor Locks
County of Hartford)

The foregoing instrument was acknowledged before me this 11th day of MARCH, 2009 by PETER F. LONGO, President Treasurer (name of officer or agent, title or officer or agent) of Hamilton Sundstrand Dowagiac Inc., a Delaware corporation, on behalf of the corporation.

Dana E. Morse, Notary Public, My Commission Expires Nov. 30, 2011

Hamilton Sundstrand Corporation hereby accepts the rights and benefits herein granted.

Signed in the presence of:

Beverly Holt

Kathleen M. McFadden

Hamilton Sundstrand Corporation

By: Peter F. Longo
Peter F. Longo
Its VP Finance & CFO

State of Connecticut)
) ss: Windsor Locks
County of Hartford)

The foregoing instrument was acknowledged before me this 11th day of MARCH, 2009 by PETER F. LONGO, VP Finance & CFO (name of officer or agent, title or officer or agent) of Hamilton Sundstrand Corporation, a Delaware corporation, on behalf of the corporation.

DANA E MORSE
Notary Public
My Commission Expires: NOV 30, 2011

UTCLI - 104962

United Technologies Corporation hereby accepts the rights and benefits herein granted.

Signed in the presence of:

Deborah Sozanski

Kathleen M. McFadden

United Technologies Corporation

By: W. F. Leikin
William F. Leikin
Its Assistant General Counsel

State of Connecticut)
) ss: Hartford
County of Hartford)

The foregoing instrument was acknowledged before me this 12th day of March, 2009 by William F. Leikin (name of officer or agent, title or officer or agent) of United Technologies Corporation, a Delaware corporation, on behalf of the corporation.

Jamie Lynn Mattese
Notary Public
My Commission Expires: 3/31/09

Drafted, in consultation with Michigan counsel, by and after Recording Return to:

Edward S. Hill, Esq.
Robinson & Cole, LLP
280 Trumbull Street
Hartford, CT 06103-3597

Exhibit A

That part of the Northwest fractional 1/4 and that part of the Northeast 1/4 of fractional Section 31, Township 5 South, Range 15 West, City of Dowagiac, described as:

Beginning at the Southeast corner of Lot 9, Dr. McMaster's Addition to the City of Dowagiac, according to the plat thereof as recorded in Liber 1 of Plats, Page 26, Cass County Records; said beginning point being 414.80 feet West of and 66.0 feet North of the center of said Section 31; thence South 35 degrees 52 minutes 38 seconds West 40.73 feet to the north line of Prairie Ronde Boulevard (formerly Boulevard Street); thence West on said North line, 186.57 feet to the East line of Louise Avenue; thence North 00 degrees 39 minutes 27 seconds West (deed North 00 degrees 53 minutes 00 seconds West) on said East line 918.86 feet to the South line of an alley; thence East on the South line of said alley, 132.0 feet; thence North 0 degrees 39 minutes 27 seconds West (deed North 00 degrees 53 minutes 00 seconds West) 208.0 feet to the South line of Lot 104 of said Addition; thence West on the South line of Lots 104 and 103 of said Addition, 132.0 feet; thence North 0 degrees 39 minutes 27 seconds West (deed North 00 degrees 53 minutes 00 seconds West) on the East line of Louise Avenue, 194.0 feet to the North line of Columbus Street of said Addition; thence West 8.04 feet to a point being 24.75 feet East of the West line of the East 1/2 of the East 1/2 of the Northwest fractional 1/4 of said Section; thence North 00 degrees 33 minutes 12 seconds West (deed North 00 degrees 53 minutes 00 seconds West) 75.0 feet; thence East 140.26 feet; thence North 00 degrees 33 minutes 12 seconds West (deed North 00 degrees 53 minutes 00 seconds West) 90.0 feet; thence West 140.26 feet, thence North 00 degrees 33 minutes 12 seconds West (deed North 00 degrees 53 minutes 00 seconds West) 783.79 feet to the North line of the South 1/2 of the Northeast 1/4 of the Northeast 1/4 of the Northwest 1/4 of said Section 31; thence South 89 degrees 55 minutes 28 seconds East, on said North line, 627.11 feet (deed South 89 degrees 57 minutes 00 seconds East, 633.59 feet) to the North and South 1/4 line of said Section 31; thence South 00 degrees 45 minutes 32 seconds East on said North and South 1/4 line 675.18 feet (deed South 00 degrees 53 minutes 00 seconds East 676.26 feet); thence South 54 degrees 26 minutes 25 seconds East, 595.92 feet (deed South 54 degrees 37 minutes 00 seconds East, 596.45 feet) to the Westerly line of West Railroad Street; thence South 35 degrees 52 minutes 38 seconds West on said Westerly line, 1498.23 feet (deed South 35 degrees 44 minutes 00 seconds West, 1496.47 feet) to the point of beginning. The above described land includes Lots 9, 10, 19 to 23, inclusive, 36 to 39 inclusive, of Dr. McMaster's First Addition, according to the plat thereof as recorded in Liber 1 of Plats, Page 26, Cass County Records, AND ALSO Lots 52 to 63 inclusive, Lots 72 to 78 inclusive, Lots 89 to 94 inclusive, Lots 103 to 112, inclusive, of Dr. McMaster's Second Addition, according to the plat thereof as recorded in Liber 1 of Plats, Page 32, Cass County Records. ALSO INCLUDING the vacated streets in said Additions lying East of Louise Avenue, and also includes the vacated alley lying between Lots 73 and 78 of said Second Addition.

Also the following described premises situated in the City of Dowagiac, County of Cass, and State of Michigan, more particularly described as follows, to–wit (Per Warranty Deed Liber 961, Pg. 117):

Beginning at a point 108 feet North of the intersection of the centerline of Columbus Street and the centerline of Louise Avenue in the City of Dowagiac, in the Northwest Quarter of Section 31, Township 5 South, Range 15 West, City of Dowagiac; thence North on the centerline of Louise Avenue extended 90 feet; thence South 89° 14' East parallel to Columbus Street, 165 feet; thence South 90 feet; thence North 89° 14' West, 165 feet to the place of beginning, except the West 24.75 thereof.

Bearings referenced from a Quit Claim Deed Recorded in Liber 316, Page 913 where the East and West quarter line bears West.

Exhibit B

[Copy of Administrative Order on Consent under Section 3008(h) of the Solid Waste Disposal Act, as amended, U.S. EPA Docket No. RCRA-05-2006-0011]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

JUN 0 2 2006

REPLY TO THE ATTENTION OF:
DE-9J

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Tom Fox, Chairman and CEO
National Tube Holding Company, Inc.
Massey Building, Suite 210
Birmingham, AL 35203

RE: National Copper Products
Dowagiac, MI
EPA ID # MID 005 068 507
RCRA-05-2006-0011

Dear Mr. Fox:

I am enclosing a fully executed copy of the 3008(h) Administrative Order on Consent covering the completion of the corrective action work at the subject facility. This performance-based agreement will provide the flexibility that you need to complete the work expeditiously. In addition, we expect that it will lead to better communication between our two organizations and the public. We look forward to working cooperatively with your staff on this project. Your spirit of cooperation in utilizing this new approach is appreciated.

In accordance with Section V of the agreement, I am hereby designating Jill Groboski as the U.S. EPA project manager for this project. If you have any questions, please contact her at (312) 886-3890.

Sincerely yours,

Margaret M. Guerriero, Director
Waste, Pesticides and Toxics Division

Enclosure

6-7-06

cc: Charles Denton, Varnum, Riddering, Schmidt, Howlett
Frank Ballo, Michigan Department of Environmental Quality

NP5006001

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

IN THE MATTER OF:

National Copper Products, Inc., and Prairie Ronde Realty Company	)))	ADMINISTRATIVE ORDER ON CONSENT U.S. EPA Docket No: RCRA-05-2006-0011
415 E. Prairie Ronde Street Dowagiac, MI EPA ID#: MID 005 068 507	))))))	Proceeding under Section 3008(h) of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6928(h).
Respondent.	)	

I. JURISDICTION

1. The Administrator of the United States Environmental Protection Agency ("U.S. EPA") is issuing this Administrative Order on Consent ("Order") to National Copper Products, Inc. and Prairie Ronde Realty Company (collectively referred to as "Respondents") under Section 3008(h) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act of 1976 ("RCRA"), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. §6928(h). The Administrator has delegated the authority to issue orders under Section 3008(h) of RCRA to the Director of the Waste, Pesticides and Toxics Division, U.S. EPA Region 5.

2. At various times, Respondents National Copper Products, Inc. (hereinafter, National Copper) and Prairie Ronde Realty Company (hereinafter, PRR), have owned or operated a copper tubing plant at 415 E. Prairie Ronde Street, Dowagiac, Michigan (hereinafter "Facility"). This plant is located on the northeast side of the City of Dowagiac, Cass County, in southwestern Michigan. The plant uses billets of pure copper to cast and draw them into various sizes of tubing.

3. Respondents are also Defendants or Intervenor-Defendants in a State of Michigan Department of Environmental Quality ("MDEQ") lawsuit brought in the Cass County Circuit Court as Case No. 83-10349-CE, in which a Consent Judgment was entered on or about December 7, 1987, addressing the remediation of historical environmental contamination at and from the Facility, including but not limited to hazardous waste management.

4. Respondents agree not to contest U.S. EPA's jurisdiction to issue this Order, U.S. EPA's jurisdiction to enforce its terms, or U.S. EPA's jurisdiction to impose sanctions for

violations of the Order.

5. Except as expressly provided in this Order, each of the Respondents waives any rights to request a hearing on this matter pursuant to Section 3008(b) of RCRA and 40 C.F.R. Part 24, and consents to the issuance of this Order without a hearing under Section 3008(b) of RCRA as a Consent Order issued pursuant to Section 3008(h) of RCRA.

II. DEFINITIONS

6. This Order incorporates the definitions in RCRA, 42 U.S.C. §§ 6901 - 6922k, and the regulations promulgated under RCRA unless otherwise specified.

III. PARTIES BOUND

7. This Order applies to and binds U.S. EPA, Respondents and their agents, successors, assigns, trustees, receivers, and all persons, including but not limited to contractors and consultants, acting on behalf of any of the Respondents. Respondents will be responsible for and liable for any violations of this Order, regardless of Respondents' use of employees, agents, contractors, or consultants to perform work required by this Order.

8. No change in ownership or corporate or partnership status relating to the Facility will alter Respondents' obligations under this Order. Any conveyance of title, easement, or other interest in the Facility, or a portion of the Facility, will not affect Respondents' obligations under this Order. A Respondent who so transfers its interest in the Facility shall give written notice of this Order to any successor in interest prior to transferring ownership or operation of the Facility or a portion thereof, and will notify U.S. EPA in writing within five days of the transfer. This written notice shall describe how such Respondent has assured that, despite the transfer, all institutional controls required now or in the future for the Facility will be implemented and maintained. This Paragraph will not apply if this Order has been terminated as to the Facility or any relevant portion of the Facility.

IV. DETERMINATIONS

9. After consideration of the Administrative Record, the Director, Waste, Pesticides and Toxics Division, U.S. EPA, Region 5, has made the following conclusions of law and determinations (collectively "determinations") without trial or adjudication:

a. Each of the Respondents is a "person" within the meaning of Section 1004(15) of RCRA.

b. Each of the Respondents is or was the owner or operator of the Facility that has operated under interim status subject to Section 3005(e) of RCRA.

c. Closure certification of the interim status storage areas at the Facility was approved December 15, 1993, prior to purchase of the Facility by Respondents National Copper and PRR, however, the Facility is still subject to RCRA corrective action requirements.

d. Certain wastes and constituents found at the Facility are hazardous wastes and/or hazardous constituents pursuant to Sections 1004(5) and 3001 of RCRA and 40 C.F.R. Part 261.

e. There is or has been a release of hazardous wastes or hazardous constituents into the environment from the Facility.

f. The actions required by this Order are necessary to protect human health or the environment.

V. PROJECT MANAGER

10. Respondents must designate a Project Manager to represent the Respondents as a group. U.S. EPA shall also designate a Project Manager. The parties to this Order shall notify each other in writing of the Project Manager selected within 14 days of the effective date of this Order. Each Project Manager will be responsible for overseeing the implementation of this Project. The parties must provide prompt written notice whenever they change Project Managers.

VI. WORK TO BE PERFORMED

11. Pursuant to Section 3008(h) of RCRA, Respondents agree to and are hereby ordered to perform the actions specified in this Section of the Order, in the manner and by the dates specified here. Respondents represent that they have the technical and financial ability to carry out corrective action at the Facility. Respondents must perform the work undertaken pursuant to this Order in compliance with RCRA and other applicable federal and state laws and their implementing regulations, and consistent with all relevant U.S. EPA guidance documents as appropriate to the Facility. The U.S. EPA may coordinate with the MDEQ to ensure that activities performed under this Order are consistent with the standards and requirements of Part 111 (Hazardous Waste Management) of the Michigan Natural Resources and Environmental Protection Act ("NREPA") and other applicable state laws and regulations. In developing the work to be performed under this Order the parties will refer to cleanup criteria established by the MDEQ, including those established by Part 201.

12. Respondents must identify and define the nature and extent of all releases of hazardous waste and hazardous constituents at or from the Facility. This responsibility includes

the following requirements:

a. Provide to U.S. EPA, no later than July 31, 2005, an update to the 2002 Current Conditions Report entitled Phase II Current Conditions Report, National Copper Facility Dowagiac, Michigan, March 2002. The updated information shall include any recent sampling data from the Facility, as provided for in the Respondents' January 13, 2005, Work Plan, and a summary of the historic operations and physical setting of the Facility. The Current Conditions Report must describe, at a minimum, conditions at all locations specified in the report, and must further identify and describe any other past or present locations at the Facility where, to any Respondent's knowledge, past treatment, storage, or disposal of hazardous waste or hazardous constituents occurred.

b. After reviewing the updated Current Conditions Report, perform an investigation to identify the nature and extent of any releases of hazardous waste and/or hazardous constituents at or from the Facility which may pose an unacceptable risk to human health or the environment, and provide a report of such investigation to U.S. EPA ("supplemental investigation report"). The supplemental investigation report must also describe the nature and extent of any releases of hazardous waste and hazardous constituents at or from the Facility which do not pose an unacceptable risk to human health and the environment, and provide the basis for those conclusions, including an evaluation of the risks. Respondents may prepare and submit the report in two phases to provide timely support for the demonstrations described in paragraph 14, below, and for the determinations and proposal described in paragraph 16, below.

13. Respondents may proceed with remedial actions to limit the site investigation or risk assessment activities necessary to complete the work as defined in Paragraphs 14 through 16, below. Respondents have implemented a groundwater remedial system, the operation of which has been overseen by MDEQ, in accordance with the Michigan State Court Consent Judgment entered December 1987. Respondents will continue to implement interim corrective measures, such as the groundwater remedial system consistent with the MDEQ Consent Judgment described in the Work Plan attached hereto as Attachment A.

14. Respondents must demonstrate, through submitting an Environmental Indicators Report, that human health threats and groundwater migration are under control by June 30, 2007, and March 31, 2008, respectively, and by performing any other necessary activities to control human health threats and groundwater migration, consistent with this Section. Respondents must specifically demonstrate that:

a. Current human exposures to contamination at or from the Facility are under control by June 30, 2007. That is, significant or unacceptable exposures do not exist for all media known or reasonably suspected to be contaminated with hazardous wastes or hazardous constituents above risk-based levels, for which there are complete pathways between contamination and human receptors.

b. Migration of contaminated groundwater at or from the Facility is stabilized by March 31, 2008. That is, the migration of all groundwater known or reasonably suspected to be contaminated with hazardous wastes or hazardous constituents above acceptable levels is stabilized to remain within any existing areas of contamination as defined by monitoring locations designated at the time of the demonstration. In addition, any known discharge of groundwater to surface water is either insignificant or currently acceptable according to an appropriate interim assessment. Respondents must collect monitoring and measurement data in the future as necessary to verify that migration of contaminated groundwater is stabilized.

15. To prepare for and provide the demonstrations required by Paragraph 14, above, Respondents must:

a. Determine appropriate risk screening criteria under current use scenarios and provide the basis and justification for the use of these criteria.

b. Determine current unacceptable risks to human health and the environment and describe why other identified risks are acceptable.

c. Control unacceptable current human exposures that Respondents identify. This includes performing any corrective actions or other response measures ("corrective measures") necessary to control current human exposures to contamination to within acceptable risk levels.

d. Stabilize the migration of contaminated groundwater. This includes implementing necessary corrective measures to stabilize the migration of contaminated groundwater.

e. Conduct groundwater monitoring to confirm that any contaminated groundwater remains within the original area of contamination as defined by monitoring locations designated at the time of the demonstration.

f. Prepare a report, either prior to or as part of the Environmental Indicators Report, that describes and justifies any interim actions performed to meet the requirements of this Section, including sampling documentation, construction completion documentation and/or confirmatory sampling results.

16. Respondents must submit for approval to U.S. EPA by no later than June 30, 2009, a Proposal identifying the final corrective measures necessary to protect human health and the environment from all current and future unacceptable risks due to releases of hazardous waste or hazardous constituents at or from the Facility (the "Final Corrective Measures Proposal"). The Proposal must describe all corrective measures implemented at the Facility since the Effective Date of this Order. It must also include a description of all other final corrective measures that Respondents evaluated, and a detailed explanation of why Respondents preferred the proposed final corrective measures over such other evaluated measures, including cost estimates for both the final corrective measures selected by Respondents and the other evaluated measures. The Proposal must also include a detailed schedule to construct and implement the final corrective measures, and a schedule for the submittal of a Final Construction Completion Report. Respondents must complete as much of the initial construction work as practicable within one year after U.S. EPA selects the final corrective measures. Respondents must complete all final corrective measures within a reasonable period of time to protect human health and the environment.

17. As part of developing its Proposal, Respondents must propose appropriate risk screening criteria, cleanup objectives, and points of compliance under current and reasonably expected future land use scenarios and provide the basis and justification for these decisions.

18. U.S. EPA may request supplemental information from Respondents if U.S. EPA determines that the Proposal and supporting information do not provide an adequate basis to select final corrective measures that will protect human health and the environment from the release of hazardous waste and hazardous constituents at or from the Facility. Respondents must provide any supplemental information that U.S. EPA requests in writing and within the time frames specified in such requests for information.

19. U.S. EPA will provide the public with an opportunity to review and comment on the Final Corrective Measures Proposal, including a detailed description and justification for the Proposal (the "Statement of Basis"). Following the public comment period, U.S. EPA will select the final corrective measures, and will notify Respondents and the public of the decision and rationale in a "Final Decision and Response to Comments" ("Final Decision").

20. Upon notice by U.S. EPA, Respondents must implement the final corrective measures selected in U.S. EPA's Final Decision according to the schedule in the Final Decision.

21. Reporting and other requirements:

a. Respondents must establish a publicly accessible repository in Cass County, Michigan, for information regarding site activities, and must also conduct public outreach and involvement activities.

b. Respondents must provide quarterly progress reports to U.S. EPA. The quarterly progress reports must identify and describe all work performed to date, all data collected, any problems encountered, the project schedule, and the percentage of the project completed.

c. The parties will communicate frequently and in good faith to assure successful completion of the requirements of this Order, and will meet at the Facility or other mutually agreed location on at least a semi-annual basis to discuss the work proposed and performed under this Order. U.S. EPA will also consult regularly with the MDEQ concerning the activities conducted and decisions made under this Order.

d. Respondents must provide a Final Construction Completion Report documenting all work that has been and will be performed pursuant to the schedule in U.S. EPA's Final Decision within 1 year of U.S. EPA issuing the Final Decision for this Facility.

e. If ongoing monitoring, operation or maintenance is required after construction of the final corrective measures, Respondents must include an Operations and Maintenance ("O&M") Plan in the Final Construction Completion Report. Respondents must revise and resubmit the report in response to U.S. EPA's written comments, if any, by the dates U.S. EPA specifies. Upon U.S. EPA's written approval, Respondents must implement the approved O&M Plan according to the schedule and terms of the Plan.

f. Any risk assessments that Respondents conduct must estimate human health and ecological risk under reasonable maximum exposure for both current and reasonably expected future land use scenarios. In conducting the risk assessments, Respondents shall follow the Risk Assessment Guidance for Superfund ("RAGS"), Volume I - Human Health Evaluation Manual (Part A), Interim Final (EPA-540-1-89-002), OSWER Directive 9285.7-01A, December 1, 1989; and Risk Assessment Guidance for Superfund (RAGS), Volume I - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments), Interim, (EPA 540-R-97-033), OSWER Directive 9285.7-01D, January 1998 and any subsequent revisions, and other relevant U.S. EPA guidance. Respondents will use appropriate screening values when screening to determine whether further investigation is required. Appropriate screening values include those derived from Part 201 of NREPA, Federal Maximum Contaminant Levels (found at 40 C.F.R.§ 141), U.S. EPA Region 9 Preliminary Remediation Goals (http://www.epa.gov/region09/waste/sfund/prg/index.htm), U.S. EPA Region 5 Ecological Screening Levels (http://www.epa.gov/reg5rcra/ca/edql.htm), U.S.

EPA Ecological Screening Levels (http://www.epa.gov/ecotox/ecossl/), U.S. EPA Region 3 Risk Based Screening Levels (http://www.epa.gov/reg3hwmd/risk), or RAGS.

g. All sampling and analysis conducted under this Order must be performed in accordance with the Region 5 RCRA Quality Assurance Project Plan Policy (April 1998) as appropriate for the Facility, and be sufficient to identify and characterize the nature and extent of all releases as required by this Order. U.S. EPA may audit laboratories Respondents select or require Respondents to purchase and have analyzed any performance evaluation samples selected by U.S. EPA which are for compounds of concern. Respondents must notify U.S. EPA in writing at least 14 days before beginning each separate phase of field work performed under this Order. At the request of U.S. EPA, Respondents shall provide or allow U.S. EPA or its authorized representative to take split or duplicate samples of any samples Respondents collect under this Order.

22. Project Managers can agree in writing to extend, for 90 days or less, any deadline in this Section. However, extensions of greater than 90 days require obtaining approval from the Director of the Waste, Pesticides and Toxics Division, which approval shall not be unreasonably withheld.

VII. ACCESS

23. Upon reasonable notice, at reasonable times and with valid identification, U.S. EPA, its contractors, employees, and designated U.S. EPA representatives may enter and freely move about the Facility to conduct activities related to this Order. Such activities may include, among other things: interview facility personnel and contractors; review Respondents' progress in carrying out the terms of this Order; conduct tests, sampling, or monitoring as U.S. EPA deems necessary; use a camera, sound recording, or other documentary equipment; and verify the reports and data that Respondents submit to U.S. EPA. Respondents may request that U.S. EPA limit any such activity on the basis of health and safety considerations, trade secret and confidential business information, and other relevant privileges. The Respondents shall permit such persons to inspect and copy all non-privileged photographs and documents, including all sampling and monitoring data, that pertain to work undertaken under this Order and that are within the possession or under the control of any Respondent or its contractors or consultants. The Respondents may obtain split samples, final laboratory results, reports, and copies of any other evidence created by U.S. EPA that is releasable under the Freedom of Information Act.

24. If Respondents must go beyond the Facility's boundary to perform work required by this Order, Respondents must use their best efforts to obtain the necessary access agreements from the present owner(s) of such property within 30 days after any Respondent knows of the need for access. Any such access agreement must provide for access by U.S. EPA and its

designated representatives. Respondents must submit a copy of any access agreement to U.S. EPA's Project Manager upon request. If they do not obtain agreements for access within 30 days, Respondents must notify U.S. EPA in writing within 14 additional days of both the efforts undertaken to obtain access and the failure to obtain access agreements. U.S. EPA may, at its discretion, assist Respondents in obtaining access. Inability to obtain access may constitute a Force Majeure.

25. Nothing in this Section limits or otherwise affects U.S. EPA's right of access and entry under applicable law, including RCRA and the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. §§ 9601-9675.

VIII. RECORD PRESERVATION

26. Respondents must retain, during the pendency of this Order and for at least six (6) years after the Order terminates, all data and all final documents now in any Respondent's possession or control or which come into its possession or control which relate to this Order. Respondents must notify U.S. EPA in writing 90 days before destroying any such records, and give U.S. EPA the opportunity to take possession of any non-privileged documents. Respondents' notice will refer to the effective date, caption, and docket number of this Order and will be addressed to:

Director
Waste, Pesticides and Toxics Division
U.S. EPA, Region 5
77 W. Jackson Blvd.
Chicago, IL 60604-3590

Respondents will also promptly give U.S. EPA's Project Manager a copy of the notice.

27. Within 30 days of retaining or employing any agent, consultant, or contractor ("agents") to carry out the terms of this Order, Respondents shall enter into an agreement with the agents to give Respondents a copy of all data and final non-privileged documents produced under this Order.

28. Respondents shall not assert any privilege claim concerning any data gathered during any investigations or other actions required by this Order.

IX STIPULATED PENALTIES

29. Respondents shall pay the following stipulated penalties to the United States for unexcused violations of this Order:

a. For failure to submit quarterly progress reports by the dates scheduled in Paragraph 21, above: $1,000 for the first 14 days, and $2,000 per day thereafter.

b. For failure to adequately demonstrate that current human exposures are under control by June 30, 2007: $3,000.

c. For failure to adequately demonstrate that groundwater migration is stabilized by March 31, 2008: $3,000.

d. For failure to submit the Final Corrective Measures Proposal in Paragraph 16 by the deadline: $1,000 per day for the first 14 days and $2,000 per day thereafter.

e. For failure to implement, according to the approved schedule, the EPA-selected final corrective measures ("Final Decision") as described in Paragraphs 19 and 20: $3,000 per day for the first 14 days and $6,000 per day thereafter.

f. For failure to submit the Final Construction Completion Report as scheduled in Paragraph 16: $1,000 per day for the first 14 days and $2,000 per day thereafter.

g. For failure to submit the updated information to the Current Conditions Report required in paragraph 12 by June 30, 2005: $500 per day for the first 14 days and $1,000 per day thereafter.

30. Whether or not any Respondent has received notice of a violation, stipulated penalties will begin to accrue on the day a violation occurs, and will continue to accrue until Respondents achieve compliance; however, for items b and c in paragraph 29, above, stipulated penalties will not accrue during the period, if any, beginning 31 days after the date of filing of an Environmental Indicators Report until the date that U.S. EPA notifies Respondents in writing of any deficiency in the required demonstration(s). Separate stipulated penalties for separate violations of this Order will accrue simultaneously.

31. Respondents must pay any stipulated penalties owed to the United States under this Section within 30 days of receiving U.S. EPA's written demand to pay the penalties, unless Respondents invoke the dispute resolution procedures under Section X: Dispute Resolution. A written demand for stipulated penalties will describe the violation and will indicate the amount of penalties due.

32. Interest will begin to accrue on any unpaid stipulated penalty balance beginning 31 days after Respondents receive U.S. EPA's demand letter. Interest will accrue at the current value of funds rate established by the Secretary of the Treasury. Under 31 U.S.C. § 3717, Respondents must pay an additional penalty of six percent per year on any unpaid stipulated

penalty balance more than 90 days overdue, except during the time period of Dispute Resolution.

33. Respondents must pay all penalties by certified or cashier's check payable to the United States of America, or by wire transfer, and will send the check to:

U.S. Department of the Treasury
Attention: U.S. EPA Region 5, Office of the Comptroller
P.O. Box 70753
Chicago, Illinois 60673.

A transmittal letter stating the name of the Facility, the name and address of the Respondent making payment, and the U.S. EPA docket number of this action must accompany the payment. The Respondent making payment shall simultaneously send a copy of the check and transmittal letter to the U.S. EPA Project Manager.

34. Respondents may dispute U.S. EPA's assessment of stipulated penalties by invoking the dispute resolution procedures under Section X: Dispute Resolution. The stipulated penalties in dispute will continue to accrue but need not be paid during the Dispute Resolution period. Respondents must pay stipulated penalties and interest, if any, according to the Dispute Resolution decision or agreement. Respondents must submit such payment to U.S. EPA within 30 days after receiving the final resolution according to the payment instructions of this Section.

35. Neither invoking dispute resolution nor paying penalties will affect Respondents' obligation to comply with the terms of this Order not directly in dispute.

36. The stipulated penalties set forth in this Section do not preclude U.S. EPA from pursuing any other remedies or sanctions which may be available to U.S. EPA for Respondents' violation of any terms of this Order. However, U.S. EPA will not seek both a stipulated penalty under this Section and a statutory penalty for the same violation. U.S. EPA Region 5 may, at its sole unreviewable discretion, elect to waive in writing any portion of stipulated penalties that have accrued pursuant to this Part IX.

X. DISPUTE RESOLUTION

37. The parties will use their best efforts to informally and in good faith resolve all disputes or differences of opinion.

38. If any party disagrees, in whole or in part, with any decision made or action taken under this Order, that party will notify the other party's Project Manager of the dispute. The Project Managers will attempt to resolve the dispute informally.

39. If the Project Managers cannot resolve the dispute informally, any party may pursue

the matter formally by placing its objections in writing. A written objection must state the specific points in dispute, the basis for that party's position, and any matters which it considers necessary for determination.

40. U.S. EPA and Respondents will in good faith attempt to resolve the dispute through formal negotiations within 21 days, or a longer period if agreed in writing by the parties. During formal negotiations, any party may request a conference with appropriate senior management of the other party to discuss the dispute.

41. If the parties are unable to reach an agreement through formal negotiations, within 14 business days after any formal negotiations end, Respondents and U.S. EPA's Project Manager may submit additional written information to the Director of the Waste, Pesticides and Toxics Division, U.S. EPA Region 5. U.S. EPA will maintain a record of the dispute, which will contain all statements of position, any other documentation submitted pursuant to this Section. U.S. EPA will allow timely submission of relevant supplemental statements of position by the parties to the dispute. Based on the record, U.S. EPA will respond to Respondents' arguments and evidence and provide a detailed written decision on the dispute signed by the Director of the Waste, Pesticides and Toxics Division, U.S. EPA Region 5 ("EPA Dispute Decision").

42. If, at the conclusion of the Dispute Resolution process, Respondents notify U.S. EPA that they refuse to implement U.S. EPA's selected final corrective measures, U.S. EPA will endeavor to pursue the action(s) it deems necessary, if any, within a reasonable period of time.

XI. FORCE MAJEURE AND EXCUSABLE DELAY

43. Force majeure, for purposes of this Order, is any event arising from causes not reasonably foreseen and beyond any Respondent's control that delays or prevents the timely performance of any obligation under this Order despite Respondents' best efforts.

44. If any event occurs or has occurred that may delay the performance of any obligation under this Order, whether or not caused by a force majeure event, Respondents must notify U.S. EPA within five (5) business days after learning that the event may cause a delay. If Respondents wish to claim a force majeure event, within 15 business days thereafter Respondents must provide to U.S. EPA in writing all relevant information relating to the claim, including a proposed revised schedule.

45. If U.S. EPA determines that a delay or anticipated delay is attributable to a force majeure event, U.S. EPA will extend in writing the time to perform the obligation affected by the force majeure event for such time as U.S. EPA determines is necessary to complete the obligation or obligations.

46. The Parties recognize and acknowledge that the MDEQ Consent Judgment may

require certain approvals of remedial activities by the MDEQ or Circuit Court Judge and may delay Respondents' performance under this Order, and that such approvals or delays may constitute force majeure events.

XII. MODIFICATION

47. This Order may be modified only by mutual agreement of U.S. EPA and Respondents. Any agreed modifications shall be in writing, signed by all parties, shall be effective on the date of signature by U.S. EPA, and shall be incorporated into this Order.

XIII. RESERVATION OF RIGHTS

48. Nothing in this Order restricts U.S. EPA's authority to seek Respondents' compliance with the Order and applicable laws and regulations. For violations of this Order, U.S. EPA reserves its rights to bring an action to enforce the Order, to assess penalties under Section 3008(h)(2) of RCRA, 42 U.S.C. § 6928(h)(2), and to issue an administrative order to perform corrective actions or other response measures. In any later proceeding for violation of this Order, Respondents shall not assert or maintain any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon a contention that the claims raised by the United States in the later proceeding were or should have been raised here. This Order is not a covenant not to sue, release, waiver, or limitation of any rights, remedies, powers, or authorities of U.S. EPA.

49. U.S. EPA reserves all of its rights to perform any portion of the work consented to here or any additional site characterization, feasibility study, and remedial work as it deems necessary to protect human health or the environment.

50. If U.S. EPA determines that Respondents' actions related to this Order have caused or may cause a release of hazardous waste or hazardous constituent(s), or a threat to human health or the environment, or that Respondents cannot perform any of the work ordered herein, U.S. EPA may order Respondents to stop implementing this Order for the time U.S. EPA determines may be needed to abate the release or threat and to take any action that U.S. EPA determines is necessary to abate the release or threat of release. Respondents' compliance with U.S. EPA's order to stop implementing this Order shall not give rise to penalties under this Order.

51. Respondents do not admit any of U.S. EPA's factual or legal determinations. Except for the specific waivers in this Order, Respondents reserve all of their rights, remedies and defenses, including all rights and defenses they may have: (a) to challenge U.S. EPA's performance of work; (b) to challenge U.S. EPA's stop work orders; and (c) regarding liability or responsibility for conditions at the Facility, except for the right to contest U.S. EPA's jurisdiction to issue or enforce this Order. Respondents have entered into this Order in good faith without

trial or adjudication of any issue of fact or law. Respondents reserve their right to seek judicial review of any U.S. EPA actions taken under this Order, including but not limited to, in a proceeding brought by the United States to enforce the Order or to collect penalties for violations of the Order, and including final decisions of U.S. EPA in dispute resolution under this Order.

52. The parties reserve all claims, rights and defenses as to any third-parties.

XIV. OTHER CLAIMS

53. Respondents waive any claims or demands for compensation or payment under Sections 106(b), 111, and 112 of CERCLA against the United States or the Hazardous Substance Superfund established by 26 U.S.C. § 9507 for, or arising out of, any activity performed or expense incurred under this Order. Additionally, this Order is not a decision on preauthorization of funds under Section 111(a)(2) of CERCLA.

XV. INDEMNIFICATION OF THE UNITED STATES GOVERNMENT

54. Each Respondent indemnifies, saves and holds harmless the United States, its agencies, departments, agents, and employees, from all claims or causes of action arising from or on account of acts or omissions of any Respondent or its officers, employees, agents, independent contractors, receivers, trustees, and assigns in carrying out activities required by this Order. This indemnification will not affect or limit the rights or obligations of Respondents or the United States under their various contracts. This indemnification will not create any obligation on the part of Respondents to indemnify the United States from claims arising from the acts or omissions of the United States.

XVI. SEVERABILITY

55. If any judicial or administrative authority holds any provision of this Order to be invalid, the remaining provisions will remain in force and will not be affected.

XVII. TERMINATION AND SATISFACTION

56. Respondents may request that U.S. EPA issue a determination that Respondents have met the requirements of the Order for all or a portion of the Facility. Respondents may also request that U.S. EPA issue a "no further interest" or "no further action" determination for all or a portion of the Facility.

57. The provisions of this Order will be satisfied upon Respondents' and U.S. EPA's execution of an "Acknowledgment of Termination and Agreement on Record Preservation and Reservation of Rights," consistent with U.S. EPA's Model Scope of Work.

58. Respondents' execution of the Acknowledgment of Termination will affirm their continuing obligation to preserve all records as required by Section VIII, to maintain any necessary institutional controls or other long terms measures, and to recognize U.S. EPA's reservation of rights as required in Section XIII.

XVIII. EFFECTIVE DATE

59. This Order is effective on the date that the Director, Waste, Pesticides and Toxics Division, U.S. EPA Region 5 signs the Order.

IT IS SO AGREED:

DATE: 5/15/06 BY:

Thomas H. Fox, Jr.
~~President~~ Chairman & CEO
National Copper Products, Inc.

DATE: 5/15/06 BY:

Thomas H. Fox, Jr.
~~President~~ Chairman & CEO
Prairie Ronde Realty Company

IT IS SO ORDERED:

DATE: 6/2/06 BY:

6 JUN -2 P2:26

Margaret M. Guerriero, Director
Waste, Pesticides and Toxics Division
U.S. Environmental Protection Agency
Region 5 RCRA-05-2006-0011

ATTACHMENT: INTERIM MEASURES WORK PLAN – PURGE WELL SYSTEM

The Facility is actively performing remediation of soil and groundwater contamination by means of a purge well system. The purge well system was established as part of a Court-approved settlement between the State of Michigan (currently represented by the Michigan Department of Environmental Quality, or MDEQ) and the Facility. Under the terms of a Circuit Court Preliminary Injunction dated January 1984, the Facility prepared and submitted a *Remedial Action Plan* (RAP) for a groundwater purge and treatment system. Subsequently, the Facility installed a system of purge wells in accordance with the RAP. In the Consent Judgment entered December 1987, the Facility agreed to continue operation of the purge system until the MDEQ stipulated, or the Court found, that continued operation of the system was no longer necessary. The Consent Judgment also requires that if the Facility makes any changes to the system, the resulting new system should be at least as effective as the purge system existing at the effective date of the Consent Judgment.

The original RAP purge system design included ten (10) purge wells installed near the forward edges of the contaminated groundwater plume (purge wells PW-1 through PW-10), and one (1) deep well near the original source area of the TCE release (the "500 GPM well"). The purge well locations and design pumping rates were as follows:

- Four (4) wells northeast of the Facility, designated as PW-1 through PW-4, operating at a pumping rate of 50 gallons per minute (gpm) each.
- Three (3) wells northwest of the Sundstrand property, designated as PW-5 through PW-7, operating at 100 gpm each.
- Three (3) wells west of the Facility, designated as PW-8 through PW-10, operating at 75 gpm each.
- One (1) well between the Facility building and Louise Street, designated as the "500 GPM well," operating at 500 gpm.

The original RAP purge system has been modified several times with the concurrence of the MDEQ; for example:

- During the original system installation, it was decided to eliminate purge well PW-2 and increase the pumping rates from PW-1, PW-3 and PW-4; the actual initial pumping rates for these wells were 68, 80 and 52 gpm respectively.
- One (1) additional purge well, designated as the ROHACS well (later designated as PW-11) was installed west of the unnamed drain in 1986.
- Purge well PW-11 was re-located to the east side of the unnamed drain and re-designated as PW-12 in 1997.

- Purge wells PW-4 and PW-6 were shut down in 1999.

- The pumping rates in purge wells PW-8, PW-9, PW-10 and PW-12 were increased (approximately doubled) during the period of 2002 to 2005, by upgrading the pump motors.

- The Facility is presently in the process of installing a new purge well, to be designated as PW-13, inside the plant building.

The Facility has also voluntarily implemented additional remedial measures to enhance source removal and contaminant containment. These and other adjustments to the remedial system have been made by the Facility to improve the capture of contaminated groundwater while evaluations of the remedial goals and final remedy are proceeding.

The original RAP purge system envisioned a total system pumping rate of 1,250 gpm; at present the total pumping rate is roughly 1,500 gpm, which is the hydraulic limit for the equipment that processes and discharges the groundwater that is pumped from the purge wells. The Facility will continue to operate and maintain the purge well system with a pumping rate of 1,250 gpm as required by the Consent Judgment.

Any further modifications to the purge well system to comply with RCRA Corrective Action requirements will be presented to the U.S. EPA for review prior to implementation. The purge system described in the original RAP has been modified and the Facility anticipates that further modifications, including adjustments to pumping rates at individual wells, addition or closure of individual wells, etc., will continue to be appropriate to improve or maintain the system's effectiveness. Minor maintenance or adjustments, such as cleaning or re-developing wells, replacing components, adjusting flow rates, etc., will be performed by the Facility as needed and will be documented in the regular monitoring reports. Major adjustments, such as adding or closing purge wells, will be proposed to the EPA in a work plan before completing the work.

CASE NAME: National Cooper Products
DOCKET NO: RCRA-05-2006-0011

CERTIFICATE OF SERVICE

I hereby certify that today I filed the original of this **Administrative Order on Consent** and this **Certificate of Service** in the office of the Regional Hearing Clerk (E-13J), United States Environmental Protection Agency, Region V, 77 W. Jackson Boulevard, Chicago, Illinois 60604 -3590.

I further certify that I then caused a true and correct copy of the filed document to be mailed on the date below, via Certified Mail, Return Receipt Requested to:

Mr. Tom Fox
Chairman and CEO
National Tube Holding Company, Inc.
Massey Building, Suite 210
Birmingham, AL 35203

Certified Mail Receipt # 7001 0320 0006 1449 0258

Dated: June 2, 2006

Katrina Jones
Katrina D. Jones
Administrative Program Assistant
Waste, Pesticides and Toxics Division - DE-9J
Enforcement, Compliance and Assurance Branch
77 W. Jackson Blvd, Chicago, IL 60604-3590

Exhibit C

[Copy of Consent Judgment , Case No. 83-10349-CE, In the Circuit Court for the County of Cass, "Kelley v. Sundstrand Heat Transfer, Inc.", decided 12-7-1987]

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF CASS

FRANK J. KELLEY, Attorney General of the State of Michigan, FRANK J. KELLEY, ex rel the Michigan Air Pollution Control Commission, Water Resources Commission, Natural Resources Commission, and DR. RONALD SKOOG, Director of the Michigan Department of Natural Resources,

Plaintiffs,

Case No. 83-10349-CE

v

SUNDSTRAND HEAT TRANSFER, INC., a subsidiary of Sundstrand Corporation, a Delaware Corporation.

Defendant.

CONSENT JUDGMENT

This matter having come before the Court upon the stipulation of the parties and the Court being fully advised in the premises;

IT IS HEREBY ORDERED that Defendant shall continue to comply with the preliminary injunction to abate public nuisance issued by this Court on January 5, 1984.

IT IS FURTHER ORDERED that the groundwater purge and treatment (purge) system created and operated pursuant to the aforementioned January 5, 1984 Order, shall continue in operation until the parties stipulate to its discontinuation or, in the alternative, upon a determination by this Court, after notice and opportunity for a hearing, that data from Defendant's continued monitoring of the groundwater indicates that the continued operation of the purge system is no longer necessary. The burden of proof shall be upon Defendant.

IT IS FURTHER ORDERED that in the event that the Defendant desires to change, replace, or alter the existing purge system, any new purge system shall perform at least as effectively as the existing purge system. The parties shall stipulate to any change, replacement or alteration of the existing treatment system or, in the alternative, may seek determination by the Circuit Court for the County of Cass, after notice and opportunity for a hearing, that the proposed change, replacement or alteration of the purge system is appropriate. The burden of proof shall be upon Defendant.

IT IS FURTHER ORDERED that the monitoring system established by the aforementioned January 5, 1984 Order, shall be continued during the entire period of operation of the purge system; provided, however, that this Court shall retain jurisdiction to order changes in the monitoring system upon a showing, by Defendant, after notice and opportunity for a hearing, that such changes are necessary, based upon data resulting from the monitoring system or upon stipulation by the parties that the system may be altered.

IT IS FURTHER ORDERED that subject to issuance of a permit by the Air Pollution Control Commission (APCC), Defendant, in its API oil separator, shall install an aeration system to treat the continuing in-plant buildup of trichloroethylene (TCE) in the effluent discharge from the plant. Defendant shall permit no discharge of effluent to the Rudy Road drain in excess of Water Resources Commission Rule 57 permitted limits for T.C.E. (94 parts ppb). In addition, the following limitations with respect to discharge of effluent to Rudy Road drain apply: 1,1,1 trichloroethane (TCA) (40 ppb); oil and grease (10 ppm). Discharge of TCE at the stripping tower effluent shall not exceed 15 ppb. Discharge of TCA at the stripping tower effluent shall not exceed 5 ppb. These limitations are subject to applicable Federal laws/regulations.

IT IS FURTHER ORDERED that Defendant shall, within 30 days of the date of this Order, make application for a NPDES permit for its discharge to the Rudy Road drain, which application shall detail the content of the effluent and the temperature of the effluent to be discharged. submitted 1/5/88

IT IS FURTHER ORDERED that Plaintiff shall process the Defendant's NPDES permit application within a reasonable time period and provide written comments on its sufficiency within 45 days of its submission. The Defendant shall thereafter have 30 days to accept any requirements ordered by the Plaintiff or shall bring the matter of requirements it feels are unacceptable before the Court for resolution. The burden of proof shall be upon the Defendant.

draft permit sent 1/11/88

IT IS FURTHER ORDERED that during the time period that the purge system is in operation, the Defendant shall pay stipulated daily penalties for noncompliance with the limitations set forth above. The limitations set forth above shall be incorporated into the aforementioned NPDES permit. During this time period, for an exceedence of up to 1.4 times the limitations set forth in the permit, Defendant shall pay $250 per sample result; from 1.4 to 3.0 times the limitation, $500 per sample result; and above 3 times the limitation, $1,000 per sample result.

IT IS FURTHER ORDERED that Defendant shall report any discharge in excess of any daily maximum effluent limitation to the Michigan Department of Natural Resources in writing, and to Surface Water District Supervisor at 621 North 10th Street, P.O. Box 355, Plainwell, Michigan 49080, no later than 5 days after becoming aware of such discharge, which report shall provide a written description of the extent and the period of the discharge including exact dates and times, if known.

IT IS FURTHER ORDERED that the existence of stipulated penalties shall not preclude the Plaintiffs from seeking injunctive or other relief as may be authorized by law for violations, if any, occurring during the stipulated penalty period, but only one recovery may be had for each day of violation and all rights and defenses, with respect to such claims, held by Defendant are hereby preserved.

IT IS FURTHER ORDERED that any stipulated penalties (and any injunctive or other relief) sought shall be subject to the "upset" defense provisions contained in 40 C.F.R. 122.41(n). No later than the 20th day of the month following the month in which any excess discharge has occurred, Defendant shall submit to Plaintiffs a recitation, in writing, of all facts and events upon which Defendant bases any claim, pursuant to this paragraph, that a stipulated penalty should not be assessed. If Plaintiff does not agree that Defendant's exceedence was due to an "upset", it shall notify Defendant within 30 days of receipt of Defendant's claim. Thereafter, Defendant shall, within 21 days of receipt of notice, either pay the sum(s) deemed to be due and owing or petition this Court to resolve the dispute. The burden of proof shall be upon Defendant to demonstrate the exceedence was due to an "upset" within the scope and meaning contained in 40 C.F.R. 122.41(n).

IT IS FURTHER ORDERED that Defendant shall pay all stipulated penalties, not excused pursuant to the provisions of this Consent Judgment, by check payable to the State of Michigan and delivered to the Assistant Attorney General in Charge, Environmental Protection Division, Michigan Department of Attorney General, 720 Law Building, Lansing, Michigan 48913, no later than the 20th day of the month following the month in which the exceedence occurred.

IT IS FURTHER ORDERED that the provisions of the Consent Judgment, including any provisions with respect to exceedences and stipulated penalties, shall not apply if the noncompliance, delay, violation or event, triggering stipulated penalties, results from any circumstances beyond Defendant's reasonable control; provided that, neither a plant shutdown nor increased cost of operating the purge and monitoring systems shall constitute circumstances beyond Defendant's reasonable control. If the parties cannot agree that the noncompliance, delay, violation or event triggering stipulated penalties resulted from circumstances beyond Defendant's reasonable control, Defendant may seek a determination of this issue by this Court, after giving notice and an opportunity for a hearing. The burden of proving causation beyond the reasonable control of Defendant, shall rest with Defendant.

IT IS FURTHER ORDERED that any notice, documentation, or recitation required by this Consent Judgment, other than the submission of monitoring or sampling results to be submitted to Plaintiff, shall be directed to the attention of the Assistant Attorney General in Charge, Environmental Protection Division, Michigan Department of Attorney General, 720 Law Building, Lansing, Michigan 48913 and to Surface Water District Supervisor, 621 North 10th Street, P.O. Box 355, Plainwell, Michigan 49080.

IT IS FURTHER ORDERED that to any extent that this Consent Judgment, in any of its aspects, is not regarded as a final judgment within the meaning of MCR 2.604 (because of this Court's continuing jurisdiction with respect to the specific future matters set forth herein, or for any other reason), this

Consent Judgment is a final judgment, and there is no just reason for delay in its entry, with particular respect to (1) the lump sum payment called for, and (2) the stipulated penalties called for.

IT IS FURTHER ORDERED that this Court shall retain jurisdiction of this matter for the purpose of resolving disputes, assessing stipulated penalties and awarding appropriate injunctive or other relief for violations, if any, set forth in this Consent Judgment, until: (1) Defendant has fully complied with this Consent Judgment, as evidenced by a stipulation of the parties, or, (2) upon further Order of this Court, after proper motion and notice of hearing made by any party.

IT IS FURTHER ORDERED that this Consent Judgment shall be in full settlement and satisfaction of all claims which could have been or were asserted by Plaintiffs in their Third Amended Complaint, including those which could have been or were asserted against the employees, officers and directors of Sundstrand Heat Transfer, Inc. and Sundstrand Corporation.

IT IS FURTHER ORDERED that Plaintiffs shall not be deemed to have waived any claims or rights they may have against any person or entity not a party to this Consent Judgment except the employees, officers and directors of Sundstrand Heat Transfer, Inc. and Sundstrand Corporation.

IT IS FURTHER ORDERED that this Court has jurisdiction of the subject matter of this case for the purpose of entering this Consent Judgment.

IT IS FURTHER ORDERED that neither entry of this Consent Judgment nor anything in this Consent Judgment shall constitute, nor be construed as, an admission of law or fact or as evidence of the violations alleged in Plaintiff's Complaint.

IT IS FURTHER ORDERED that the terms and conditions of this Consent Judgment are reasonable, adequately resolve the environmental issues raised in Plaintiff's Complaint, and properly protect the interests of the People of the State of Michigan.

IT IS FURTHER ORDERED that this Consent Judgment shall apply to and be binding upon the parties, their successors and assigns, and upon all persons, firms, subsidiaries and corporations acting under, through or for, or in act of concert or participation with the parties in the performance of any obligation hereunder.

IT IS FURTHER ORDERED that Defendant Sundstrand Heat Transfer, Inc. shall pay, to the State of Michigan, as compensation for environmental damage and the costs incurred by Plaintiffs in the prosecution of this action, the sum of one hundred twenty-five thousand dollars ($125,000.00) This payment shall be made within ten days of the entry of this Consent Judgment, by check payable to the State of Michigan, and delivered to the Assistant Attorney General in Charge, Environmental Protection Division, Michigan Department of Attorney General, 720 Law Building, Lansing, Michigan 48913.

IT IS SO ORDERED.

Dated: 12-7-87

MICHAEL E. DODGE

Honorable Michael E. Dodge
Cass County Circuit Judge

APPROVED AS TO FORM AND CONTENT

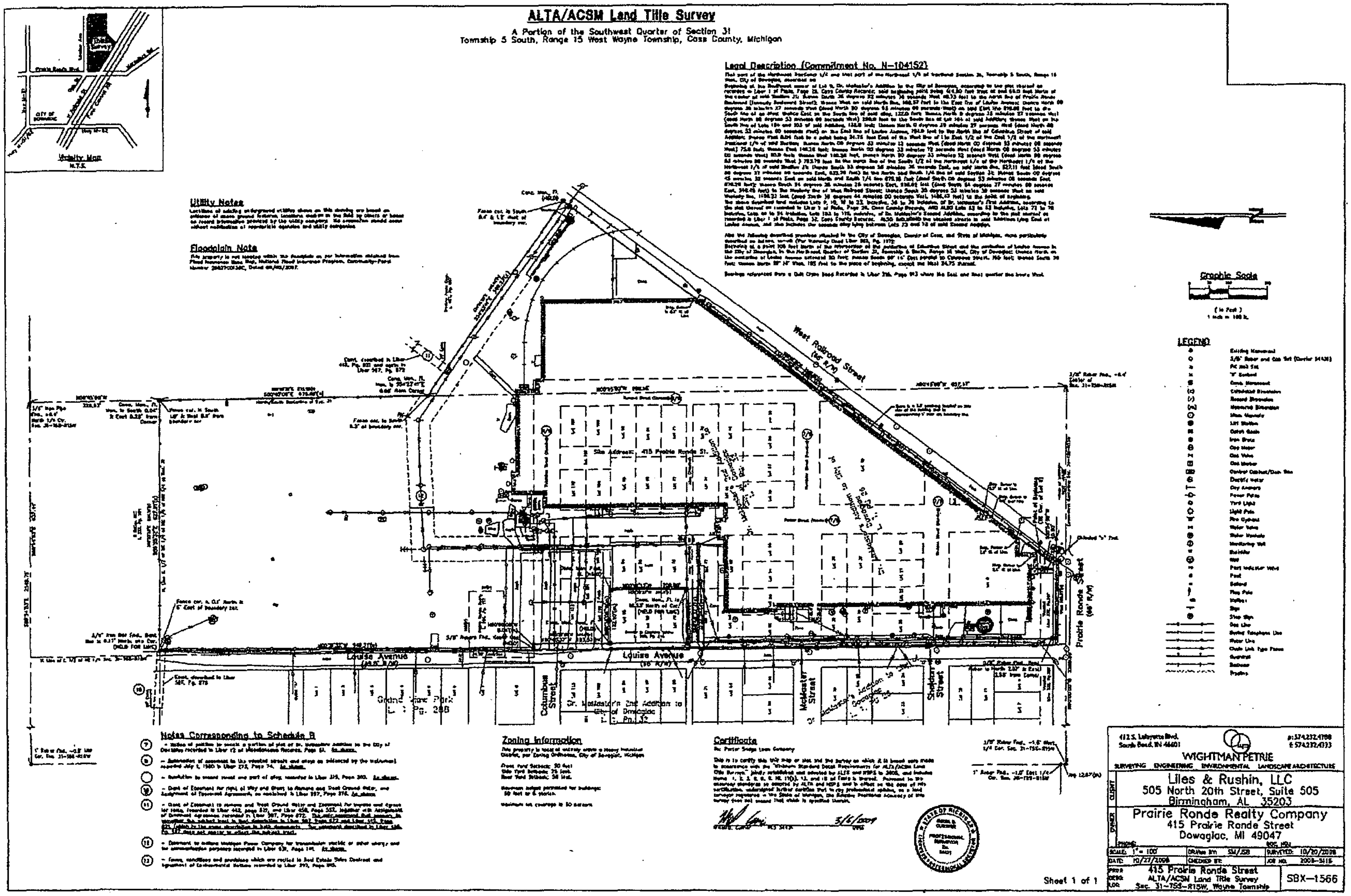
J. Clarke Nims (P24352)
for Defendant
Sundstrand Heat Transfer

Mark S. Meadows (P24101)
for Plaintiffs
Frank J. Kelley and
Dr. Ronald Skoog

I HAVE [illegible] original record thereof [illegible]
In Testimony [illegible] affixed
[illegible]
A.D. 19 87
, Clerk

Exhibit D

[Legal Size Reduced Copy of Survey]


ALTA/ACSM Land Title Survey
A Portion of the Southwest Quarter of Section 31
Township 5 South, Range 15 West Wayne Township, Cass County, Michigan
Vicinity Map
N.T.S.
Legal Description (Commitment No. N-1041521)
Utility Notes
Floodplain Note
Graphic Scale
LEGEND
Site Address: 415 Prairie Ronde St.
West Railroad Street
Louise Avenue
Prairie Ronde Street
Columbus Street
McMaster Street
Sheldon Street
Notes Corresponding to Schedule B
Zoning Information
Certificate
Sheet 1 of 1
412 S. Lafayette Blvd.
South Bend, IN 46601
p:574.232.4788
f:574.232.4333
WIGHTMAN PETRIE
SURVEYING ENGINEERING ENVIRONMENTAL LANDSCAPE ARCHITECTURE
CLIENT
Liles & Rushin, LLC
505 North 20th Street, Suite 505
Birmingham, AL 35203
OWNER
Prairie Ronde Realty Company
415 Prairie Ronde Street
Dowagiac, MI 49047
SCALE: 1" = 100'
DRAWN BY: SM/JSB
SURVEYED: 10/20/2008
DATE: 10/27/2008
CHECKED BY:
JOB NO. 2008-3115
415 Prairie Ronde Street
ALTA/ACSM Land Title Survey
Sec. 31-T5S-R15W, Wayne Township
SBX-1566

Appendix C

Response to CMP Comments Regarding On-Site Soil

R. David Mursch, P.E.

Geotechnical and Environmental Engineer

September 30, 2011

Mr. Tom Fox
National Tube Holding Company, Inc.
Ste 303
2025 Third Avenue North
Birmingham, AL 35203-3372

Subject: Response to CMP Comments Regarding On-Site Soil Issues
Prairie Ronde Realty Property – Dowagiac, Michigan
MID 005 068 507

Dear Mr. Fox:

The Prairie Ronde Realty (PRR) Property in Dowagiac, Michigan has submitted a draft Corrective Measures Proposal (CMP) to the United States Environmental Protection Agency (USEPA) Region V offices in Chicago, Illinois. In an e-mail dated September 12, 2011 from Michelle Kaysen (USEPA) to Tom Fox (PRR), the USEPA presented comments on the draft CMP. In comment 2.1.3 on page 7 and 8 of those comments the USEPA requested that "PRR should submit, under separate cover, the on-site soil sample results compared to soil-to-groundwater leaching criteria." This letter is in response to that request.

Background

The PRR property was historically impacted by on-site releases of chlorinated solvents, which were discovered and investigated in 1983. Since then, the property has undergone extensive remediation including direct excavation and removal of soil, pump-and-treat control of groundwater, soil vapor extraction (SVE) remediation of soil, and air injection/sparging of groundwater. These efforts have resulted in significant decreases in the level of impact in soil and groundwater throughout the PRR property and at adjacent properties.

In 2008, PRR began development of a CMP as required by the USEPA. In order to develop the CMP in a manner consistent with USEPA expectations and to ensure that an appropriate level of assessment was performed in the CMP development, PRR submitted a work plan titled *Assessment for Development of Corrective Measures Proposal* dated June 5, 2008 (CMP Work Plan). Among the activities included in the CMP Work Plan was an evaluation of on-site soil to determine what, if any, additional soil remediation should be incorporated into the draft CMP.

The on-site soil evaluation proposed in the CMP Work Plan included a review of soil gas analytical data and historical soil sampling data to determine what areas of the plant might still contain volatile organic compound (VOC) concentration in soil at levels of concern, soil sampling at these locations for laboratory analysis, and evaluation of the data. The field work and soil analysis described in the CMP Work Plan were completed in the fall of 2008 and the findings were submitted to USEPA in the *Report of Supplemental Soil Sampling Report* dated November 28, 2008 (SSR). A copy of this report is enclosed for reference.

104 Rivercliff Drive
Connelly Springs, North Carolina 28612
Phone (828) 234-5906
email: davidmursch@earthlink.net

Discussion of 2008 Soil Sampling Report Findings

The objective of the 2008 on-site soil review was to determine whether additional on-site soil remediation would be required. The review began with a compilation of historical soil data, and evaluation of possible remaining areas of soil impact. This evaluation also included a review of historical soil gas data obtained through the plant's SVE system from the system's inception through June of 2008. As discussed in the SSR, the soil gas data showed that trichloroethene (TCE) levels in the soil had declined significantly. When the SVE system was initially placed into operation in 1994 the system was recovering TCE from the soil at rates exceeding 100 pounds per day, but by late 2007 the extraction rate had declined to generally less than 0.5 pounds per day with most of the individual soil gas samples having no TCE above the laboratory detection limits.

Soil gas data from individual SVE wells were used to determine the distribution of residual TCE in the on-site soil. A graphic plot of the data (SSR Figure 1) demonstrated that residual TCE in soil gas was concentrated in the three primary source areas in the plant; the Oil Storage Room (OSR), the Main Degreaser Area (MDA), and the former lagoon/backdoor area (BDA). Other areas of the plant had low levels of TCE in soil gas that likely reflected volatilization from the groundwater - enhanced by operation of the air sparging system - rather than a presence of TCE in the unsaturated soil.

In addition to soil gas data, the SSR included a review of soil sample data obtained during site assessments performed in 1983, 1990, 1995, 2000, and 2002. The known and available data from past assessments was tabulated and plotted on a plan of the PRR building (SSR Figure 3).

After review of the SVE and historical soil data, PRR selected six locations for supplemental soil sampling in October 2008. The locations selected were within the three known source areas, and were the locations that had the highest reported VOC concentrations in soil from previous soil assessments. The only compound that was detected in these nine soil samples was TCE, and the concentrations reported were orders of magnitude below the concentrations detected in prior assessments at the same locations and depths.

The SSR included a comparison of the SSR soil data to the MDEQ Part 201 generic criteria for protection of groundwater for the GSI standard. The highest TCE concentration reported in the nine samples was 420 µg/kg (micrograms per kilogram), which is an order of magnitude less that the Part 201 GSI protection criterion of 4,000 µg/kg. The highest TCE concentration reported in the historical soil data (not including data from soil that was subsequently excavated and removed from the site) was 9,500,000 µg/kg; this location, inside the OSR, was re-sampled as part of the SSR and a TCE concentration of 110 µg/kg was obtained. This comparison illustrates the successful reduction of TCE in the on-site soil through the SVE remediation efforts.

In summary, the SSR demonstrated that the SVE system had successfully remediated the soil beneath the plant to essentially residual levels.

Other Criteria

In the CMP comments the USEPA requested that PRR consider and discuss the soil criteria protective of volatilization to indoor air (VIA) and protective of leaching to groundwater that would be used for drinking water for the residual TCE impact in the on-site soil. These criteria were not discussed in the SSR.

The Part 201 soil criteria for VIA (37,000 µg/kg for TCE) are much higher than the more restrictive GSI protection criteria. The soil samples collected after the operation of the SVE system were all one to two orders of magnitude below the appropriate criteria for indoor air (SSR Table 2).

The Part 201 protection of drinking water criterion of TCE in soil is 100 µg/kg. As noted above the SSR included analysis of nine soils samples from the locations that had the highest historical TCE concentrations in soil. Of these nine SSR samples, only four samples had detections of TCE above laboratory detection limits. These detections ranged from 51 to 420 µg/kg. No other VOCs were detected in the nine SSR soil samples. Two of the SSR soil samples had reported TCE above the Part 201 protection of drinking water criterion for TCE, with concentrations of 110 and 420 µg/kg. These concentrations slightly exceed the drinking water protection value but represent residual TCE levels at the historically most heavily impacted locations, and based on the methodology used for the SSR these are expected to be the highest TCE concentrations remaining in the soil (at the time the sampling was performed in 2008).

Some isolated small zones within the soil mass contain residual TCE concentrations, and some of these zones may locally exceed the drinking water protection criteria. However these small local soil areas of minor residual TCE concentrations will not cause any significant issues with respect to the overall site remediation strategy; specifically there does not appear to be sufficient residual TCE remaining in the on-site soil to materially affect the long-term natural attenuation goals for the groundwater.

Summary

The SSR demonstrated that the active site remediation performed at the site has decreased TCE concentrations in the soil from the high levels recorded in 1983 to nominal levels. The current concentrations are below Part 201 criteria protective of indoor air and also below criteria protective of leaching to groundwater and flow into surface waters. Furthermore, the soil concentrations are generally well below the Part 201 criteria protective of leaching to groundwater and groundwater use as a source of drinking water. The two SSR soil samples that had TCE concentrations slightly above the generic Part 201 criteria protective of groundwater use as a source of drinking water are under the building foundation and are not expected to impact the long term ability to achieve groundwater cleanup at the site.

After submittal of the SSR to the EPA in November, 2008 the findings were discussed with USEPA by telephone. In a subsequent email from Jill Groboski dated December 16, 2008 USEPA noted that: "*Our risk assessor reviewed the supplemental soil sampling report and while she agrees that the source of contamination in the soil has been reduced to appropriate levels,…*". The December 16, 2008 email goes on to note a possible concern with VIA at residences down-gradient of the plant after shutdown of the SVE system, and these concerns were ultimately addressed by further sampling west of the plant. However, as noted, the USEPA risk assessor and project manager in 2008 concurred with PRR that no additional soil remediation would be required as part of the draft CMP.

We hope that this review has adequately addressed your concerns regarding on-site soil at the PRR property.

Sincerely,

R. David Mursch, P.E.
Consultant

Enclosure: *Report of Supplemental Soil Sampling* dated November 28, 2008.

Cc: Jim Tolbert (3)
Charles Denton
Scott Moyer (via email)
MDEQ (via Jim Tolbert)
USEPA (via Jim Tolbert)

November 28, 2008

Ms Jill Groboski
U.S. Environmental Protection Agency Region V
77 West Jackson Boulevard
Mail Code DE-9J
Chicago, Illinois 60604-3590

Subject: Report of Supplemental Soil Assessment
National Copper Products, Inc. Facility - MID 005 068 507
Dowagiac, Michigan

Dear Ms Groboski:

The National Copper Products, Inc. (NCP) plant in Dowagiac, Michigan is proceeding with studies to develop a draft Corrective Measures Proposal (CMP) for submittal to your office. As part of these studies, NCP has evaluated the current levels of volatile organic compounds (VOCs), particularly trichloroethene (TCE), in the unsaturated soil zone beneath the plant building to determine whether additional corrective measures for the soil should be included in the draft CMP. This work was performed in accordance with the work plan titled *Assessment for Development of Corrective Measures Proposal* dated June 5, 2008.

Background Review

The soil evaluation portion of the work plan included a review of soil gas analytical data and historical soil sampling data, selection of locations for soil sampling, sampling and field screening of soil using direct push (DP) methods, and laboratory analysis of soil samples.

Soil gas samples have been obtained through the plant's soil vapor extraction (SVE) system on an annual basis for several years, with the most recent samples being obtained in June of 2008. For this sampling, as outlined in the work plan referenced above, the SVE and sparge injection wells in the plant building were shut down for several weeks and the SVE wells were then sampled for analysis of VOCs in the soil gas. A description of the sampling procedures, the laboratory analytical reports and a table of the data are included in the *Third Quarter 2008 Monitoring Report* dated November 14, 2008. A plot of the TCE data is included on the site plan attached to this report as Figure 1.

The soil gas sampling data plot in Figure 1 demonstrates that there are three areas in the building that have relatively high TCE levels in the soil gas. This conforms to the historical distribution of TCE in the previous SVE sampling events and confirms that there are three source areas of TCE impact to the subsurface in the plant building; these are the Oil and Solvent Storage Room, the Main Degreaser Area, and the former lagoon area.

The soil gas data were also reviewed to determine the trend of TCE in the soil gas with time. Figure 2 is a plot of TCE extraction rates measured in the combined SVE manifold since the SVE system was installed in 1995 (in pounds per day). The chart shows that the TCE levels in the soil gas have decreased steadily and are now consistently at or near non-detect levels.

Table 1 shows a summary of the historical TCE concentrations at six SVE wells located in the source areas. The table presents the TCE concentrations from 2000, when the sparge system was put into operation, to the most recent data. The data show that the TCE levels in these areas have been dramatically reduced. The table also shows that the June 2008 levels are higher than the levels measured in recent years; these higher levels are also reflected in the time-trend chart in Figure 2, which shows a temporary spike in the SVE system's TCE extraction rate in June and July of 2008. This spike could not be due to any increase in TCE concentrations in the soil itself, since TCE has not been used at the plant since the late 1980s and it is unlikely that a release from a new or previously-unknown source would impact the entire site at the same time.

The short-term TCE spike in the SVE system may be due to atypically low groundwater levels that the site experienced during this past summer as documented in the *Third Quarter 2008 Monitoring Report* hydrographs. The lower groundwater level could have allowed the SVE system to extract TCE from the zone of fluctuation at the water table surface, by removing residual TCE adsorbed to a thin zone of soil that became accessible to the SVE extraction system as the groundwater dropped.

The TCE levels measured in the SVE manifold have returned to near-non-detect levels in August, September and October of 2008 (See Figure 1).

In conjunction with the SVE soil gas sampling and data review, NCP reviewed the soil analytical data obtained in past soil assessments. Soil samples were analyzed during the original 1983 source area investigation; during environmental site assessments in 1990 and 1995; during site status assessments performed in 2002 by SECOR and MDEQ; and as part of a geotechnical evaluation by NCP in 2002 for a potential plant modernization. The sampling locations and TCE concentrations measured beneath the plant in these past assessments are shown on Figure 3.

Soil Sampling and Analysis

After review of the SVE and historical soil data, NCP selected six representative locations for supplemental soil sampling in October 2008. At each location, designated as 08-G1 through 08-G6, the soil was continuously sampled with direct-push soil boring equipment to the water table. This method involves pushing a 2-inch diameter by 5-foot long hollow steel sampling tube into the ground. A continuous core of the soil is contained in a plastic sleeve inside the sampling tube.

The soil cores were screened in the field using a photo-ionization detector (PID) and the soil sections with the highest PID readings at each boring were selected for laboratory analysis. The selected core sections were sampled in accordance with USEPA Method 5035. For each sample, a 10-gram plug of soil was extracted using a pre-calibrated coring device and extruded into a pre-weighed 40-milliliter (ml) septum vial. Each sample was field-preserved with 10 ml of methanol, which was added to the vials from pre-measured plastic ampules provided by the laboratory.

The samples were placed on ice and sent to Trimatrix Laboratories in Grand Rapids, Michigan for analysis of volatile organic compounds using USEPA Method 8260. A field methanol blank, which was prepared by emptying a methanol ampule into an empty vial, was included for analysis as a check on laboratory procedures and on possible methanol impurities. The data are summarized on the attached Table 2 and are plotted on the site plan in Figure 3; the analytical report is enclosed.

Evaluation of Soil Data

The soil data summarized on Table 2 and Figure 3 show that VOC levels have been greatly reduced in the soil beneath the plant since the release was originally investigated in 1983. In the samples obtained for this supplemental study, the only compound that was detected is TCE and the concentrations reported were well below the concentrations detected in prior assessments at similar locations and depths.

The MDEQ Act 451, Part 201 contains generic remediation criteria for soil that are relevant for sites located in Michigan. Table 2 shows the data obtained in this study and the Part 201 criteria for protection of the groundwater/surface water interface (GSI) groundwater criteria. As shown on the table, the TCE concentrations ranged from non-detect to 420 µg/kg and five of the samples had no TCE above the laboratory detection limits. None of the samples exceeded the GSI protection criterion for TCE of 4,000 µg/kg.

The current and historical data plotted on Figure 3 show that the TCE concentrations in the soil have been significantly reduced since the releases at this plant were initially assessed. Several of the soil borings were drilled at locations that, in the 1983 source area investigation, had TCE levels of 170,000 to 9,500,000 µg/kg; these locations now have TCE concentrations ranging from less than 50 to 110 µg/kg. Table 3 shows a comparison of TCE concentrations in soil at various times for nine representative locations. At each of these locations, the data show TCE levels have been reduced in each sampling event relative to previous samples at those locations.

Conclusions and Recommendations

This assessment has demonstrated that the TCE concentrations in the soil have been reduced from the high levels recorded in 1983 to nominal levels generally below relevant MDEQ Part 201 generic criteria. In particular, the data demonstrate that the soil has been remediated to concentrations below the generic criteria for protection of the GSI groundwater quality standard.

The SVE system was installed in 1995 on a voluntary basis to reduce TCE levels in the soil, and this has been accomplished as demonstrated in this report. Also, the graph in Figure 2 shows that the rate of TCE removal through the SVE system has declined to the point where it is now minimal, and the diminishing removal rate is now insufficient to warrant continued operation.

NCP has been operating the SVE system in recent years primarily to capture air injected through the groundwater remediation sparging system. However, the NCP plant has been permanently closed and the only workers present in the building are for periodic maintenance requirements

Considering the above, NCP proposes to close and abandon the SVE system as follows:

1. Dismantle and remove the SVE blower, associated piping and equipment.
2. Grout the screened interval and riser in each SVE well except for well 98-226A, which is also used as a monitoring well.
3. Cut off the riser of each SVE well located outside of the building at a depth of about 2 feet below ground surface, then backfill and finish the resulting excavation to match the surrounding area.

NCP proposes to take the SVE system out of operation in December 2008. The closure will be completed after review and consideration of any comments received from the USEPA. When the work is completed a report documenting the closure and abandonment will be submitted.

Should you have any questions about this report, please contact NCP or R. David Mursch, P.E.

Sincerely,

R. David Mursch, P.E.
Consultant

Attachments:

Table 1 –	Trichloroethene Concentrations in Selected Soil Vapor Extraction Wells
Table 2 –	Summary of Soil Analytical Data – October 2008
Table 3 –	Comparison of Trichloroethene Concentrations at Similar Locations
Figure 1 –	Trichloroethene Concentrations in Soil Gas – June 2008
Figure 2 –	Time Trend Chart of Trichloroethene Extraction Rate in Soil Vapor Extraction System
Figure 3 –	Soil Sample Locations and Trichloroethene Concentrations

Enclosure: Trimatrix Laboratories, Inc. Analytical Report Dated November 7, 2008

Cc: Tom Fox
Tamara Buitendorp
Charles Denton
Bruce Baker
Scott Moyer (via email)
Greg Bettmann (MDEQ)

TABLE 1 - TRICHLOROETHENE CONCENTRATIONS IN SELECTED SOIL VAPOR EXTRACTION WELLS

	SVE-3	SVE-4	SVE-5	SVE-6	SVE-8	98-226A
Jan-2000	8.9	50.4	0.94	8.6	70.7	23.4
May-2000	5.1	24.5	2.7	4.9	34.2	20.2
Sep-2000	6.2	14.6	3.8	7.5	52.4	12.7
Sep-2002	3.6	19	3.4	4.8	15	8.3
Sep-2003	1.7	19	3.7	5.2	29	9.3
Sep-2004	1.4	19	1.7	4.3	15	5.9
Sep-2005	1.7	13	3.3	3.9	12	5.7
Sep-2006	0.49	6.5	1.8	3	9.6	5.7
Sep-2007	0.63	6.7	1.6	2.5	1.3	--
Jun-2008	2.7	11	1.9	2.4	3.2	14

NOTES:

Results are in parts per million volume

-- = Not analyzed

TABLE 2: SUMMARY OF SOIL ANALYTICAL DATA - OCTOBER 2008

BORING LOCATION	DEPTH, FEET	PID, PPM	TRICHLOROETHENE	1,1,1-TRICHLOROETHANE	CIS-1,2 DICHLOROETHENE	TRANS-1,2-DICHLOROETHENE	VINYL CHLORIDE
MDEQ PART 201 GSI PROTECTION CRITERIA [1] ***:***			***4,000***	***4,000***	***12,000***	***30,000***	***300***
O8-G1	22	59	**110**	< 59	< 59	< 59	< 59
O8-G2	15	161	< 56	< 56	< 56	< 56	< 56
O8-G3	7	17	< 54	< 54	< 54	< 54	< 54
O8-G3	18	139	< 52	< 52	< 52	< 52	< 52
O8-G4	4	625	**51**	< 47	< 47	< 47	< 47
O8-G4	19	141	**98**	< 59	< 59	< 59	< 59
O8-G5	7	496	< 56	< 56	< 56	< 56	< 56
O8-G5	12	924	**420**	< 57	< 57	< 57	< 57
O8-G6	15	208	< 65	< 65	< 65	< 65	< 65
FIELD BLANK[2]	--	--	< 1	< 1	< 1	< 1	< 1

NOTES:

All samples were analyzed by EPA Method 8260; results are in micrograms per kilogram.

< = Less than

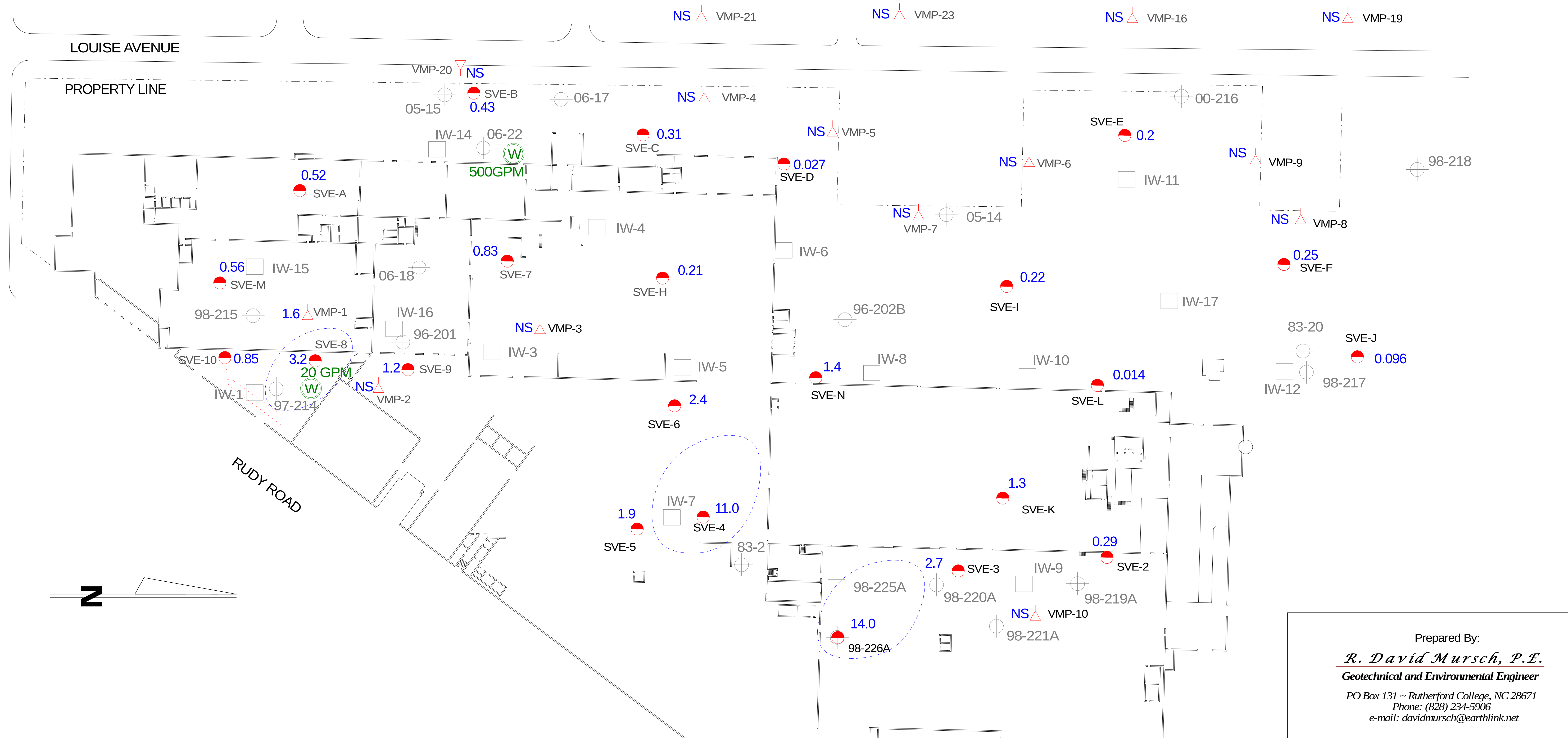
ppm = parts per million volume in vapor

[1] = Michigan Department of Environmental Quality Act 451, Part 201 generic soil concentration criteria for protection of the groundwater/surface water interface criteria

[2] = Micrograms per liter in field-prepared methanol blank

TABLE 3: COMPARISON OF TRICHLOROETHENE CONCENTRATIONS AT SIMILAR LOCATIONS

SOURCE AREA	DEPTH RANGE, FEET	BORING/ DATE	TRICHLOROETHENE, micrograms per kilogram
OIL AND SOLVENT ROOM - CENTER	15 - 19	OS-12/ 1983	550,000
		G-12/ 1995	<5
	20 - 24	OS-6/ 1983	9,500,000
		08-G1/ 2008	110
OIL AND SOLVENT ROOM - NORTH END	19 - 22	OS-10/ 1983	210,000
		G-11/ 1995	5
		SB-4/ 2002	<50
OIL AND SOLVENT ROOM - WEST SIDE	15	OS-15/ 1983	170,000
		08-G2/ 2008	<56
MAIN DEGREASER - SOUTH END	4 - 10	D-9/ 1983	230,000
		02-251/ 2002	4,200
		08-G4/2008	51
	17 - 19	02-251/ 2002	6,000
		08-G4/ 2008	98
MAIN DEGREASER - NORTH END	0 - 10	83-2/ 1983	860
		G-16/ 1995	<5
		SB-10/ 2002	<50
	15 - 22	83-2/ 1983	120
		G-16/ 1995	<5
		SB-10/ 2002	170
MAIN DEGREASER - WEST SIDE	7 - 8	02-254/ 2002	2,300
		08-G3/ 2008	<54
MAIN DEGREASER - CENTER	5 - 10	D-4/ 1983	470,000
		02-260/2002	420
		CP-6/ 2002	690
BACKDOOR - LAGOON / EAST	5 - 10	G-21/ 1995	1,360
		08-G5/ 2008	<56
	12 - 15	G-21/1995	1,230
		08-G5/ 2008	420
BACKDOOR - LAGOON / NORTH	10 - 20	SB-11/ 2002	630
		08-G6/ 2008	<56



LEGEND:

- VAPOR MONITORING POINT (VMP)
- SOIL VAPOR EXTRACTION (SVE) WELL
- 3.3 TRICHLOROETHENE IN VMP OR SVE WELL AIRSTREAM, PARTS PER MILLION VOLUME (PPMV) - SYRINGE SAMPLE ANALYZED BY METHOD AM 4.02.
- ESTIMATED LIMITS OF TRICHLOROETHENE CONCENTRATION IN SOIL VAPOR GREATER THAN 3 PPMV BASED ON KNOWN SOURCE AREAS AND MONITORING DATA
- AIR SPARGE INJECTION WELL
- MONITORING WELL

Prepared By:

R. David Mursch, P.E.

Geotechnical and Environmental Engineer

PO Box 131 ~ Rutherford College, NC 28671
Phone: (828) 234-5906
e-mail: davidmursch@earthlink.net

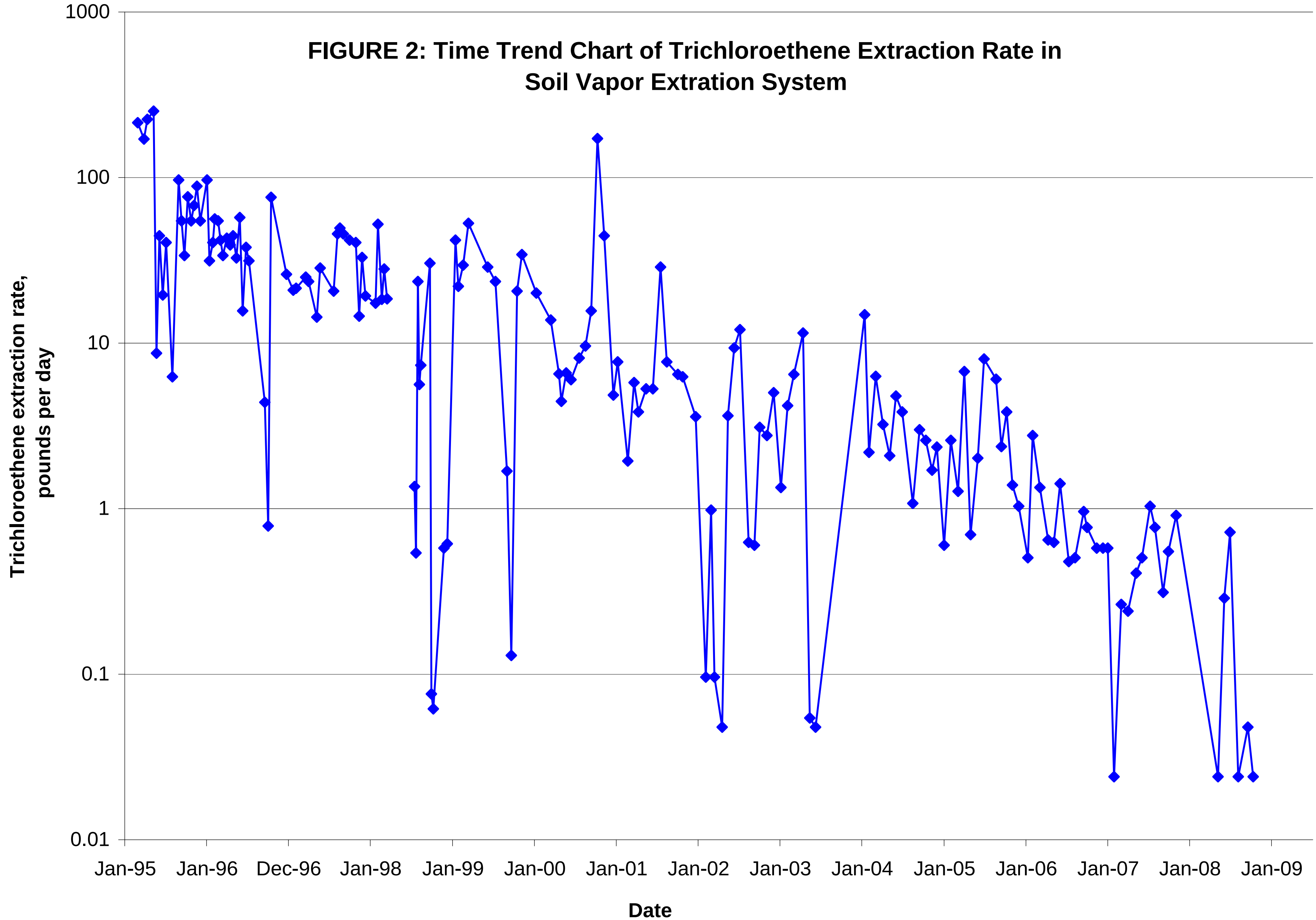
REPORT OF SUPPLEMENTAL SOIL SAMPLING

FOR:

NATIONAL COPPER PRODUCTS, INC.
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

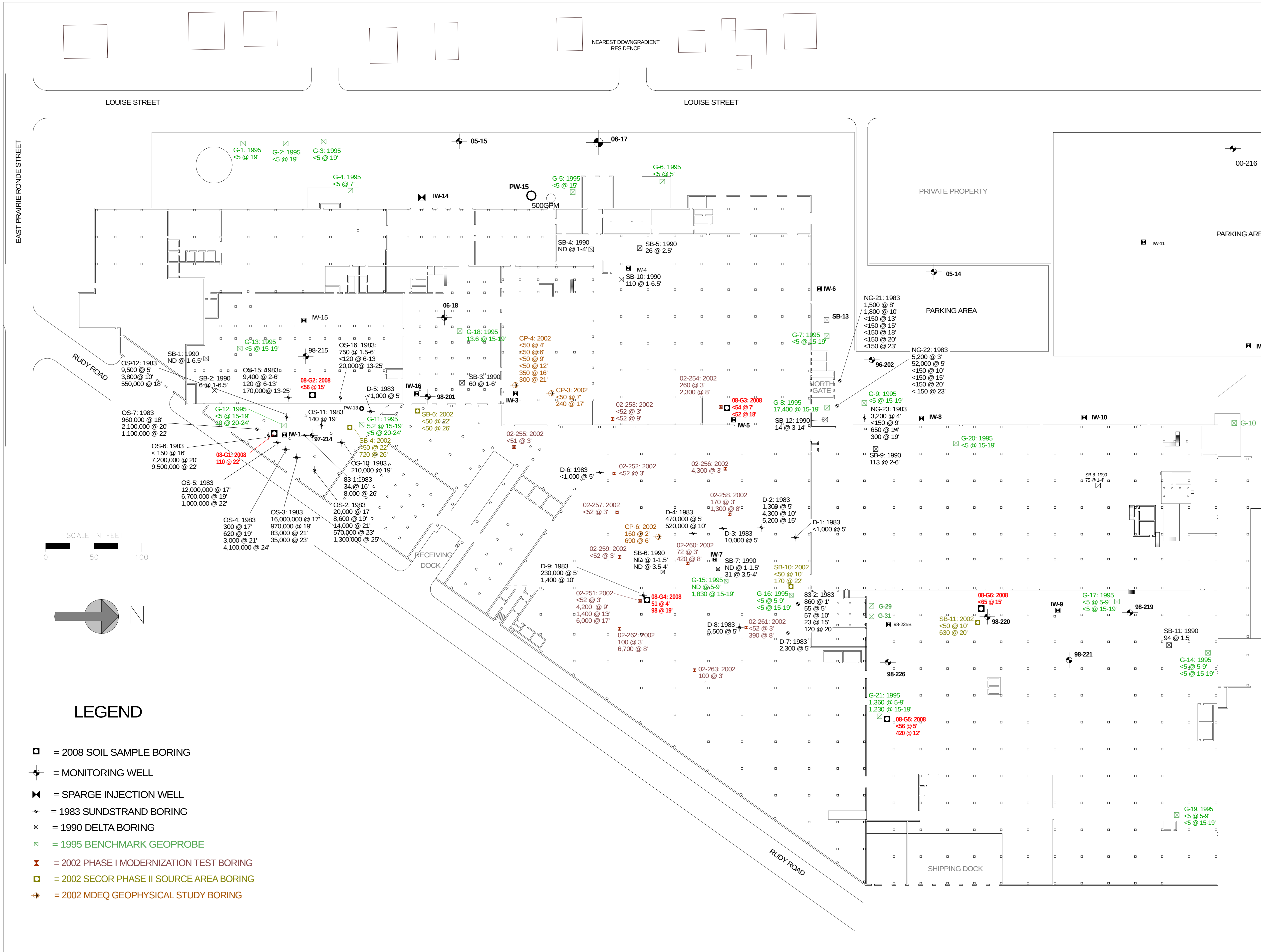
TRICHLOROETHENE CONCENTRATIONS IN SOIL GAS - JUNE, 2008



Prairie Ronde Realty Company
Dowagiac, Michigan

REPORT OF SUPPLEMENTAL
SOIL SAMPLING

R. David Mursch, P.E.
Geotechnical and Environmental Engineer



Prepared By:
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e-mail: davidmursch@earthlink.net

REPORT OF SUPPLEMENTAL SOIL SAMPLING

FOR:

NATIONAL COPPER PRODUCTS, INC.
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 3:

SOIL SAMPLE LOCATIONS AND TRICHLOROETHENE CONCENTRATIONS

November 07, 2008

Prairie Ronde Realty Company
Attn: Mr. R. David Mursch
4363 River Run Circle
Hickory, NC 28602

Project: Volatile / Miscellaneous Analyses

Dear Mr. R. David Mursch,

Enclosed is a copy of the laboratory report, comprised of the following work order(s), for test samples received by TriMatrix Laboratories:

Work Order	**Received**	**Description**
0810575	10/24/2008	NCP-Dowagiac: Soil

This report relates only to the sample(s), as received. Test results are in compliance with the requirements of the National Environmental Laboratory Accreditation Conference (NELAC). Any qualifications of results, including sample acceptance requirements, are explained in the Statement of Data Qualifications.

Estimates of analytical uncertainties for the test results contained within this report are available upon request.

If you have any questions or require further information, please do not hesitate to contact me.

Sincerely,

Gary L. Wood

Gary L. Wood
Project Chemist

Enclosures(s)

5560 Corporate Exchange Court SE • Grand Rapids, MI 49512 • (616) 975-4500 • Fax (616) 942-7463

TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G1 @ 22'**	Sampled:	10/22/08 11:40
Lab Sample ID:	**0810575-01**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<890	890
71-43-2	Benzene	<59	59
75-27-4	Bromodichloromethane	<59	59
75-15-0	Carbon Disulfide	<300	300
56-23-5	Carbon Tetrachloride	<59	59
108-90-7	Chlorobenzene	<59	59
110-75-8	2-Chloroethyl Vinyl Ether	<300	300
67-66-3	Chloroform	<59	59
74-87-3	Chloromethane	<59	59
95-50-1	1,2-Dichlorobenzene	<59	59
106-46-7	1,4-Dichlorobenzene	<59	59
75-34-3	1,1-Dichloroethane	<59	59
107-06-2	1,2-Dichloroethane	<59	59
75-35-4	1,1-Dichloroethene	<59	59
156-59-2	cis-1,2-Dichloroethene	<59	59
156-60-5	trans-1,2-Dichloroethene	<59	59
78-87-5	1,2-Dichloropropane	<59	59
100-41-4	Ethylbenzene	<59	59
591-78-6	2-Hexanone	<3000	3000
75-09-2	Methylene Chloride	<300	300
78-93-3	2-Butanone (MEK)	<3000	3000
100-42-5	Styrene	<59	59
79-34-5	1,1,2,2-Tetrachloroethane	<59	59
127-18-4	Tetrachloroethene	<59	59
108-88-3	Toluene	<59	59
71-55-6	1,1,1-Trichloroethane	<59	59
79-00-5	1,1,2-Trichloroethane	<59	59
79-01-6	Trichloroethene	**110**	59
75-01-4	Vinyl Chloride	<59	59
1330-20-7	Xylene (Total)	<180	180

Surrogates:	***% Recovery***	***Control Limits***
Dibromofluoromethane	88	*75-123*

Continued on next page

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G1 @ 22'**	Sampled:	10/22/08 11:40
Lab Sample ID:	**0810575-01**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	98	*83-116*
Toluene-d8	95	*85-113*
4-Bromofluorobenzene	93	*81-117*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G1 @ 22'**	Sampled:	10/22/08 11:40
Lab Sample ID:	**0810575-01**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical / Chemical Parameters by EPA / APHA / ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**97**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**Field Blank**	Sampled:	10/22/08 00:00
Lab Sample ID:	**0810575-02**	Sampled By:	R. David Mursch
Matrix:	Water	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812502	Analytical Batch:	8103153

Volatile Organic Compounds by EPA Method 8260B

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<5.0	5.0
71-43-2	Benzene	<1.0	1.0
75-27-4	Bromodichloromethane	<0.25	0.25
75-15-0	Carbon Disulfide	<5.0	5.0
56-23-5	Carbon Tetrachloride	<1.0	1.0
108-90-7	Chlorobenzene	<1.0	1.0
110-75-8	2-Chloroethyl Vinyl Ether	<5.0	5.0
67-66-3	Chloroform	<0.25	0.25
74-87-3	Chloromethane	<1.0	1.0
95-50-1	1,2-Dichlorobenzene	<1.0	1.0
106-46-7	1,4-Dichlorobenzene	<1.0	1.0
75-34-3	1,1-Dichloroethane	<1.0	1.0
107-06-2	1,2-Dichloroethane	<1.0	1.0
75-35-4	1,1-Dichloroethene	<1.0	1.0
156-59-2	cis-1,2-Dichloroethene	<1.0	1.0
156-60-5	trans-1,2-Dichloroethene	<1.0	1.0
78-87-5	1,2-Dichloropropane	<1.0	1.0
100-41-4	Ethylbenzene	<1.0	1.0
591-78-6	2-Hexanone	<5.0	5.0
75-09-2	Methylene Chloride	<1.0	1.0
78-93-3	2-Butanone (MEK)	<5.0	5.0
100-42-5	Styrene	<1.0	1.0
79-34-5	1,1,2,2-Tetrachloroethane	<0.50	0.50
127-18-4	Tetrachloroethene	<1.0	1.0
108-88-3	Toluene	<1.0	1.0
71-55-6	1,1,1-Trichloroethane	<1.0	1.0
79-00-5	1,1,2-Trichloroethane	<1.0	1.0
79-01-6	Trichloroethene	<1.0	1.0
75-01-4	Vinyl Chloride	<1.0	1.0
1330-20-7	Xylene (Total)	<3.0	3.0

Surrogates:	***% Recovery***	***Control Limits***
Dibromofluoromethane	94	*88-115*

Continued on next page

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**Field Blank**	Sampled:	10/22/08 00:00
Lab Sample ID:	**0810575-02**	Sampled By:	R. David Mursch
Matrix:	Water	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812502	Analytical Batch:	8103153

Volatile Organic Compounds by EPA Method 8260B (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	92	*81-116*
Toluene-d8	97	*87-113*
4-Bromofluorobenzene	96	*78-116*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G2 @ 15'**	Sampled:	10/22/08 13:35
Lab Sample ID:	**0810575-03**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	95		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<840	840
71-43-2	Benzene	<56	56
75-27-4	Bromodichloromethane	<56	56
75-15-0	Carbon Disulfide	<280	280
56-23-5	Carbon Tetrachloride	<56	56
108-90-7	Chlorobenzene	<56	56
110-75-8	2-Chloroethyl Vinyl Ether	<280	280
67-66-3	Chloroform	<56	56
74-87-3	Chloromethane	<56	56
95-50-1	1,2-Dichlorobenzene	<56	56
106-46-7	1,4-Dichlorobenzene	<56	56
75-34-3	1,1-Dichloroethane	<56	56
107-06-2	1,2-Dichloroethane	<56	56
75-35-4	1,1-Dichloroethene	<56	56
156-59-2	cis-1,2-Dichloroethene	<56	56
156-60-5	trans-1,2-Dichloroethene	<56	56
78-87-5	1,2-Dichloropropane	<56	56
100-41-4	Ethylbenzene	<56	56
591-78-6	2-Hexanone	<2800	2800
75-09-2	Methylene Chloride	<280	280
78-93-3	2-Butanone (MEK)	<2800	2800
100-42-5	Styrene	<56	56
79-34-5	1,1,2,2-Tetrachloroethane	<56	56
127-18-4	Tetrachloroethene	<56	56
108-88-3	Toluene	<56	56
71-55-6	1,1,1-Trichloroethane	<56	56
79-00-5	1,1,2-Trichloroethane	<56	56
79-01-6	Trichloroethene	<56	56
75-01-4	Vinyl Chloride	<56	56
1330-20-7	Xylene (Total)	<170	170

Surrogates:	***% Recovery***	***Control Limits***
Dibromofluoromethane	88	*75-123*

Continued on next page

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G2 @ 15'**	Sampled:	10/22/08 13:35
Lab Sample ID:	**0810575-03**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	95		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	97	*83-116*
Toluene-d8	95	*85-113*
4-Bromofluorobenzene	95	*81-117*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G2 @ 15'**	Sampled:	10/22/08 13:35
Lab Sample ID:	**0810575-03**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**95**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G3 @ 7-8'**	Sampled:	10/22/08 14:15
Lab Sample ID:	**0810575-04**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	93		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<800	800
71-43-2	Benzene	<54	54
75-27-4	Bromodichloromethane	<54	54
75-15-0	Carbon Disulfide	<270	270
56-23-5	Carbon Tetrachloride	<54	54
108-90-7	Chlorobenzene	<54	54
110-75-8	2-Chloroethyl Vinyl Ether	<270	270
67-66-3	Chloroform	<54	54
74-87-3	Chloromethane	<54	54
95-50-1	1,2-Dichlorobenzene	<54	54
106-46-7	1,4-Dichlorobenzene	<54	54
75-34-3	1,1-Dichloroethane	<54	54
107-06-2	1,2-Dichloroethane	<54	54
75-35-4	1,1-Dichloroethene	<54	54
156-59-2	cis-1,2-Dichloroethene	<54	54
156-60-5	trans-1,2-Dichloroethene	<54	54
78-87-5	1,2-Dichloropropane	<54	54
100-41-4	Ethylbenzene	<54	54
591-78-6	2-Hexanone	<2700	2700
75-09-2	Methylene Chloride	<270	270
78-93-3	2-Butanone (MEK)	<2700	2700
100-42-5	Styrene	<54	54
79-34-5	1,1,2,2-Tetrachloroethane	<54	54
127-18-4	Tetrachloroethene	<54	54
108-88-3	Toluene	<54	54
71-55-6	1,1,1-Trichloroethane	<54	54
79-00-5	1,1,2-Trichloroethane	<54	54
79-01-6	Trichloroethene	<54	54
75-01-4	Vinyl Chloride	<54	54
1330-20-7	Xylene (Total)	<160	160

Surrogates:	*% Recovery*	*Control Limits*
Dibromofluoromethane	89	*75-123*

Continued on next page

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G3 @ 7-8'**	Sampled:	10/22/08 14:15
Lab Sample ID:	**0810575-04**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	93		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	98	*83-116*
Toluene-d8	95	*85-113*
4-Bromofluorobenzene	96	*81-117*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G3 @ 7-8'**	Sampled:	10/22/08 14:15
Lab Sample ID:	**0810575-04**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical / Chemical Parameters by EPA / APHA / ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**93**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G3 @ 18'**	Sampled:	10/22/08 14:30
Lab Sample ID:	**0810575-05**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	96		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<780	780
71-43-2	Benzene	<52	52
75-27-4	Bromodichloromethane	<52	52
75-15-0	Carbon Disulfide	<260	260
56-23-5	Carbon Tetrachloride	<52	52
108-90-7	Chlorobenzene	<52	52
110-75-8	2-Chloroethyl Vinyl Ether	<260	260
67-66-3	Chloroform	<52	52
74-87-3	Chloromethane	<52	52
95-50-1	1,2-Dichlorobenzene	<52	52
106-46-7	1,4-Dichlorobenzene	<52	52
75-34-3	1,1-Dichloroethane	<52	52
107-06-2	1,2-Dichloroethane	<52	52
75-35-4	1,1-Dichloroethene	<52	52
156-59-2	cis-1,2-Dichloroethene	<52	52
156-60-5	trans-1,2-Dichloroethene	<52	52
78-87-5	1,2-Dichloropropane	<52	52
100-41-4	Ethylbenzene	<52	52
591-78-6	2-Hexanone	<2600	2600
75-09-2	Methylene Chloride	<260	260
78-93-3	2-Butanone (MEK)	<2600	2600
100-42-5	Styrene	<52	52
79-34-5	1,1,2,2-Tetrachloroethane	<52	52
127-18-4	Tetrachloroethene	<52	52
108-88-3	Toluene	<52	52
71-55-6	1,1,1-Trichloroethane	<52	52
79-00-5	1,1,2-Trichloroethane	<52	52
79-01-6	Trichloroethene	<52	52
75-01-4	Vinyl Chloride	<52	52
1330-20-7	Xylene (Total)	<160	160

Surrogates:	***% Recovery***	***Control Limits***
Dibromofluoromethane	89	*75-123*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G3 @ 18'**	Sampled:	10/22/08 14:30
Lab Sample ID:	**0810575-05**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	96		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	98	*83-116*
Toluene-d8	94	*85-113*
4-Bromofluorobenzene	94	*81-117*

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G3 @ 18'**	Sampled:	10/22/08 14:30
Lab Sample ID:	**0810575-05**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**96**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G4 @ 4'**	Sampled:	10/22/08 15:20
Lab Sample ID:	**0810575-06**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<710	710
71-43-2	Benzene	<47	47
75-27-4	Bromodichloromethane	<47	47
75-15-0	Carbon Disulfide	<240	240
56-23-5	Carbon Tetrachloride	<47	47
108-90-7	Chlorobenzene	<47	47
110-75-8	2-Chloroethyl Vinyl Ether	<240	240
67-66-3	Chloroform	<47	47
74-87-3	Chloromethane	<47	47
95-50-1	1,2-Dichlorobenzene	<47	47
106-46-7	1,4-Dichlorobenzene	<47	47
75-34-3	1,1-Dichloroethane	<47	47
107-06-2	1,2-Dichloroethane	<47	47
75-35-4	1,1-Dichloroethene	<47	47
156-59-2	cis-1,2-Dichloroethene	<47	47
156-60-5	trans-1,2-Dichloroethene	<47	47
78-87-5	1,2-Dichloropropane	<47	47
100-41-4	Ethylbenzene	<47	47
591-78-6	2-Hexanone	<2400	2400
75-09-2	Methylene Chloride	<240	240
78-93-3	2-Butanone (MEK)	<2400	2400
100-42-5	Styrene	<47	47
79-34-5	1,1,2,2-Tetrachloroethane	<47	47
127-18-4	Tetrachloroethene	<47	47
108-88-3	Toluene	<47	47
71-55-6	1,1,1-Trichloroethane	<47	47
79-00-5	1,1,2-Trichloroethane	<47	47
79-01-6	Trichloroethene	**51**	47
75-01-4	Vinyl Chloride	<47	47
1330-20-7	Xylene (Total)	<140	140

Surrogates:	*% Recovery*	*Control Limits*
Dibromofluoromethane	87	*75-123*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G4 @ 4'**	Sampled:	10/22/08 15:20
Lab Sample ID:	**0810575-06**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	96	*83-116*
Toluene-d8	94	*85-113*
4-Bromofluorobenzene	94	*81-117*

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G4 @ 4'**	Sampled:	10/22/08 15:20
Lab Sample ID:	**0810575-06**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical / Chemical Parameters by EPA / APHA / ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**97**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G4 @ 19'**	Sampled:	10/22/08 15:30
Lab Sample ID:	**0810575-07**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	98		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<880	880
71-43-2	Benzene	<59	59
75-27-4	Bromodichloromethane	<59	59
75-15-0	Carbon Disulfide	<290	290
56-23-5	Carbon Tetrachloride	<59	59
108-90-7	Chlorobenzene	<59	59
110-75-8	2-Chloroethyl Vinyl Ether	<290	290
67-66-3	Chloroform	<59	59
74-87-3	Chloromethane	<59	59
95-50-1	1,2-Dichlorobenzene	<59	59
106-46-7	1,4-Dichlorobenzene	<59	59
75-34-3	1,1-Dichloroethane	<59	59
107-06-2	1,2-Dichloroethane	<59	59
75-35-4	1,1-Dichloroethene	<59	59
156-59-2	cis-1,2-Dichloroethene	<59	59
156-60-5	trans-1,2-Dichloroethene	<59	59
78-87-5	1,2-Dichloropropane	<59	59
100-41-4	Ethylbenzene	<59	59
591-78-6	2-Hexanone	<2900	2900
75-09-2	Methylene Chloride	<290	290
78-93-3	2-Butanone (MEK)	<2900	2900
100-42-5	Styrene	<59	59
79-34-5	1,1,2,2-Tetrachloroethane	<59	59
127-18-4	Tetrachloroethene	<59	59
108-88-3	Toluene	<59	59
71-55-6	1,1,1-Trichloroethane	<59	59
79-00-5	1,1,2-Trichloroethane	<59	59
79-01-6	Trichloroethene	**98**	59
75-01-4	Vinyl Chloride	<59	59
1330-20-7	Xylene (Total)	<180	180

Surrogates:	***% Recovery***	***Control Limits***
Dibromofluoromethane	89	*75-123*

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G4 @ 19'**	Sampled:	10/22/08 15:30
Lab Sample ID:	**0810575-07**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	98		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	97	*83-116*
Toluene-d8	94	*85-113*
4-Bromofluorobenzene	93	*81-117*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G4 @ 19'**	Sampled:	10/22/08 15:30
Lab Sample ID:	**0810575-07**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**98**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G5 @ 7'**	Sampled:	10/22/08 14:10
Lab Sample ID:	**0810575-08**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<840	840
71-43-2	Benzene	<56	56
75-27-4	Bromodichloromethane	<56	56
75-15-0	Carbon Disulfide	<280	280
56-23-5	Carbon Tetrachloride	<56	56
108-90-7	Chlorobenzene	<56	56
110-75-8	2-Chloroethyl Vinyl Ether	<280	280
67-66-3	Chloroform	<56	56
74-87-3	Chloromethane	<56	56
95-50-1	1,2-Dichlorobenzene	<56	56
106-46-7	1,4-Dichlorobenzene	<56	56
75-34-3	1,1-Dichloroethane	<56	56
107-06-2	1,2-Dichloroethane	<56	56
75-35-4	1,1-Dichloroethene	<56	56
156-59-2	cis-1,2-Dichloroethene	<56	56
156-60-5	trans-1,2-Dichloroethene	<56	56
78-87-5	1,2-Dichloropropane	<56	56
100-41-4	Ethylbenzene	<56	56
591-78-6	2-Hexanone	<2800	2800
75-09-2	Methylene Chloride	<280	280
78-93-3	2-Butanone (MEK)	<2800	2800
100-42-5	Styrene	<56	56
79-34-5	1,1,2,2-Tetrachloroethane	<56	56
127-18-4	Tetrachloroethene	<56	56
108-88-3	Toluene	<56	56
71-55-6	1,1,1-Trichloroethane	<56	56
79-00-5	1,1,2-Trichloroethane	<56	56
79-01-6	Trichloroethene	<56	56
75-01-4	Vinyl Chloride	<56	56
1330-20-7	Xylene (Total)	<170	170

Surrogates:	*% Recovery*	*Control Limits*
Dibromofluoromethane	89	*75-123*

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G5 @ 7'**	Sampled:	10/22/08 14:10
Lab Sample ID:	**0810575-08**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	97	*83-116*
Toluene-d8	94	*85-113*
4-Bromofluorobenzene	94	*81-117*

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G5 @ 7'**	Sampled:	10/22/08 14:10
Lab Sample ID:	**0810575-08**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**97**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G5 @ 12'**	Sampled:	10/22/08 15:20
Lab Sample ID:	**0810575-09**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	98		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<860	860
71-43-2	Benzene	<57	57
75-27-4	Bromodichloromethane	<57	57
75-15-0	Carbon Disulfide	<290	290
56-23-5	Carbon Tetrachloride	<57	57
108-90-7	Chlorobenzene	<57	57
110-75-8	2-Chloroethyl Vinyl Ether	<290	290
67-66-3	Chloroform	<57	57
74-87-3	Chloromethane	<57	57
95-50-1	1,2-Dichlorobenzene	<57	57
106-46-7	1,4-Dichlorobenzene	<57	57
75-34-3	1,1-Dichloroethane	<57	57
107-06-2	1,2-Dichloroethane	<57	57
75-35-4	1,1-Dichloroethene	<57	57
156-59-2	cis-1,2-Dichloroethene	<57	57
156-60-5	trans-1,2-Dichloroethene	<57	57
78-87-5	1,2-Dichloropropane	<57	57
100-41-4	Ethylbenzene	<57	57
591-78-6	2-Hexanone	<2900	2900
75-09-2	Methylene Chloride	<290	290
78-93-3	2-Butanone (MEK)	<2900	2900
100-42-5	Styrene	<57	57
79-34-5	1,1,2,2-Tetrachloroethane	<57	57
127-18-4	Tetrachloroethene	<57	57
108-88-3	Toluene	<57	57
71-55-6	1,1,1-Trichloroethane	<57	57
79-00-5	1,1,2-Trichloroethane	<57	57
79-01-6	Trichloroethene	**420**	57
75-01-4	Vinyl Chloride	<57	57
1330-20-7	Xylene (Total)	<170	170

Surrogates:	***% Recovery***	***Control Limits***
Dibromofluoromethane	89	*75-123*

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G5 @ 12'**	Sampled:	10/22/08 15:20
Lab Sample ID:	**0810575-09**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	98		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	96	*83-116*
Toluene-d8	93	*85-113*
4-Bromofluorobenzene	93	*81-117*

TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G5 @ 12'**	Sampled:	10/22/08 15:20
Lab Sample ID:	**0810575-09**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**98**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G6 @ 15'**	Sampled:	10/22/08 17:20
Lab Sample ID:	**0810575-10**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/kg dry	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level)

CAS Number	Analyte	Analytical Result	RL
67-64-1	Acetone	<970	970
71-43-2	Benzene	<65	65
75-27-4	Bromodichloromethane	<65	65
75-15-0	Carbon Disulfide	<320	320
56-23-5	Carbon Tetrachloride	<65	65
108-90-7	Chlorobenzene	<65	65
110-75-8	2-Chloroethyl Vinyl Ether	<320	320
67-66-3	Chloroform	<65	65
74-87-3	Chloromethane	<65	65
95-50-1	1,2-Dichlorobenzene	<65	65
106-46-7	1,4-Dichlorobenzene	<65	65
75-34-3	1,1-Dichloroethane	<65	65
107-06-2	1,2-Dichloroethane	<65	65
75-35-4	1,1-Dichloroethene	<65	65
156-59-2	cis-1,2-Dichloroethene	<65	65
156-60-5	trans-1,2-Dichloroethene	<65	65
78-87-5	1,2-Dichloropropane	<65	65
100-41-4	Ethylbenzene	<65	65
591-78-6	2-Hexanone	<3200	3200
75-09-2	Methylene Chloride	<320	320
78-93-3	2-Butanone (MEK)	<3200	3200
100-42-5	Styrene	<65	65
79-34-5	1,1,2,2-Tetrachloroethane	<65	65
127-18-4	Tetrachloroethene	<65	65
108-88-3	Toluene	<65	65
71-55-6	1,1,1-Trichloroethane	<65	65
79-00-5	1,1,2-Trichloroethane	<65	65
79-01-6	Trichloroethene	<65	65
75-01-4	Vinyl Chloride	<65	65
1330-20-7	Xylene (Total)	<190	190

Surrogates:	*% Recovery*	*Control Limits*
Dibromofluoromethane	88	*75-123*

Continued on next page

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G6 @ 15'**	Sampled:	10/22/08 17:20
Lab Sample ID:	**0810575-10**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00
Unit:	ug/L	Prepared:	10/29/08 By: JDM
Dilution Factor:	1	Analyzed:	10/29/08 By: JDM
QC Batch:	0812763	Analytical Batch:	8103146
Percent Solids:	97		

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Surrogates (Continued):	***% Recovery***	***Control Limits***
1,2-Dichloroethane-d4	96	*83-116*
Toluene-d8	94	*85-113*
4-Bromofluorobenzene	93	*81-117*

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TriMatrix Laboratories, Inc.

ANALYTICAL REPORT

Client:	**Prairie Ronde Realty Company**	Work Order:	**0810575**
Project:	Volatile/Miscellaneous Analyses	Description:	NCP-Dowagiac: Soil
Client Sample ID:	**08-G6 @ 15'**	Sampled:	10/22/08 17:20
Lab Sample ID:	**0810575-10**	Sampled By:	R. David Mursch
Matrix:	Soil	Received:	10/24/08 09:00

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
Percent Solids	**97**	0.1	%	1	USEPA-3550B	11/05/08	KNC	0812944

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QUALITY CONTROL REPORT

Volatile Organic Compounds by EPA Method 8260B

QC Batch: 0812502 5030B Aqueous Purge & Trap/USEPA-8260B

Method Blank — Analyzed: 10/29/2008 By: JDM
Unit: ug/L — Analytical Batch: 8103153

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
Acetone			<5.0					5.0
Benzene			<1.0					1.0
Bromodichloromethane			<0.25					0.25
Carbon Disulfide			<5.0					5.0
Carbon Tetrachloride			<1.0					1.0
Chlorobenzene			<1.0					1.0
2-Chloroethyl Vinyl Ether			<5.0					5.0
Chloroform			<0.25					0.25
Chloromethane			<1.0					1.0
1,2-Dichlorobenzene			<1.0					1.0
1,4-Dichlorobenzene			<1.0					1.0
1,1-Dichloroethane			<1.0					1.0
1,2-Dichloroethane			<1.0					1.0
1,1-Dichloroethene			<1.0					1.0
cis-1,2-Dichloroethene			<1.0					1.0
trans-1,2-Dichloroethene			<1.0					1.0
1,2-Dichloropropane			<1.0					1.0
Ethylbenzene			<1.0					1.0
2-Hexanone			<5.0					5.0
Methylene Chloride			<1.0					1.0
2-Butanone (MEK)			<5.0					5.0
Styrene			<1.0					1.0
1,1,2,2-Tetrachloroethane			<0.50					0.50
Tetrachloroethene			<1.0					1.0
Toluene			<1.0					1.0
1,1,1-Trichloroethane			<1.0					1.0
1,1,2-Trichloroethane			<1.0					1.0
Trichloroethene			<1.0					1.0
Vinyl Chloride			<1.0					1.0
Xylene (Total)			<3.0					3.0
Surrogates:								
Dibromofluoromethane				*95*	*88-115*			
1,2-Dichloroethane-d4				*94*	*81-116*			
Toluene-d8				*96*	*87-113*			
4-Bromofluorobenzene				*96*	*78-116*			

Laboratory Control Sample — Analyzed: 10/29/2008 By: JDM
Unit: ug/L — Analytical Batch: 8103153

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
Benzene		40.0	**42.7**	107	86-122			1.0

Continued on next page

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QUALITY CONTROL REPORT

Volatile Organic Compounds by EPA Method 8260B (Continued)

QC Batch: 0812502 (Continued) 5030B Aqueous Purge & Trap/USEPA-8260B

Laboratory Control Sample (Continued) Analyzed: 10/29/2008 By: JDM

Unit: ug/L Analytical Batch: 8103153

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
Chlorobenzene		40.0	**39.8**	100	88-114			1.0
1,1-Dichloroethene		40.0	**42.8**	107	81-125			1.0
Toluene		40.0	**42.0**	105	87-123			1.0
Trichloroethene		40.0	**44.2**	111	80-122			1.0

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QUALITY CONTROL REPORT

Volatile Organic Compounds by EPA Method 8260B (High Level)

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL

QC Batch: 0812763 5030B Aqueous Purge & Trap/USEPA-8260B

Method Blank Analyzed: 10/29/2008 By: JDM
Unit: ug/kg wet Analytical Batch: 8103146

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
Acetone			<750					750
Benzene			<50					50
Bromodichloromethane			<50					50
Carbon Disulfide			<250					250
Carbon Tetrachloride			<50					50
Chlorobenzene			<50					50
2-Chloroethyl Vinyl Ether			<250					250
Chloroform			<50					50
Chloromethane			<50					50
1,2-Dichlorobenzene			<50					50
1,4-Dichlorobenzene			<50					50
1,1-Dichloroethane			<50					50
1,2-Dichloroethane			<50					50
1,1-Dichloroethene			<50					50
cis-1,2-Dichloroethene			<50					50
trans-1,2-Dichloroethene			<50					50
1,2-Dichloropropane			<50					50
Ethylbenzene			<50					50
2-Hexanone			<2500					2500
Methylene Chloride			<250					250
2-Butanone (MEK)			<2500					2500
Styrene			<50					50
1,1,2,2-Tetrachloroethane			<50					50
Tetrachloroethene			<50					50
Toluene			<50					50
1,1,1-Trichloroethane			<50					50
1,1,2-Trichloroethane			<50					50
Trichloroethene			<50					50
Vinyl Chloride			<50					50
Xylene (Total)			<150					150

Method Blank Analyzed: 10/29/2008 By: JDM
Unit: ug/L Analytical Batch: 8103146

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
Surrogates:								
Dibromofluoromethane				*98*	*75-123*			
1,2-Dichloroethane-d4				*100*	*83-116*			

Continued on next page

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QUALITY CONTROL REPORT

Volatile Organic Compounds by EPA Method 8260B (High Level) (Continued)

Analyte	Sample Conc.	Spike Qty.	Result	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
QC Batch: 0812763 (Continued) 5030B Aqueous Purge & Trap/USEPA-8260B								
Method Blank (Continued) Unit: ug/L					Analyzed: 10/29/2008 By: JDM; Analytical Batch: 8103146			
Surrogates (Continued):								
Toluene-d8				*94*	*85-113*			
4-Bromofluorobenzene				*90*	*81-117*			
Laboratory Control Sample Unit: ug/kg wet					Analyzed: 10/29/2008 By: JDM; Analytical Batch: 8103146			
Benzene		2000	**1890**	95	85-118			50
Chlorobenzene		2000	**1920**	96	86-114			50
1,1-Dichloroethene		2000	**1980**	99	80-121			50
Toluene		2000	**1870**	94	86-120			50
Trichloroethene		2000	**1880**	94	83-125			50
Laboratory Control Sample Unit: ug/L					Analyzed: 10/29/2008 By: JDM; Analytical Batch: 8103146			
Surrogates:								
Dibromofluoromethane				*99*	*75-123*			
1,2-Dichloroethane-d4				*100*	*83-116*			
Toluene-d8				*97*	*85-113*			
4-Bromofluorobenzene				*91*	*81-117*			
Laboratory Control Sample Duplicate Unit: ug/kg wet					Analyzed: 10/29/2008 By: JDM; Analytical Batch: 8103146			
Benzene		2000	**1980**	99	85-118	4	20	50
Chlorobenzene		2000	**1970**	99	86-114	3	20	50
1,1-Dichloroethene		2000	**2060**	103	80-121	4	20	50
Toluene		2000	**1940**	97	86-120	3	20	50
Trichloroethene		2000	**1960**	98	83-125	4	20	50
Laboratory Control Sample Duplicate Unit: ug/L					Analyzed: 10/29/2008 By: JDM; Analytical Batch: 8103146			
Surrogates:								
Dibromofluoromethane				*100*	*75-123*			
1,2-Dichloroethane-d4				*100*	*83-116*			
Toluene-d8				*99*	*85-113*			
4-Bromofluorobenzene				*91*	*81-117*			

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TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT

Physical/Chemical Parameters by EPA/APHA/ASTM Methods

QC Type	Sample Conc.	Spike Qty.	Result	Unit	Spike % Rec.	Control Limits	RPD	RPD Limits	RL
Analyte: Percent Solids/USEPA-3550B									
QC Batch: 0812944 (General Inorganic Prep)							Analyzed: 11/05/2008		By: KNC
Method Blank			<0.1	%					0.1
0810575-03 [08-G2 @ 15']									
Duplicate	95		**95**	%			0.3	20	0.1

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STATEMENT OF DATA QUALIFICATIONS

All analyses have been validated and comply with our Quality Control Program.
No Qualifications required.

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TriMatrix Laboratories, Inc.
5560 Corporate Exchange Court SE Grand Rapids, MI 49512
Phone (616) 975-4500 Fax (616) 942-7463
www.trimatrixlabs.com

Chain of Custody Record

COC No. 126695

For Lab Use Only

Cart: 1 (72.8W water)

VOA Rack/Tray: 167 Blue soil

Receipt Log No.: 37-1

Project Chemist: RW

Laboratory Project No.: E-0810575

Client Name	Project Name
R. DAVID MURSCH	NCP
Address: P.O. BOX 131 RUTHERFORD COLLEGE NC 28671	Client Project No./P.O. No.: 96-01
	Invoice No.: NCP ☐ Client ☐ Other (comments)
Phone: (828) 234-5906	Contact/Report To: RDM
Fax	

Analyses Requested: GA; VOCs-8260 MC

Container Type (corresponds to Container Packing List): 22, 20

PRESERVATIVES
- A NONE pH~7
- B HNO_3 pH<2
- C H_2SO_4 pH<2
- D 1+1 HCl pH<2
- E NaOH pH>12
- F ZnAc/NaOH pH>9
- G MeOH
- H Other (note below)

Test Group	Matrix Code	Laboratory Sample Number		Sample ID	Cooler ID	Sample Date	Sample Time	COMP	GRAB	Matrix	22	20	Total	Sample Comments
09		01	1	08-G1 @ 22'		10-22-08	1140		✓	S	1	1		
05		02	2	FIELD BLANK		—	—		✓	–	1	—		
09		03	3	08-G-2 @ 75'		10-22-08	1335		✓	S	1	1		
		04	4	08-G3 @ 7-8'			1415		✓	S	1	1		
		05	5	08-G3 @ 18'			1430		✓	S	1	1		
		06	6	08-G4 @ 4'			1520		✓	S	1	1		
		07	7	08-G4 @ 19'			1530		✓	S	1	1		
		08	8	08-G5 @ 7'			1410		✓	S	1	1		
		09	9	08-G5 @ 12'			1520		✓	S	1	1		
		10	10	08-G6 @ 15'			1720		✓	S	1	1		

Sampled By (print): R. DAVID MURSCH

Sampler's Signature: [signature]

Company:

How Shipped? Hand Carrier: Fed Ex

Tracking No.: 9546 3614 9040

Comments:

1. Relinquished By	Date	Time	2. Relinquished By	Date	Time	3. Relinquished By	Date	Time
[signature]								
1. Received By	Date	Time	2. Received By	Date	Time	3. Received For Lab By	Date	Time
						[signature]	10/24/08	0900

TriMatrix Laboratories, Inc.

SAMPLE RECEIVING / LOG-IN CHECKLIST

Client: R. David Mursch
Project-Submittal No: 0810575 (new / add to)
Receipt Record Page/Line No: 37-1
Project Chemist | Sample Nos.

Coolers Received

Recorded by (initials/date): LR 10-24-08

☑ Cooler ☐ Box ☐ Other ____ — Qty Received: 2

Thermometer Used: ☑ IR Gun (#202) ☐ Digital Thermometer (#54) ☐ Other (# ____) — ☐ See Additional Cooler Information Form

	Cooler 1	Cooler 2	Cooler 3	Cooler 4
Cooler No. / Time	798 / 9:13	1008 / 922		
Custody Seals	☑ none ☐ present / intact ☐ present / not intact	☑ none ☐ present / intact ☐ present / not intact	☐ none ☐ present / intact ☐ present / not intact	☐ none ☐ present / intact ☐ present / not intact
Coolant Location: Dispersed / Top / Middle / Bottom	Bottom	Bottom		
Coolant/Temperature Taken Via	☑ bagged ice / avg 2-3 containers	☑ bagged ice / avg 2-3 containers	☐ loose ice ☐ bagged ice ☐ blue ice ☐ none / avg 2-3 containers	☐ loose ice ☐ bagged ice ☐ blue ice ☐ none / avg 2-3 containers
Alternate Temperature Taken Via	☑ temperature blank (tb) ☐ 1 container	☑ temperature blank (tb) ☐ 1 container	☐ temperature blank (tb) ☐ 1 container	☐ temperature blank (tb) ☐ 1 container
tb: Recorded °C / Correction Factor °C / Actual °C	4.1 / — / 4.1	3.7 / — / 3.7		
tb location: representative / in ice				
1	7.5 / — / 7.5	6.0 / — / 6.0		
2	8.9 / — / 8.9	7.3 / — / 7.3		
3	9.3 / — / 9.3	5.9 / — / 5.9		
Average °C	8.6	4.4		
Cooler ID on COC?	☐	☐	☐	☐
VOC trip blank received?	☑	☐	☐	☐

If any shaded areas checked, complete Sample Receiving Non-Conformance Form

Paperwork Received

☐ No COC received

N/A	Yes	No	
	☑	☐	Chain of Custody Record(s)?
	☐		If No, COC initiated by ____
	☑		Rec'd for Lab signed/date/time?
☐	☑		Shipping Document?
☑	☐		Other ____

COC ID Nos.

☑ TriMatrix 126695, 125882

☐ Other (name or ID#) ____

Check COC for Accuracy

☐ No analysis requested

Yes	No	
☑	☐	Sample ID matches COC?
☑	☐	Sample date and time matches COC?
☑		Container type completed on COC?
☑	☐	All container types indicated are received?

Sample Condition Summary

☐ Non-TriMatrix containers, see Notes

N/A	Yes	No	
	☐	☑	Broken containers/lids?
	☐	☑	Missing or incomplete labels?
	☐	☑	Illegible information on labels?
	☐	☑	Low volume received?
	☐	☑	Inappropriate containers received?
☑	☐	☐	VOC vials / TOX containers have headspace?
☑	☐	☐	Extra sample locations / containers not listed on COC?

Check Sample Preservation

N/A	Yes	No	
	☑	☐	Average sample temperature ≤6° C?
☐	☑		Completed Sample Preservation Verification Form?
☐	☑	☐	Samples preserved correctly?
☑	☐		If "No", added orange tag?
☑	☐		Received pre-preserved VOC soils?

☐ MeOH ☐ Na_2SO_4

Check for Short Hold-Time Prep/Analyses

☐ Bacteriological
☐ Air Bags
☑ EnCores / Methanol Pre-Preserved
☐ Formaldehyde/Aldehyde
☐ Green-tagged Containers
☐ Yellow/White-tagged 1L Ambers (SV Prep-Lab)

AFTER HOURS ONLY: COPIES OF COC TO LAB AREA(S)
☐ NONE RECEIVED
☑ RECEIVED, COCs TO LAB(S)

Notes

☑ Trip blank received ☐ Trip blank not listed on COC
☐ No COC received, Proj. Chemist reviewed (init./date) ____
☐ No analysis requested, Proj. Chemist completed (init./date) ____

Cooler Received (Date/Time)	Paperwork Delivered (Date/Time)	≤1 Hour Goal Met?
10/24/08 0900	10/24/08 9:30	Yes (circled) / No

Appendix D

Report of ABC®+ Pilot Test

REPORT OF ABC+ PILOT TEST

~

National Copper Products, Inc.

Dowagiac, Michigan

Prepared For:

Mr. Tom Fox
National Tube Holding Company
201 Massey Building
290 North 21st Street
Birmingham, AL 35203

Cc: James Tolbert (5)
Charlie Denton
Brian DeLong
Scott Moyer (via email only)
USEPA (via Jim Tolbert)
MDEQ (via Jim Tolbert)

~

Prepared By:

R. David Mursch, P.E.
104 Rivercliff Drive
Connelly Springs, North Carolina 28612

~

November 17, 2011

TABLE OF CONTENTS

1.0 INTRODUCTION

The former copper tube mill located at 415 Prairie Ronde Street in Dowagiac, Michigan, was acquired by Prairie Ronde Realty Company (PRR) from the Sundstrand Corporation (UTC/Sundstrand) in 1995. The shallow soil and groundwater beneath this plant were impacted by volatile organic compounds (VOCs), primarily trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), prior to acquisition of the property by PRR. The contamination was discovered in 1983, and the impacted soil and groundwater have been actively remediated since 1984.

The plant is underlain by glacial outwash deposits. In general, there is an upper layer of medium to fine sand grading to sandy gravel. This upper layer is typically 50 to 60 feet thick within the main plant area, and groundwater in this layer occurs under water table conditions. Underlying this upper layer is a variable but persistent aquitard layer consisting of inter-bedded clay, fine silty sand, clayey silt and clayey sand, which has sometimes been referred to as the “clay layer”. The aquitard is typically several feet thick but in some areas it is tens of feet thick. The soil below the aquitard consists of inter-bedded sand and gravel that together form a semi-confined aquifer, and there is generally an upward hydraulic gradient across the aquitard. The assessment and monitoring data have shown that there is little VOC impact to the groundwater below the aquitard layer.

In 1984 a groundwater remediation system consisting of twelve purge wells was installed, and this system has been operating since then under the terms of a Consent Judgment between UTC/Sundstrand (formerly Sundstrand Heat Transfer, Inc.) and the Michigan Department of Environmental Quality (MDEQ, formerly the Department of Natural Resources).

In 2004, MDEQ requested that the US Environmental Protection Agency (EPA) assume the regulatory lead for this site and PRR subsequently entered into a voluntary Consent Agreement with the USEPA (EPA CA) for completion of the site’s environmental assessment and remediation. The USEPA CA required, among other things, submittal of a Corrective Measures Proposal (CMP) for a final remedy of the site by the fall of 2009. The CMP was subsequently submitted as required. The CMP proposed continued operation of the purge well system to protect surface waters until the levels of VOC impact were below agreed surface-water criteria, followed by monitored natural attenuation (MNA) until drinking water criteria were achieved. The CMP also proposed chemical injections to reduce VOC levels at source areas in the plant, primarily at the former Oil and Solvent Room (OSR).

During development of the CMP, PRR initiated a pilot test of a chemical injection technology using a proprietary formula designated as Anaerobic Biochem Plus Zero-Valent Iron (ZVI) (ABC+) to verify that this technology was applicable to this site. A Phase I pilot injection was completed in the fall of 2008, followed by a limited supplemental injection in July 2009 to address a limited area where the initial injection had not delivered the material effectively. Based on the results PRR confirmed that the technology was effective and safe for the site and the technology was incorporated into the CMP.

In the fall of 2010, PRR performed a Phase II test injection at the OSR to evaluate injection rates and dosages that would be needed for full-scale application of the technology to the OSR and to other areas of the site.

This report summarizes the findings of the two pilot test phases, provides the injection and monitoring data for reference, and presents PRR’s conclusions and recommendations for application of ABC+ technology to the site.

2.0 SCOPE OF WORK AND PROCEDURES

The ABC+ pilot testing described in this report was completed in two phases. An initial Phase I injection was made in October 2008; a supplemental Phase I injection was made in June of 2009 to address an area that was not effectively dosed in the initial Phase I test injection. After the first phase injection demonstrated that the technology would be effective, a Phase II test injection was performed in October 2010 to evaluate injection frequency and dosages for full-scale application of the ABC+.

Figure 1 shows the PRR site and the ABC+ pilot test area location on the site. Figure 2 shows the pilot test area (i.e. the OSR) in detail, including the locations of the pilot test monitoring wells.

The following sections describe the pre-test analyses of the aquifer targeted for treatment, the three injections, and the post-injection groundwater monitoring for ABC-related parameters.

2.1 Pre-Test Sampling

Prior to the start of the ABC+ pilot test, PRR submitted a work plan to EPA and MDEQ outlining the proposed testing procedures (*Assessment for Development of Corrective Measures Proposal* dated June 5, 2008). The proposed test monitoring program was subsequently modified at the request of MDEQ and additional submittals were made to address issues raised by EPA and MDEQ, including the *Response to Letter Dated July 23, 2008* dated July 29, 2008 and the *Response to letter Dated August 16, 2008* dated August 26, 2008. The pilot test protocol was approved by MDEQ in an email dated October 6, 2008.

The pre-sampling submittals included a range of pre-test sampling and analysis of groundwater for parameters relevant to natural attenuation and ABC+ technology. The data were submitted in the *Third Quarter 2008 Monitoring Report* dated November 14, 2008 and are not included in this report.

Prior to the start of the test, four 1-inch PVC monitoring wells were installed at the OSR at locations specified by the MDEQ. The wells were sampled prior to the test injection for analysis of:

- VOCs by EPA Method 8260;
- Dissolved gases ethane and ethene by Method RSK-175;
- Total organic carbon (TOC) by Method SM 5310;
- Total metals iron, manganese and sodium by EPA Method 6010.

These data were reported in the *Fourth Quarter 2008 Monitoring Report* dated January 27, 2009 and are included on Table 1 of this report. The laboratory analytical reports are included on the enclosed data CD.

2.2 Phase I Feasibility Pilot Test – October 2008

The first phase of ABC+ pilot testing was designed to evaluate the feasibility of the ABC+ technology at this site. The test injection was completed in October of 2008 at the OSR. The injection was performed using a Geoprobe drilling rig with a specially-designed injection nozzle attached to the end of the push rods. The material was injected at designated depth intervals starting at the deepest interval. At each interval a pre-determined volume of ABC+ mixed in water was injected; the rods were then raised up to the next injection depth interval.

Following completion of the pilot test injection, wells TW-1, TW-2, TW-3, TW-4, 96-201B, 97-214B and the 20GPM purge well were sampled on October 26, 2008 for analysis of the test monitoring parameters listed above.

The seven wells listed above plus well 98-215A and the CMT ports at 06-18/1 and 06-18/2 (ten monitoring points altogether) were sampled for analysis of the pilot test parameters at designated time intervals following the injection, on December 7, 2008; February 2, 2009; April 23, 2009; and June 17, 2009. The samples obtained on December 7, 2008 were also analyzed for dehalococcoides bacteria (DHC) and total metals. The samples obtained in February, April and June were analyzed for total arsenic n addition to the regular test parameters.

A detailed description of the injection and sampling procedures, the initial test data and the ABC+ injection logs and material records provided by the contractor (Redox Tech, LLC) were included in the *Fourth Quarter 2008 Monitoring Report* dated January 27, 2009. The post-injection monitoring data for February 2, 2009 were included in the *First Quarter 2009 Monitoring Report* dated May 19, 2009, and were summarized and discussed in the *ABC+ Pilot Test Status Report* dated March 30, 2009. The post-injection monitoring data for the April 3 and June 17, 2009 events were included in the *Second Quarter 2009 Monitoring Report* dated August 6, 2009.

The chemical data obtained in these various events are summarized on the attached Table 1; the DHC census data are summarized on Table 2; and the metals data are summarized on Table 3. The test injection records and a figure showing the injection points, along with the laboratory analytical reports are included on the enclosed data CD.

2.3 Phase I Supplemental Injection – July 2009

After review of the post-injection monitoring data, PRR determined that the pilot test injection procedure may have resulted in localized “short-circuiting” of injected material; that is, the material that was injected into the upper fine sand portion of the aquifer at some locations may have flowed down along the outside of the injection rods and out into the lower gravel portion of the aquifer, resulting in an incomplete delivery of material into the upper fine sand layer. Subsequently, after approval by EPA and MDEQ, PRR performed a focused re-injection of ABC material in the fine sand layer at the OSR. The ABC+ material was injected only into the upper fine sands; the rods were not pushed into the deeper gravel so that short-circuiting could not occur.

The focused injection was performed on July 6 and 7, 2009 in accordance with the procedures outlined in the *ABC+ Pilot Test - Second Status Report* dated June 26, 2009. The injection point locations, injection logs, and other details are described in the *Second Quarter 2009 Monitoring Report* dated August 6, 2009.

Following the focused re-injection, the ten monitoring wells were sampled for analyses of the pilot test parameters on August 9, 2009; September 9, 2009; December 9, 2009; April 10, 2010; and September 10, 2010. These data were reported in the *Third Quarter 2009 Monitoring Report* dated November 2, 2009; the *Fourth Quarter 2009 Monitoring Report* dated January 11, 2010; the *Second Quarter Monitoring Report* dated August 9, 2010; and the *Third Quarter 2010 Monitoring Report* dated December 14, 2010.

These data are included with the ABC test monitoring data in the attached Tables and are included on the enclosed data CD.

2.4 Phase II Pilot Test Injection – November 2010

Based on the Phase I results, PRR incorporated the ABC+ injection technology in the CMP submitted to the EPA in the fall of 2009. PRR subsequently performed a second, Phase II test injection at the OSR to evaluate the frequency and dosage rates for further remedial injections. PRR submitted the *Revised Work Plan for Supplemental ABC+ Pilot Test Injection* dated October 8, 2010 and after agency approval the second injection was completed by Redox Tech, LLC in November, 2010. The test injection locations and logs of the injection (amounts, pressures, depths etc.) were included in the *Fourth Quarter 2010 Monitoring Report* dated February 22, 2011.

As part of the second injection, Redox Tech, LLC installed six injection wells consisting of 1-inch PVC pipes and screens, with three set into the deeper gravel layer and three in the fine upper sand. These wells will allow further injections to be made expeditiously at the two more heavily impacted parts of the OSR.

After the Phase II injection was completed, the 20GPM well pump failed and a former sparge injection well, IW-1, was substituted for monitoring purposes. The ten pilot test monitoring locations were sampled at designated time intervals for the same pilot test monitoring parameters as the Phase I monitoring , plus methane, nitrate and sulfate. Purge well PW-13, which had been shut down for the duration of the pilot testing, was also sampled after the Phase II injection but only for analysis of VOCs.

The monitoring frequency following the Phase II injection was increased over the Phase I test frequency in order to more fully assess of the rate of decay in the ABC organic substrate (measured by TOC analyses). The post-injection monitoring samples were obtained on December 8, 2010; December 20, 2010; January 12, 2011; February 3, 2011; March 2, 2011; and May 6, 2011. The data were reported in the *Fourth Quarter 2010 Monitoring Report* dated February 22, 2011; the *First Quarter 2011 Monitoring Report*, dated May 8, 2011; and the *Second Quarter 2011 Monitoring Report* dated August 4, 2011. An additional set of data that was obtained on September 23, 2011 is included in this report and will also be included in the monitoring report for the third quarter of 2011.

In addition to the chemical analyses, the test monitoring samples that were obtained on March 2, 2011 were analyzed for DHC bacteria.

The post-injection ABC+ monitoring data for the Phase II test injection are included on the attached Table 1 and 2 and the analytical reports are included n the enclosed data CD.

2.5 Groundwater Sampling Procedures

In general the groundwater samples for the pilot test analyses were obtained using low-flow procedures and peristaltic pumps. The 20GPM well and purge well PW-13 were sampled directly from the pump discharge line, after running the pumps for about five minutes to purge the well bore and pump.

2.6 Documentation

For convenience and ease of reference, the injection logs, analytical reports, and figures showing injection locations for each injection event that have been previously submitted as part of regular monitoring reports are included on the attached data CD in *.pdf format.

3.0 RESULTS AND EVALUATION

As described above the pilot test included a Phase I full-scale injection of the ABC+ material at the OSR in October 2008, a focused supplemental Phase I injection in July 2009, and a Phase II injection in November 2010. Figure 2 shows the OSR pilot testing location and the monitoring wells; figures showing the injection locations for each phase, along with logs of each injection point (amounts, pressures, depths etc.) as recorded by Redox Tech, LLC, are included on the enclosed data CD to provide a single source of this information for convenience of review and reference. The groundwater monitoring data related to the pilot testing are summarized in Table 1 and Table 2.

As shown in Table 1, designated monitoring points were sampled for analysis of designated parameters before and after each phase of injection. The monitoring parameters for Phase I included the target VOC compounds, dissolved gases ethane and ethene (which may be produced as a result of degradation of chlorinated compounds), iron and sodium (constituents of the ABC+ material), TOC (an indicator parameter for the injected ABC material), and DHC and metals at some events. The indicator parameters (iron, TOC etc.) are measured to show which wells have been impacted by the ABC+ material; the effectiveness of the remediation is monitored by measurements of TCE and its degradation products. In the Phase II test, the groundwater was also analyzed for nitrate, sulfate and methane.

The Phase I test monitoring network included three wells within the test injection area (97-214B, 20GPM, and TW-1); three wells immediately down-gradient of the test injection area (TW-2, TW-3, and TW-4); two wells side-gradient of the injection area (96-210B and 98-215A; and two down-gradient compliance point wells (06-18/1 and 06-18/2). In the Phase II testing, the 20GPM well was replaced by sparge well IW-1and purge well PW-13 was also sampled for VOC analysis as part of the Phase II evaluation.

Figure 3 shows time-trend data plots for TCE, cis-1,2-dichloroethene (cisDCE) and vinyl chloride for the wells located within and immediately down-gradient of the OSR injection area. Figure 4 shows the same time-trend graphs for wells located side-gradient of the injection area and the two compliance point wells. Figure 5 shows time-trend plots of TOC concentration for three wells inside the injection area and three wells immediately down-gradient of the injection area.

The time-trend graphs in Figures 3 show that the wells within the OSR test injection area (wells 97-214B, IW-1, PW-13 and TW-1, Figure 3) have had a progressive degradation of TCE to cisDCE and then the concentrations of cisDCE have in turn gradually decreased. Only trace levels of further degradation products (trans-1,2dichloroethene and vinyl chloride) were produced; this is due to the presence of the ZVI component of ABC+, which causes a direct chemical breakdown of TCE with little accumulation of these two degradation compounds.

In the down-gradient wells TW-2, 3 and 4 the Figure 3 time trend graphs show low initial TCE concentrations being rapidly replaced by a jump in cisDCE levels, which was subsequently degraded with limited production of vinyl chloride. The jump in cisDCE in these down-gradient wells could be due to changes in the flow patterns of impacted groundwater from the OSR as a result of the injection.

In summary, Figure 3 indicates that in all of the wells in or immediately down-gradient of the OSR injection area the TCE has been generally degraded to cisDCE; the cisDCE is being degraded with little production of vinyl chloride; and where vinyl chloride has developed the concentrations have been low and stable or decreasing.

Figure 4 shows time-trend graphs for the wells that are side-gradient (96-201B and 98-215A) or further down-gradient of the OSR injection area (compliance point wells 06-18/1 and 06-18/2). The graphs show that these wells have not been impacted by the ABC+ injections and, in contrast to the wells depicted in Figure 3, there is no discernable pattern of TCE degradation in these four wells. This supports a conclusion that the degradation observed at the wells in and immediately down-gradient of the OSR injection area is due to the ABC+ material.

Figure 5 shows time-trend graphs of TOC concentrations in the groundwater monitoring wells. TOC is a marker for the carbon substrate in the ABC+. The graphs in Figure 5 provide some insight into the migration and rate of dissipation of the ABC+ following injection. From a review of Figure 5 the following observations have been made:

- In the lower zone wells within the OSR injection area (97-214B and IW-1), TOC levels increased after each injection and dissipated within three to four months.
- At shallow well TW-1, there was no increase in TOC up to 8 months after the initial Phase I injection. The focused supplemental Phase I injection (which was performed because of the lack of ABC material reaching this well) did produce an increase in TOC, and the TOC levels then dissipated within two months. The dissipation rate at TW-1 after the Phase II injection was similar to the rate observed after the Phase I supplemental injection.
- In the down-gradient wells TW-2, TW-3 and TW-4 no apparent TOC impact was observed within eight months following the initial Phase I injection. However some increase in TOC was noted several months after the supplemental injection in all three of these wells, confirming that the TOC was migrating down-gradient to some extent.

  In addition, all three of these down-gradient wells showed significant TOC impact after the Phase II injection. In the shallow wells TW-2 and TW-3, the TOC arrived about four to six months after the injection and dissipated about five months later. At the deep well TW-4 the TOC arrived within one month after the injection and lasted about two months or less. The difference in the arrival and dissipation times reflects the fact that the shallow wells are screened in fine sands whereas the deep well is screened in the gravel layer where the material would be expected to migrate more quickly.

At the request of the MDEQ, samples from the pilot test area were analyzed for DHC and DHC functional genes. DHC bacteria reduce vinyl chloride and a population of DHC is generally considered necessary to allow biodegradation of VOCs to proceed to completion in instances where vinyl chloride accumulates. Five monitoring points were analyzed for DHC in July 2008, before the Phase I injection; samples from the ABC+ test monitoring wells were subsequently analyzed for DHC in December 2008, December 2009, September 2010, and March 2011. The data are presented in Table 2 and show that low levels of DHC are naturally present in the groundwater at all of the monitoring points. At several of the wells where low concentrations of vinyl chloride developed during the test period (TW-2, TW-3, TW-4, and 97-214B), DHC concentrations increased slightly and low concentrations of vinyl-chloride-degrading functional genes also appeared. The lack of large increases in DHC colonies is consistent with the fact that no significant concentrations of vinyl chloride developed during this test period.

In summary it is concluded that DHC is present and available to reduce vinyl chloride, but that the injection and the actual degradation process that subsequently developed did not produce levels of vinyl chloride that would stimulate significant growth of DHC colonies. Since some slight but definite growth of vinyl-chloride-reducing functional genes did occur in wells where low levels of vinyl chloride were measured, it is likely that much higher DHC densities would develop if higher levels of vinyl chloride should occur in the future.

In conjunction with the Phase I injection, the groundwater was analyzed for ten toxic metals (in addition to iron, which was injected as part of the pilot test). The metals data are presented in Table 3. Samples from nine wells (the 20GPM well was not used for the total metals sampling) were analyzed for total metals in December 2008, January 2009, April 2009, and June 2009. In addition, four of these wells were analyzed for total metals in July 2008, prior to the test injection. These data (Table 3) showed the metals concentrations in the pilot test area were generally consistent with historical values and below relevant Part 201 criteria, except for arsenic. Arsenic was detected in four wells at levels above historical and background levels. In two of the four wells, 97-214B and TW-4, one or more of the samples had arsenic concentrations above the Part 201 drinking water criterion for arsenic of 10 µg/l. In well 97-214B the arsenic concentration initially rose to 12 µg/l and then decreased to below the 10 µg/l drinking water criterion. At TW-4 the arsenic concentrations ranged from 12 to 19 µg/l; however, the arsenic concentrations at this well appeared to be stable or decreasing, and were well below the GSI for arsenic of 150 µg/l. Typically, metals can appear in groundwater samples following an ABC injection due to turbulence of the injection process and the low pH of the injection material. However this effect is typically minor, as shown in this data set, and the effects typically disappear as he ABC material dissipates and the aquifer returns to pre-injection conditions.

Prior to the pilot test, one concern raised by the MDEQ was the possibility of significant increases in sodium levels in the groundwater. As shown on Table 1there has been no indication of an increase in sodium concentrations above the pre-test levels.

During the groundwater sampling, field measurements of pH, dissolved oxygen (DO) and oxidation/reduction potential (ORP) were made. The data are included in Table 1. The data show that the groundwater has a pH generally in the range of 6 to 7.5, DO levels typically less than 0.3 milligrams per liter (mg/l), and a negative ORP indicating that the groundwater has reducing conditions. These parameters are all within an acceptable range for biologic degradation of chlorinated VOCs.

The Phase II monitoring included analyses of nitrate and sulfate. These compounds tend to compete with the chlorinated VOCs as electron acceptors and thus interfere with the degradation process by consuming the ABC substrate. At this site, the side-gradient and compliance point wells (96-201B, 98-215A, 06-18/1 and 06-18/2) have nitrate concentrations generally in the range of 200 to 3,000 µg/l and sulfate concentrations in the range of 14,000 to 25,000 µg/l. In and immediately down-gradient of the OSR injection area the wells generally have nitrate levels below the laboratory detection limit of 50 µg/l and sulfate concentrations range from below laboratory detection limit of 5,000 µg/l to a high of 13,000 µg/l. This confirms that the ABC material has suppressed the nitrate and sulfate compounds, allowing the ABC substrate to effectively reduce the chlorinated VOCs.

4.0 CONCLUSION AND RECOMMENDATIONS

The pilot test data have demonstrated that the ABC+ material is effective at degrading TCE and its daughter products at this site. The injections have produced reducing conditions in the groundwater and have suppressed the competing electron acceptors nitrate and sulfate. The process of degrading chlorinated VOCs has been fully developed in the injection area and appears to be proceeding to completion where sufficient TOC (ABC substrate) is available.

The degradation process is not generating significant levels of vinyl chloride; this is because the injected material includes ZVI, which causes direct chemical degradation of cisDCE to harmless products without formation of vinyl chloride.

The data also indicate that the injection is not causing metals impact to the groundwater above pre-test levels except for arsenic. Arsenic concentrations increased at four wells, and at two of these wells the arsenic increased to levels slightly above the Michigan Part 201 drinking water criterion but well below the GSI criterion. The arsenic concentrations should return to pre-test levels as the ABC material dissipates in the aquifer.

Vinyl chloride-reducing DHC bacteria are present and have been shown to grow with increasing presence of vinyl chloride. However the degradation process is not producing significant accumulation of vinyl chloride, and therefore the DHC bacteria have also not increased significantly. The data show that DHC is present and available to degrade the vinyl chloride if it does begin to accumulate at higher levels, however it is not expected that vinyl chloride will accumulate at this site.

ABC material should be injected on an interval of about five months to maintain optimum conditions for degradation of chlorinated compounds. Based on the pilot testing, PRR anticipates that each injection will include 500 gallons of solution, consisting of 105 gallons of ABC mixed with 395 gallons of water, into each of the six permanent injection wells that were installed during the Phase II test injection.

PRR plans to continue injections and monitoring until VOC concentrations are reduced to remediation goals established in the CMP. Prior to each injection, a work plan will be submitted to the USEPA for review and comment.

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 1 of 11) - micrograms per liter

Location	IW-1 (54 feet) - Injection area; Phase I							IW-1; Phase II						
Parameter	Pre-Injection	Six Months	Eight Months	Ten Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Six weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	9-Sep-08	23-Apr-09	17-Jun-09	9-Aug-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	--	--	--	<1.0	--	--	<1.0	--	--	1.4	--	7.8	3.0	3.1
Ethylene	--	--	--	<1.0	--	--	<1.0	--	--	15	--	31	15	6.9
Methane	--	--	--	--	--	--	24	--	--	7.5	--	840	450	1600
Trichloroethene	43,000	23,000	330	420	23,000	61,000	66,000	--	5,200	9,700	20,000	17,000	500	210
cis-1,2 Dichloroethene	7,300	7,800	600	2,300	5,600	17,000	16,000	--	13,000	16,000	29,000	34,000	64,000	58,000
trans-1,2 Dichloroethene	<500	<200	<5	<25	<200	70	56	--	100	160	210	120	120	120
Vinyl Chloride	<500	<200	<5	<25	<200	<10	<50	--	<100	18	<200	29	<50	16(J)
1,1,1-Trichloroethane	<500	280	10	28	<200	650	560	--	<100	120	<200	110	110	110
1,1-Dichloroethene	<500	<200	<5	<25	<200	260	200	--	<100	74	<200	190	660	320
1,1-Dichloroethane	780	420	15	46	360	1,400	1,200	--	230	350	600	630	380	610
Iron	--	--	--	2,600	--	--	1,600	--	93,000	130,000	110,000	61,000	30,000	11,000
Manganese	--	--	--	95	--	--	--	--	--	3,500	--	1,900	--	--
Sodium	--	--	--	7,800	--	--	--	--	--	24,000	--	14,000	--	--
Arsenic	--	--	--	3	--	--	--	--	--	1.5	--	1.5	--	--
Nitrate	--	--	--	--	--	--	<250	--	--	<50	--	<50	50	<50
Sulfate	--	--	--	--	--	--	32,000	--	--	12,000	--	<5,000	5,800	12,000
Total Organic Carbon	--	--	--	<1,000	1,400	--	2,300	5,700,000	3,400,000	2,300,000	1,600,000	830,000	150,000	24,000
pH (standard units)	--	--	7.7	7.7	7.3	6.9	7.2	5.9	5.6	5.6	5.8	6.0	6.3	6.3
Dissolved Oxygen (milligrams per liter)	--	--	0.23	0.18	0.03	--	0.00	0.15	0.05	0.15	0.23	0.18	--	0.00
Oxygen-Reduction Potential (millivolts)	--	-124	--	--	--	--	-159	--	--	--	--	-50	-100	-153
Ratio of trichloroethene to cis-1,2, dichloroethene	5.89	2.95	0.55	0.18	4.11	3.59	4.13	--	0.40	0.61	0.69	0.50	0.01	0.00

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 2 of 11) - micrograms per liter

Location	97-214B (40 feet) - Injection area; Phase I											98-214B; Phase II						
Parameter	Pre-Injection	Post-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	8-Sep-08	26-Oct-08	7-Dec-09	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	<1.0	<1.0	4.2	5.3	7.9	4.8	28	26	--	--	63	--	--	120	--	74	34	170
Ethylene	--	<1.0	3.5	3.2	6.0	4.0	32	37	--	--	90	--	--	52	--	30	17	46
Methane	<0.5	--	--	--	--	--	--	--	--	--	59	--	--	900	--	1,200	1,100	1,900
Trichloroethene	1,500	8,700	210	34	28	12	56	<50	<50	10	<10	--	--	17	--	2.6	<2.0	<10
cis-1,2 Dichloroethene	1,500	2,600	3,800	2,800	2,200	1,400	5,600	6,700	8,500	8,900	6,900	--	--	940	--	920	140	740
trans-1,2 Dichloroethene	<10	<50	<50	<25	<20	<10	<50	<50	<50	28	21	--	--	<10	--	1.3	<2.0	<10
Vinyl Chloride	<10	<50	<50	<25	<20	<10	<50	52	<50	52	50	--	--	13	--	12	<2.0	8.3(J)
1,1,1-Trichloroethane	460	1,300	330	130	75	38	170	160	830	630	280	--	--	<10	--	2.0	<2.0	9.8(J)
1,1-Dichloroethene	12	<50	<50	<25	<20	<10	<50	<50	58	54	38	--	--	<10	--	2.7	<2.0	2.8(J)
1,1-Dichloroethane	12	<50	<50	55	67	34	140	180	220	230	200	--	--	36	--	44	5.7	71
Iron	<10	12	7,300e	20,000	9,600	3,900	15,000	11,000	--	--	6,900	--	--	64,000	61,000	30,000	7,900	8,000
Manganese	120	55	2,300	1,400	920	660	590	600	--	--	--	--	--	2,700	--	950	--	--
Sodium	13,000	12,000	11,000	12,000	11,000	10,000	18,000	15,000	--	--	--	--	--	15,000	--	16,000	--	--
Arsenic	<1.0	--	6.7	12	8.8	5.3	6.4	5.2	--	--	--	--	--	8.1	--	14	--	--
Nitrate	--	--	--	--	--	--	--	--	--	--	130	--	--	<50	--	<50	<50	<50
Sulfate	--	--	--	--	--	--	--	--	--	--	6,800	--	--	<5,000	--	<5,000	<5,000	6,100
Total Organic Carbon	2,400	310,000	54,000	72,000	44,000	15,000	86,000	57,000	31,000	43,000	37,000	490,000	270,000	380,000	370,000	200,000	38,000	50,000
pH (standard units)	6.9	7.4	7.2	7.2	7.0	7.2	7.0	7.0	7.3	6.9	7.3	--	--	6.6	6.6	6.7	6.9	6.9
Dissolved Oxygen (milligrams per liter)	4.4	1.6	0.2	0.2	0.2	0.2	0.2	0.1	0.04	--	0.00	--	--	0.06	0.11	0.13	--	0.00
Oxygen-Reduction Potential (millivolts)	71	--	--	--	--	--	--	--	--	--	-195	--	--	--	--	-93	-169	-181
Ratio of trichloroethene to cis-1,2, dichloroethene	1.00	3.35	0.06	0.01	0.01	0.01	0.01	--	--	0.001	--	--	--	0.018	--	0.003	--	--

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 3 of 11) - micrograms per liter

Location	20GPM (36 feet) - injection area; Phase I							PW-13 (58 feet) - Injection Area; Phase I			PW-13; Phase II	
Parameter	Post-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten months	Eleven Months	Fourteen Months	Eighteen Months	Twenty -four Months	Twenty-three Weeks	Ten Months
	26-Oct-08	7-Dec-09	2-Feb-09	3-Apr-09	9-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	6-May-11	23-Sep-11
Ethane	2.7	--	--	--	--	--	--	--	--	--	--	--
Ethylene	1.1	--	--	--	--	--	--	--	--	--	--	--
Methane	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	18,000	13,000	880	7,600	3,900	7,400	1,300	310	73	140	<10	<10
cis-1,2 Dichloroethene	2,200	20,000	8,900	11,000	15,000	38,000	19,000	1,900	1,700	1,400	740	710
trans-1,2 Dichloroethene	<100	<200	<100	<100	<100	<250	<250	<10	1.2	<10	<10	<10
Vinyl Chloride	<100	<200	<100	<100	<100	<250	<250	94	460	310	260	340
1,1,1-Trichloroethane	1,300	2,000	380	1,300	1,100	3,400	1,400	<10	2.9	<10	<10	<10
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	<10	3.2(J)
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	16	14
Iron	1,200	--	--	--	--	--	--	--	--	--	--	--
Manganese	330	--	--	--	--	--	--	--	--	--	--	--
Sodium	12,000	--	--	--	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	--	--	--	--	--	--	--	--	--	--	--	--
Total Organic Carbon	17,000	--	--	--	--	--	--	--	--	--	--	--
pH (standard units)	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Oxygen (milligrams per liter)	--	--	--	--	--	--	--	--	--	--	--	--
Oxygen-Reduction Potential (millivolts)	--	--	--	--	--	--	--	--	--	--	--	--
Ratio of trichloroethene to cis-1,2, dichloroethene	8.18	0.65	0.10	0.69	0.26	0.19	0.07	0.16	0.04	0.10	--	--

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 4 of 11) - micrograms per liter

Location	TW-1 (30 feet) - Injection area; Phase I											TW-1; Phase II						
Parameter	Pre-Injection	Post-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty Four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	23-Oct-08	26-Oct-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	1.6	1.4	1.6	4.4	<1.0	3.5	4.1	6.4	--	--	1.9	--	--	7.3	--	17	14	410
Ethylene	1.8	1.6	1.4	2.8	1	5.1	3.5	9.6	--	--	5.7	--	--	18	--	20	10	67
Methane	--	--	--	--	--	--	--	--	--	--	<0.5	--	--	<0.5	--	1.7	<0.5	6.4
Trichloroethene	36,000	41,000	60,000	42,000	45,000	39,000	13,000	1,000	1,700	2,400	8,900	3,200	4,300	7,000	8,900	6,000	1,100	64
cis-1,2 Dichloroethene	2,200	2,700	3,900	5,100	3,900	6,300	23,000	47,000	24,000	24,000	18,000	25,000	29,000	80,000	50,000	24,000	25,000	25,000
trans-1,2 Dichloroethene	<250	<250	<500	<500	<500	<500	<200	<500	<250	19	<25	<250	<250	<1,000	<500	<50	<50	22
Vinyl Chloride	<250	<250	<500	<500	<500	<500	<200	<500	<250	<10	<25	<250	<250	<1,000	<500	<50	<50	17(J)
1,1,1-Trichloroethane	<250	<250	4,300	3,300	3,200	2,400	1,300	1,700	1,700	1,800	2,000	1,900	2,400	5,300	3,700	1,700	1,500	1,200
1,1-Dichloroethene	<250	<250	<500	<500	<500	<500	<200	<500	<250	260	170	<250	<250	<1,000	<500	200	200	180
1,1-Dichloroethane	<250	<250	<500	<500	<500	<500	<200	<500	<250	140	120	<250	<250	<1,000	<500	<50	170	250
Iron	600	600	250	2,700	740	790	1,300	12,000	--	--	4,300	4,200	4,400	7,100	8,600	6,300	4,100	8,300
Manganese	650	590	650	780	660	790	850	1,000	--	--	--	--	--	730	--	740	--	--
Sodium	23,000	21,000	25,000	36,000	21,000	20,000	53,000	42,000	--	--	--	--	--	29,000	--	17,000	--	--
Arsenic	--	--	<1.0	4.8	2.5	2.7	3.6	10	--	--	--	--	--	11	--	12	--	--
Nitrate	--	--	--	--	--	--	--	--	--	--	<50	--	--	<50	--	<50	<50	<50
Sulfate	--	--	--	--	--	--	--	--	--	--	12,000	--	--	9,700	--	12,000	5,200	10,000
Total Organic Carbon	--	2,900	29,000	11,000	2,700	6,900	120,000	11,000	7,300	5,800	4,300	19,000	8,800	51,000	22,000	5,000	6,800	19,000
pH (standard units)	7.4	7.4	7.3	7.3	6.7	7.1	7.0	7.0	7.1	6.9	6.8	6.9	6.8	6.8	6.8	6.8	6.8	6.9
Dissolved Oxygen (milligrams per liter)	0.2	0.2	0.3	0.3	0.7	0.2	0.16	0.10	0.06	0.22	0.17	0.19	0.19	0.21	0.20	0.23	--	0.01
Oxygen-Reduction Potential (millivolts)	-130	-103	--	--	-83	--	--	--	--	--	-135	--	--	--	--	-68	-150	-158
Ratio of trichloroethene to cis-1,2, dichloroethene	16.36	15.19	15.38	8.24	11.54	6.19	0.57	0.02	0.07	0.10	0.49	0.13	0.15	0.09	0.18	0.25	0.044	0.003

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 5 of 11) - micrograms per liter

Location	TW-2 (30 feet) - Downgradient; Phase I											TW-2: Phase II						
Parameter	Pre-Injection	Post-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	23-Oct-08	26-Oct-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	1.2	<1.0	<1.0	<1.0	3.2	4.6	14	11.0	--	--	13	--	--	5.0	--	23	4.0	69
Ethylene	1.4	1.1	<1.0	<1.0	8.0	2.7	6.5	8.0	--	--	18	--	--	4.7	--	44	5.4	30
Methane	--	--	--	--	--	--	--	--	--	--	9.8	--	--	6.0	--	300	740	1,400
Trichloroethene	3,300	2,900	1,000	580	710	84	<100	<100	<100	17	26	<50	<50	11	14	11	8.1	8.2(J)
cis-1,2 Dichloroethene	3,300	3,100	1,400	1,700	5,900	7,400	15,000	17,000	14,000	16,000	12,000	5,300	4,400	3,400	4,800	2,900	2,300	7,000
trans-1,2 Dichloroethene	<25	<25	<10	<10	<50	<50	<100	<100	<100	39	20	<50	<50	16	21	12	10	21
Vinyl Chloride	<25	<25	<10	<10	<50	<50	<100	<100	<100	17	15	<50	<50	<10	<10	24	3.4	23
1,1,1-Trichloroethane	750	900	410	310	480	570	880	1,300	910	880	660	350	350	260	360	280	190	330
1,1-Dichloroethene	42	36	20	18	54	65	<100	130	<100	100	61	<50	<50	22	38	25	18	55
1,1-Dichloroethane	82	100	110	85	110	130	330	260	380	250	190	78	77	71	88	60	50	200
Iron	3,400	4,600	3,600	2,000	1,300	2,300	5,100	8,200	--	--	4,200	4,700	4,600	3,700	3,700	3,600	5,600	16,000
Manganese	460	590	460	500	500	880	720	1,100	--	--	--	--	--	350	--	430	--	--
Sodium	78,000	78,000	67,000	36,000	25,000	43,000	48,000	41,000	--	--	--	--	--	64,000	--	48,000	--	--
Arsenic	--	--	3.2	2.4	3.0	4.2	5.7	7.3	--	--	--	--	--	6.2	--	7.0	--	--
Nitrate		--	--	--	--	--	--	--	--	--	<50	--	--	100	--	<50	<50	<50
Sulfate		--	--	--	--	--	--	--	--	--	9,600	--	--	13,000	--	9,100	11,000	5,300
Total Organic Carbon	--	26,000	37,000	7,400	9,000	12,000	63,000	120,000	14,000	--	13,000	5,100	6,400	5,800	3,800	9,600	6,500	88,000
pH (standard units)	7.7	7.4	7.2	7.4	6.8	7.2	7.1	7.1	7.3	7.0	6.9	6.9	6.8	7.1	7.0	7.0	6.7	6.6
Dissolved Oxygen (milligrams per liter)	0.2	0.20	0.20	0.30	1.20	0.21	0.16	0.16	0.06	0.17	0.16	0.13	0.27	0.17	0.25	0.22	--	0.00
Oxygen-Reduction Potential (millivolts)	-191	-183	--	--	-107	--	--	--	--	--	-155	--	--	--	--	-40	-133	-191
Ratio of trichloroethene to cis-1,2, dichloroethene	1.00	0.94	0.71	0.34	0.12	0.01	--	--	--	0.001	0.002	--	--	0.003	0.003	0.004	0.004	--

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 6 of 11) - micrograms per liter

Location	TW-3 (30 feet) - Downgradient; Phase I											TW-3; Phase II						
Parameter	Pre-Injection	Post-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	23-Oct-08	26-Oct-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	1.3	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	--	--	3.4	--	--	17	--	<1.0	45	110
Ethylene	1.6	1.3	1.1	<1.0	<1.0	<1.0	<1.0	1.1	--	--	5.5	--	--	29	--	37	220	110
Methane	--	--	--	--	--	--	--	--	--	--	1.1	--	--	10	--	<0.5	55	130
Trichloroethene	200	210	250	190	160	91	170	170	100	69	1,900	<200	<200	<200	<200	37	<50	42(J)
cis-1,2 Dichloroethene	1,100	1,000	2,300	2,400	1,300	890	450	1,600	7,500	5,500	13,000	28,000	24,000	24,000	20,000	17,000	41,000	13,000
trans-1,2 Dichloroethene	<10	<10	<20	<20	<10	<10	<5	<10	<50	7.7	14	<200	<200	<200	<200	<20	<50	<100
Vinyl Chloride	<10	<10	<20	<20	<10	<10	<5	<10	<50	<5	15	<200	<200	190	2,000	1,200	1,800	490
1,1,1-Trichloroethane	200	250	260	400	210	190	82	190	430	290	1,300	1,200	1,100	980	680	440	700	550
1,1-Dichloroethene	<10	<10	<20	<20	<10	<10	<5	14	<50	33	85	<200	<200	<200	<200	83	200	87(J)
1,1-Dichloroethane	20	21	<20	28	15	<10	<5	24	98	55	110	240	250	200	270	280	540	150
Iron	1,000	180	28	93	98	97	85	140	--	--	440	810	1,600	2,000	4,100	4,700	6,900	3,400
Manganese	730	650	380	600	360	470	270	510	--	--	--	--	--	860	--	1,200	--	--
Sodium	19,000	21,000	24,000	22,000	11,000	9,100	7,400	15,000	--	--	--	--	--	22,000	--	37,000	--	--
Arsenic	--	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	2.2	--	4.0	--	--
Nitrate	--	--	--	--	--	--	--	--	--	--	98	--	--	100	--	<50	<50	<50
Sulfate	--	--	--	--	--	--	--	--	--	--	17,000	--	--	9,800	--	<5,000	<5,000	6,800
Total Organic Carbon	--	15,000	11,000	8,000	7,000	6,000	6,400	8,300	7,500	19,000	7,800	22,000	14,000	16,000	28,000	71,000	58,000	21,000
pH (standard units)	8.0	7.6	7.3	7.5	6.9	7.3	7.3	7.4	7.4	7.0	7.3	6.8	6.8	6.9	7.1	6.9	7.0	6.7
Dissolved Oxygen (milligrams per liter)	0.20	0.20	0.40	0.30	0.92	0.16	0.20	0.17	0.05	0.17	0.00	0.21	0.24	0.16	0.23	0.20	--	0.00
Oxygen-Reduction Potential (millivolts)	-99	-109	--	--	-80	--	--	--	--	--	-108	--	--	--	--	-63	-164	-144
Ratio of trichloroethene to cis-1,2, dichloroethene	0.18	0.21	0.11	0.08	0.12	0.10	0.38	0.11	0.01	0.01	0.15	--	--	--	--	0.002	--	--

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 7 of 11) - micrograms per liter

Location	TW-4 (45 feet) - Downgradient; Phase I											TW-4; Phase II							
Parameter	Pre-Injection	Post-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Month	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	23-Oct-08	26-Oct-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	--	<1.0	--	1.4	<1.0	1.2
Ethylene	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	1.3	<1.0	--	--	6.9	--	--	1.6	--	2.0	1.2	3.9
Methane	--	--	--	--	--	--	--	--	--	--	99	--	--	84	--	8.4	26	110
Trichloroethene	69	110	6.7	6.9	<2.0	<2.5	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2 Dichloroethene	25	100	250	210	180	300	350	140	15	6	1.7	2.3	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2 Dichloroethene	<1.0	<1.0	<2	<2	<2.0	<2.5	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	<1.0	<1.0	<2	<2	<2.0	<2.5	3.1	9.8	46	22	30	21	24	13	13	8.6	10	19
1,1,1-Trichloroethane	7.8	21	10	6.7	3.6	3.1	2.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	<1.0	<1.0	<2	2.4	<2	<2.5	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	<1.0	<1.0	<2	2.4	2.9	5.3	5.2	1.8	2	1.2	1.4	1.4	1.3	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	720	72	8,200	7,800	6,700	5,400	5,800	10,000	--	--	3,700	37,000	17,000	9,100	6,500	5,800	4,100	4,500
Manganese	530	470	1,400	410	160	140	150	170	--	--	--	--	--	210	--	190	--	--
Sodium	11,000	11,000	12,000	12,000	11,000	11,000	11,000	12,000	--	--	--	--	--	15,000	--	19,000	--	--
Arsenic	--	--	14	19	17	12	13	13	--	--	--	--	--	12	--	12	--	--
Nitrate	--	--	--	--	--	--	--	--	--	--	<50	--	--	<50	--	<50	<50	<50
Sulfate	--	--	--	--	--	--	--	--	--	--	<5,000	--	--	<5,000	--	8,500	6,900	<5,000
Total Organic Carbon	--	1,300	52,000	4,000	1,700	2,300	14,000	1,400	<1,000	1,400	910	75,000	9,400	970	820	740	670	1,600
pH (standard units)	7.7	7.3	7.3	7.6	7.4	7.5	7.4	7.4	7.5	7.2	7.1	6.7	6.8	7.0	7.1	7.1	7.0	7.0
Dissolved Oxygen (milligrams per liter)	0.40	0.20	0.30	0.20	0.20	0.18	0.22	0.19	0.06	0.16	0.22	0.18	0.19	0.21	0.22	0.20	--	0.01
Oxygen-Reduction Potential (millivolts)	72	-56	--	--	--	--	--	--	--	--	-170	--	--	--	--	-124	-165	-190
Ratio of trichloroethene to cis-1,2, dichloroethene	2.76	1.10	0.03	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 8 of 11) - micrograms per liter

Location	96-201B (50 feet) - Side-gradient; Phase I									96-201B: Phase II						
Parameter	Pre-Injection	Post-Injection	Six Weeks	Three Months	Six Months	Ten Months	Eleven Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	8-Sep-08	26-Oct-08	7-Dec-09	2-Feb-09	23-Apr-09	9-Aug-09	9-Sep-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Ethylene	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	<1.0	--	--	<1.0	--	1.1	<1.0	<1.0
Methane	<0.5	--	--	--	--	--	--	--	<0.5	--	--	68	--	<0.5	<0.5	2.8
Trichloroethene	1,100	170	57	29	23	23	27	24	28	--	--	100	--	220	59	48
cis-1,2 Dichloroethene	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
trans-1,2 Dichloroethene	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Vinyl Chloride	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	57	5	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	4.8	--	12	2.8	2.9
1,1-Dichloroethene	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
1,1-Dichloroethane	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Iron	<10	20	34	100	53	43	66	--	<10	--	--	230	180	25	30	79
Manganese	<10	<10	<10	26	<10	<10	<10	--	--	--	--	34	--	<10	--	--
Sodium	12,000	13,000	13,000	12,000	12,000	11,000	12,000	--	--	--	--	13,000	--	13,000	--	--
Arsenic	<1.0	--	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	<1.0	--	<1.0	--	--
Nitrate	--	--	--	--	--	--	--	--	840	--	--	380	--	350	240	860
Sulfate	--	--	--	--	--	--	--	--	16,000	--	--	22,000	--	24,000	25,000	16,000
Total Organic Carbon	1,100	1,100	1,000	1,000	<1,000	<1,000	<1,000	1,200	600	900	650	550	620	570	610	1,200
pH (standard units)	7.3	7.5	7.4	7.3	7.1	7.2	7.2	6.9	7.3	--	6.8	6.9	6.9	6.9	6.9	6.8
Dissolved Oxygen (milligrams per liter)	1.0	0.7	0.9	1.1	1.0	1.0	1.1	0.63	0.8	--	0.51	0.38	0.41	0.41	--	0.57
Oxygen-Reduction Potential (millivolts)	--	90	--	--	--	--	--	--	78	--	--	--	--	156	51	--
Ratio of trichloroethene to cis-1,2, dichloroethene	>110	>170	>59	>29	>23	>23	>27	>24	>28	--	--	--	--	--	--	--

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 9 of 11) - micrograms per liter

Location	98-215A (30 feet) - Side-gradient; Phase I										98-215A: Phase II						
Parameter	Pre-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	9-Sep-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Ethylene	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	--	<1.0	--	1.1	<1.0	<1.0
Methane	--	--	--	--	--	--	--	--	--	<0.5	--	--	<0.5	--	0.75	<0.5	<0.5
Trichloroethene	33	45	53	63	43	46	40	43	43	39	--	--	34	--	31	38	27
cis-1,2 Dichloroethene	6.1	19	19	33	5.4	14	6.4	5.1	5.3	4.6	--	--	5.3	--	6.1	14	4.3
trans-1,2 Dichloroethene	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Vinyl Chloride	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	2.1	4.4	4.0	9.4	3.0	15	8.6	2.4	2.3	3.1	--	--	1.7	--	1.8	2.4	1.5
1,1-Dichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
1,1-Dichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.	--	<1.0	<1.0	<1.0
Iron	35	<20	31	38	33	48	73	--	--	22	--	--	<1.0	29	15	<10	16
Manganese	160	150	55	300	72	410	740	--	--	--	--	--	97	--	22	--	--
Sodium	60,000	70,000	72,000	58,000	43,000	37,000	62,000	--	--	--	--	--	68,000	--	45,000	--	--
Arsenic	<1.0	<1.0	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	<1.0	--	<1.0	--	--
Nitrate	--	--	--	--	--	--	--	--	--	2,400	--	--	2,600	--	3,100	3,200	3,000
Sulfate	--	--	--	--	--	--	--	--	--	20,000	--	--	14,000	--	15,000	17,000	16,000
Total Organic Carbon	--	2,200	1,300	2,000	1,500	1,300	1,700	1,300	--	1,700	1,400	1,300	1,600	1,700	1,600	1,700	1,500
pH (standard units)	6.8	7.3	7.4	6.8	7.2	7.2	7.3	7.4	7.0	7.5	--	6.9	7.1	7.0	7.0	6.9	6.8
Dissolved Oxygen (milligrams per liter)	8.0	5.1	5.4	4.1	4.6	4.7	2.8	4.4	6.2	8.0	--	5.1	4.7	5.1	5.6	--	5.4
Oxygen-Reduction Potential (millivolts)	--	--	--	-68	--	--	--	--	--	69	--	--	--	--	243	126	--
Ratio of trichloroethene to cis-1,2, dichloroethene	5.41	2.37	2.79	1.91	7.96	3.29	6.25	8.43	8.11	8.48	--	--	6.42	--	5.08	2.71	6.28

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 10 of 11) - micrograms per liter

Location	06-18/1 (30 feet) - Compliance point; Phase I										06-18/1; Phase II						
Parameter	Pre-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four Weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	8-Sep-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	<1.0	<1.0	<1.0	1	3.5	3.5	5.5	--	--	1.3	--	--	<1.0	--	<1.0	<1.0	1.2
Ethylene	<1.0	1.1	<1.0	1.2	4.6	4.6	10	--	--	1.3	--	--	<1.0	--	1.2	<1.0	<1.0
Methane	0.54	--	--	--	--	--	--	--	--	<0.5	--	--	<0.5	--	0.84	<0.5	<0.5
Trichloroethene	1,800	5,800	3,300	670	560	340	270	510	170	290	--	--	2,400	--	3,300	2,200	960
cis-1,2 Dichloroethene	1,600	2,700	3,000	2,600	5,200	6,000	16,000	4,500	7,100	3,100	--	--	690	--	480	420	900
trans-1,2 Dichloroethene	<25	<50	<25	<25	<50	<50	<100	<50	<10	<10	--	--	<10	--	<10	<2.5	<10
Vinyl Chloride	<25	<50	<25	<25	<50	<50	<100	<50	14	<10	--	--	<10	--	<10	<2.5	21
1,1,1-Trichloroethane	280	580	450	180	220	240	590	350	380	300	--	--	400	--	430	280	270
1,1-Dichloroethene	<1.0	<1.0	<25	<25	<50	<50	110	<50	53	24	--	--	<50	--	11	6.9	27
1,1-Dichloroethane	<1.0	<1.0	<25	<25	<50	58	110	<50	76	32	--	--	32	--	<10	2.7	<10
Iron	<10	54	68	35	20	91	25	--	--	13	--	--	17	80	18	37	17
Manganese	76	200	270	180	160	160	230	--	--	--	--	--	690	--	730	--	--
Sodium	22,000	23,000	21,000	16,000	14,000	15,000	22,000	--	--	--	--	--	19,000	--	21,000	--	--
Arsenic	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	<1.0	--	<1.0	--	--
Nitrate	--	--	--	--	--	--	--	--	--	78	--	--	<50	--	87	<50	160
Sulfate	--	--	--	--	--	--	--	--	--	18,000	--	--	18,000	--	20,000	21,000	17,000
Total Organic Carbon	7,000	6,900	2,200	3,400	4,900	4,000	6,800	2,700	--	2,900	1,200	1,100	980	960	910	1,000	2,000
pH (standard units)	--	7.3	7.4	7.3	7.3	7.3	7.4	7.4	7.0	7.4	6.9	6.8	6.9	6.9	6.9	6.8	7.5
Dissolved Oxygen (milligrams per liter)	--	0.4	0.4	0.3	0.20	0.29	0.26	0.20	0.24	1.4	0.27	0.40	0.22	0.31	0.26	--	0.17
Oxygen-Reduction Potential (millivolts)	--	--	--	--	--	--	--	--	--	22	--	--	--	--	126	70	-191
Ratio of trichloroethene to cis-1,2, dichloroethene	1.13	2.15	1.10	0.26	0.11	0.06	0.02	0.11	0.02	0.09	--	--	3.48	--	6.88	5.24	1.07

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 1: SUMMARY OF ABC+ PILOT TEST ANALYTICAL DATA (Page 11 of 11) - micrograms per liter

Location	**06-18/2 (50 feet) - Compliance point; Phase I**										**06-18/2; Phase II**						
Parameter	Pre-Injection	Six Weeks	Three Months	Six Months	Eight Months	Ten Months	Eleven Months	Fourteen Months	Eighteen Months	Twenty-four Months	Two Weeks	Four weeks	Seven Weeks	Ten Weeks	Fourteen Weeks	Twenty-three Weeks	Ten Months
	8-Sep-08	7-Dec-08	2-Feb-09	23-Apr-09	17-Jun-09	9-Aug-09	9-Sep-09	9-Dec-09	10-Apr-10	10-Sep-10	8-Dec-10	20-Dec-10	12-Jan-11	3-Feb-11	2-Mar-11	6-May-11	23-Sep-11
Ethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Ethylene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	<1.0	--	--	<1.0	--	1.1	<1.0	<1.0
Methane	<0.5	--	--	--	--	--	--	--	--	<0.5	--	--	0.5	--	2.0	0.74	<0.5
Trichloroethene	10,000	690	550	370	380	310	190	150	100	80	--	--	110	--	620	170	62
cis-1,2 Dichloroethene	<100	17	84	250	180	430	20	15	22	16	--	--	13	--	12	14	9.8
trans-1,2 Dichloroethene	<100	<10	<5	<2.0	<2.5	<5.0	<2.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
Vinyl Chloride	<100	<10	<5	<2.0	<2.5	18	<2.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	630	26	25	18	16	17	6.2	4.1	3.2	2.7	--	--	4.0	--	31	6.8	2.4
1,1-Dichloroethene	<1.0	<1.0	<5	<2	<2.5	<5	<2.0	<1.0	<1.0	<1.0	--	--	<1.0	--	<1.0	<1.0	<1.0
1,1-Dichloroethane	<1.0	<1.0	<5	<2	<2.5	<5	<2.0	<1.0	<1.0	<1.0	--	--	<1.0	--	1.8	<1.0	<1.0
Iron	<10	400	20	21	<10	20	<10	--	--	<10	--	--	35	51	38	17	<10
Manganese	<10	260	170	260	230	220	200	--	--	--	--	--	<10	--	<10	--	--
Sodium	10,000	12,000	13,000	11,000	9,600	9,200	12,000	--	--	--	--	--	13,000	--	14,000	--	--
Arsenic	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	<1.0	--	<1.0	--	--
Nitrate	--	--	--	--	--	--	--	--	--	1,200	--	--	400	--	270	290	980
Sulfate	--	--	--	--	--	--	--	--	--	18,000	--	--	20,000	--	23,000	24,000	17,000
Total Organic Carbon	2,400	1,100	<1,000	<1,000	<1,000	<1.0	<1,000	<1,000	1,000	620	660	640	540	960	600	660	660
pH (standard units)	--	7.2	7.3	6.8	7.2	7.2	7.2	7.2	7.0	6.8	6.9	6.8	6.9	6.9	6.9	6.8	6.8
Dissolved Oxygen (milligrams per liter)	--	0.3	0.4	1.0	0.27	0.23	0.28	0.20	1.1	0.61	0.49	0.39	0.26	0.25	0.27	--	0.20
Oxygen-Reduction Potential (millivolts)	--	--	--	-81	--	--	--	--	--	121	--	--	--	--	153	45	--
Ratio of trichloroethene to cis-1,2, dichloroethene	>100	40.59	6.55	1.48	2.11	0.72	9.50	10.00	4.55	5.00	--	--	8.46	--	51.67	12.14	6.33

NOTES:

All chemical data are in micrograms per liter; units for field parameters are as shown

(J) = Data qualified; see laboratory analytical report

< = Less than

TABLE 2: DECHLORINATING BACTERIA CENSUS ANALYSES

LOCATION	DATE	Trichloroethene, µg/L	Cis-1,2 Dichloroethene, µg/L	Vinyl Chloride, µg/l	DO, mg/L	DHC, cells/ml	DHC FUNCTIONAL GENES		
							TCE-R Dase, cells/ml	BAV1 VC R-Dase, cells/ml	VC R-Dase, cells/ml
SHALLOW UPPER AQUIFER (A-LEVEL) WELLS:									
98-215A	July, 2008	31	7.0	<1	3.1	0.128	< 0.455	< 0.455	< 0.455
	December, 2008	45	19.0	<1.0	5.1	0.8	<0.4	<0.4	**0.4**
	September, 2010	39	4.6	<1	8.0	8.6	<0.4	<0.4	<0.4
	March, 2011	31	6.1	<1	5.6	1.8	<0.4	<0.4	<0.4
06-18/1	July, 2008	4,000	3,200	<25	0.3	259	< 0.357	< 0.357	< 0.357
	December, 2008	5,800	2,700	<50	0.4	19.2	<0.4	<0.4	<0.4
	December, 2009	510	4,500	<50	0.2	45.7	<0.5	**0.200**	**0.200**
	September, 2010	290	3,100	<10	1.4	17.3	**0.10**	**7.100**	<0.3
	March, 2011	3,300	480	<10	0.3	70	<0.4	**0.3**	<0.4
TW-1	December, 2008	60,000	3,900	<500	0.3	0.6	<0.4	<0.4	<0.4
	December, 2009	1,700	24,000	<250	0.06	1.4	<0.4	<0.4	<0.4
	September, 2010	8,900	18,000	<25	0.20	1.0	<0.3	<0.3	<0.3
	March, 2011	6,000	24,000	<50	0.23	1.6	<0.4	<0.4	<0.4
TW-2	December, 2008	1,000	1,400	<10	0.2	2.8	<0.4	<0.4	<0.4
	December, 2009	<100	14,000	<100	0.1	3.5	<0.5	<0.5	<0.5
	September, 2010	26	12,000	**15**	0.2	1.4	<0.5	<0.5	**0.100**
	March, 2011	11	2,900	**24**	0.2	238	**21.6**	**294**	<0.4
TW-3	December, 2008	250	2,300	<20	0.4	9.9	<0.4	<0.4	<0.4
	December, 2009	100	7,500	<50	0.05	6.7	<0.5	<0.5	**0.100**
	September, 2010	1,900	13,000	**15**	0.00	5.3	<0.4	<0.4	<0.4
	March, 2011	37	17,000	**1,200**	0.20	733	**55.9**	**675**	<0.4
DEEP UPPER AQUIFER (B-LEVEL) WELLS:									
96-201B	July, 2008	940	< 10	<10	0.8	< 0.417	< 0.417	< 0.417	< 0.417
	December, 2008	57	<1.0	<1.0	0.9	0.2	<0.4	<0.4	<0.4
	September, 2010	28	<1	<1	0.8	0.9	<0.4	<0.4	**0.10**
	March, 2011	220	<1	<1	0.4	0.3	<0.4	**0.4**	<0.4
97-214B	July, 2008	1,400	1,500	<10	0.9	4.56	< 0.321	< 0.321	< 0.321
	December, 2008	210	3,800	<50	0.2	1.2	<0.4	<0.4	<0.4
	December, 2009	<50	8,500	<50	0.0	2.9	<0.5	<0.5	<0.5
	September, 2010	<10	6,900	**50**	0.0	2.6	<0.2	**0.200**	<0.2
	March, 2011	3	920	**12**	0.1	5.7	<0.7	<0.7	**0.3**
06-18/2	July, 2008	280	4	<100	0.5	3.27	< 0.435	< 0.435	**0.3**
	December, 2008	690	17	<10	0.3	1.2	<0.4	<0.4	<0.4
	December, 2009	150	15	<1	0.2	1.4	<0.4	<0.4	<0.4
	September, 2010	80	16	<1	0.6	1.0	<0.4	**0.10**	<0.4
	March, 2011	620	12	<1	0.3	0.1	<0.4	<0.4	<0.4
TW-4	December, 2008	7	250	<2	0.3	2.5	<0.4	<0.4	<0.4
	December, 2009	<1	15	**46**	0.06	35,300	**16.4**	**16,100**	<0.5
	September, 2010	<1	2	**30**	0.22	134,000	**1,810**	**17,300**	<0.4
	March, 2011	<1	<1	**8.6**	0.20	5,110	**54.3**	**4,040**	<0.4
IW-1	September, 2010	66,000	16,000	<50	0.00	0.1	<0.4	<0.4	<0.4
	March, 2011	17,000	34,000	**29**	0.18	<2.5	<2.5	<2.5	<2.5

NOTES:

µg/L = Micrograms per liter
mg/L = milligrams per liter
ml = milliliters
< = Less than
-- = Not analyzed
DHC = Dehalococcoides

TABLE 3: SUMMARY OF METALS DATA IN ABC+ PILOT TEST AREA

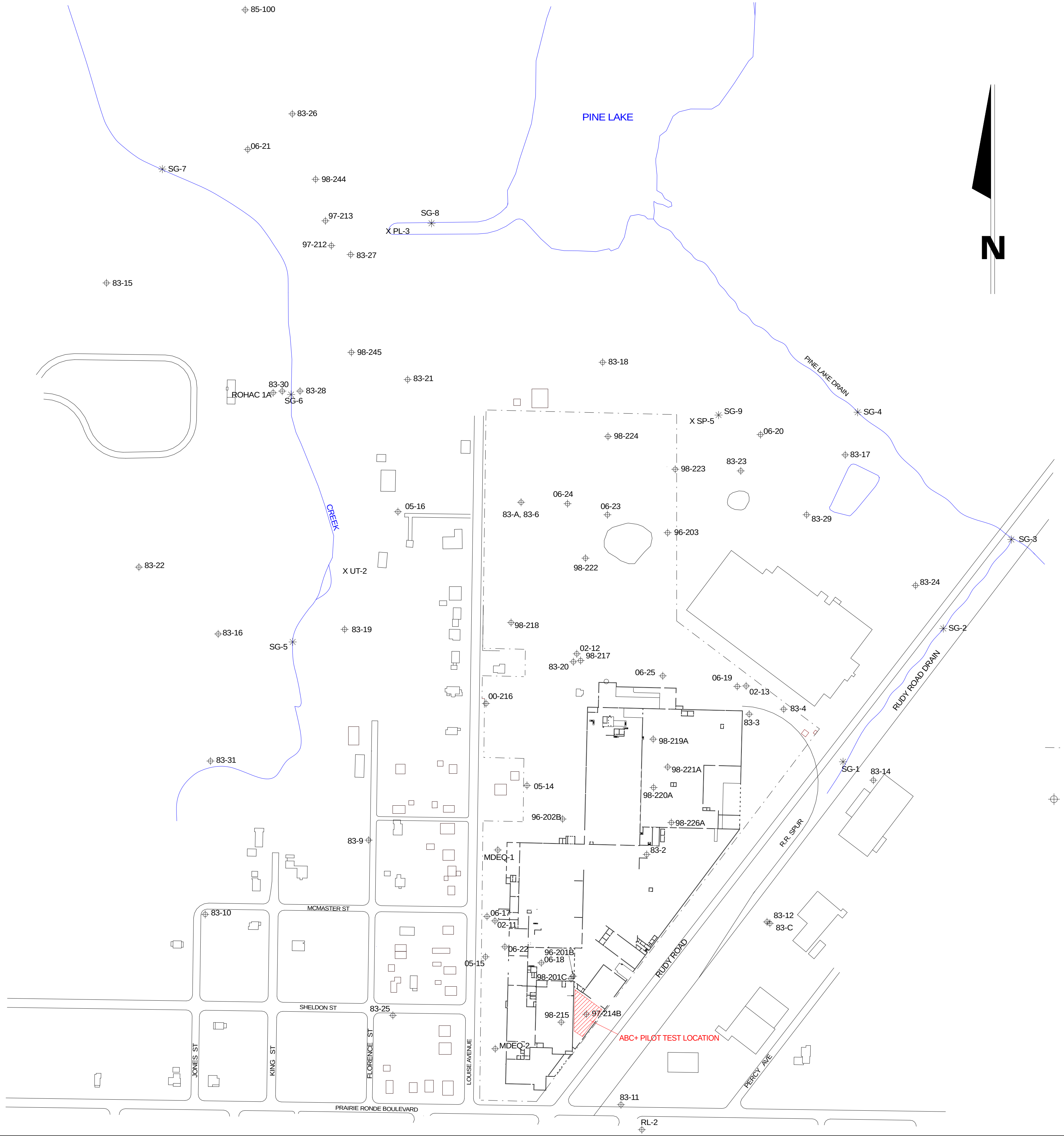
LOCATION	DATE	ARSENIC ug/l	BARIUM ug/l	CADMIUM ug/l	CHROMIUM ug/l	COPPER ug/l	LEAD ug/l	MERCURY ug/l	SELENIUM ug/l	SILVER ug/l	ZINC ug/l
SHALLOW UPPER AQUIFER (A-LEVEL) WELLS:											
TW-1	Dec-08	<1.0	**19**	<0.20	<1.0	**2.3**	<1.0	<0.20	<1.0	<0.20	**38**
	Feb-09	**4.8**	--	--	--	--	--	--	--	--	--
	Apr-09	**2.5**	--	--	--	--	--	--	--	--	--
	Jun-09	**2.7**	--	--	--	--	--	--	--	--	--
TW-2	Dec-08	**3.2**	**16**	<0.20	<1.0	**5.8**	<1.0	<0.20	<1.0	<0.20	**47**
	Feb-09	**2.4**	--	--	--	--	--	--	--	--	--
	Apr-09	**3.0**	--	--	--	--	--	--	--	--	--
	Jun-09	**4.2**	--	--	--	--	--	--	--	--	--
TW-3	Dec-08	<1.0	**21**	<0.20	<1.0	**4.6**	**3.4**	<0.20	<1.0	<0.20	**10**
	Feb-09	<1.0	--	--	--	--	--	--	--	--	--
	Apr-09	<1.0	--	--	--	--	--	--	--	--	--
	Jun-09	<1.0	--	--	--	--	--	--	--	--	--
98-215A	Dec-08	<1.0	**14**	<0.20	**1.1**	**1.4**	<1.0	<0.20	**1.7**	<0.20	**10**
	Apr-09	<1.0	--	--	--	--	--	--	--	--	--
	Jun-09	<1.0	--	--	--	--	--	--	--	--	--
06-18/1	Jul-08	<1.0	**57**	<0.20	<1.0	**4.7**	<1.0	<0.20	<1.0	<0.20	**11**
	Dec-08	<1.0	**49**	<0.20	<1.0	**3.5**	<1.0	<0.20	<1.0	<0.20	**5.8**
	Feb-09	<1.0	--	--	--	--	--	--	--	--	--
	Apr-09	<1.0	--	--	--	--	--	--	--	--	--
	Jun-09	<1.0	--	--	--	--	--	--	--	--	--
DEEP UPPER AQUIFER (B-LEVEL) WELLS:											
TW-4	Dec-08	**14**	**330**	<0.20	<1.0	**3.4**	<1.0	<0.20	<1.0	<0.20	**9.8**
	Feb-09	**19**	--	--	--	--	--	--	--	--	--
	Apr-09	**17**	--	--	--	--	--	--	--	--	--
	Jun-09	**12**	--	--	--	--	--	--	--	--	--
96-201B	Jul-08	<1.0	**56**	<0.20	<1.0	**6.3**	<1.0	<0.20	<1.0	<0.20	**15**
	Dec-08	<1.0	**54**	<0.20	<1.0	**5.4**	<1.0	<0.20	<1.0	<0.20	**37**
	Feb-09	<1.0	--	--	--	--	--	--	--	--	--
	Apr-09	<1.0	--	--	--	--	--	--	--	--	--
	Jun-09	--	--	--	--	--	--	--	--	--	--
97-214B	Jul-08	<1.0	**30**	<0.20	<1.0	**1.5**	<1.0	<0.20	<1.0	<0.20	**11**
	Dec-08	**6.7**	**95**	<0.20	<1.0	**6.2**	<1.0	<0.20	<1.0	<0.20	**14**
	Feb-09	**12**	--	--	--	--	--	--	--	--	--
	Apr-09	**8.8**	--	--	--	--	--	--	--	--	--
	Jun-09	**5.3**	--	--	--	--	--	--	--	--	--
06-18/2	Jul-08	<1.0	**57**	<0.20	<1.0	**2.0**	<1.0	<0.20	<1.0	<0.20	**7.2**
	Dec-08	<1.0	**59**	<0.20	<1.0	**3.2**	<1.0	<0.20	<1.0	<0.20	**9.0**
	Feb-09	<1.0	--	--	--	--	--	--	--	--	--
	Apr-09	<1.0	--	--	--	--	--	--	--	--	--
	Jun-09	<1.0	--	--	--	--	--	--	--	--	--
MICHIGAN PART 201 GENERIC CRITERIA FOR GROUNDWATER											
Drinking Water		10	2,000	5	100	1,000	4	2	50	34	2,400
GSI		150	1,300	4.7	170	21	30	0.0013	5	0.2	280

NOTES:

ug/L = Micrograms per Liter

< = Less Than

GSI = Groundwater/surface water interface



FACILITY LOCATION
not to scale

LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS

GRAPHIC SCALE

0 100 200 400

Prepared By:

R. David Mursch, P.E.

Geotechnical and Environmental Engineer

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REPORT OF ABC+ PILOT TEST

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

SITE PLAN

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REPORT OF ABC+ PILOT TEST

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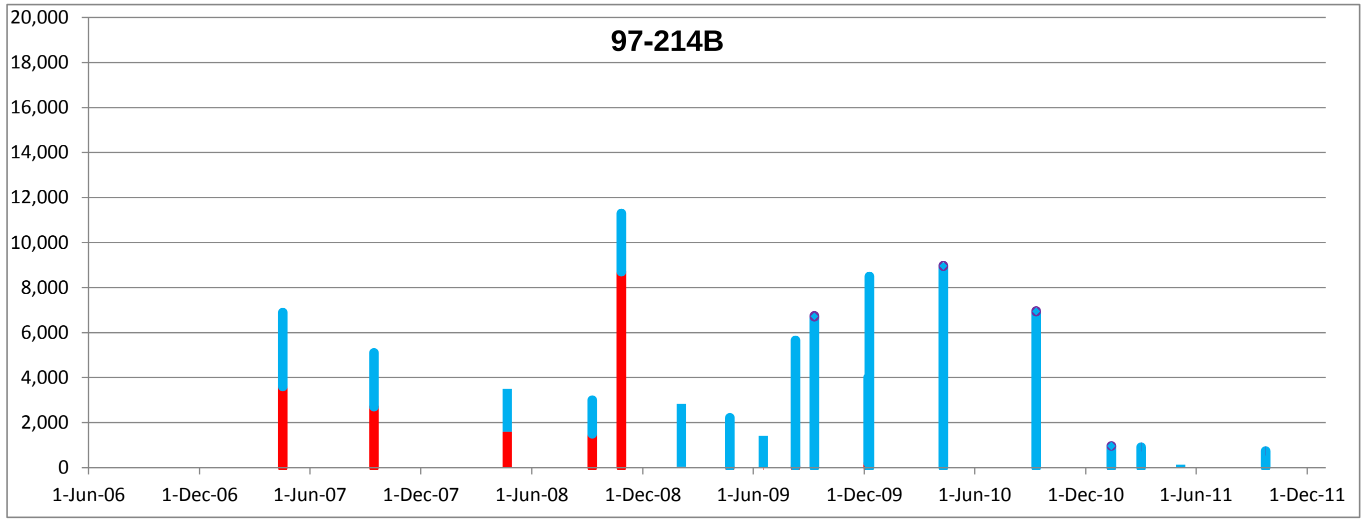
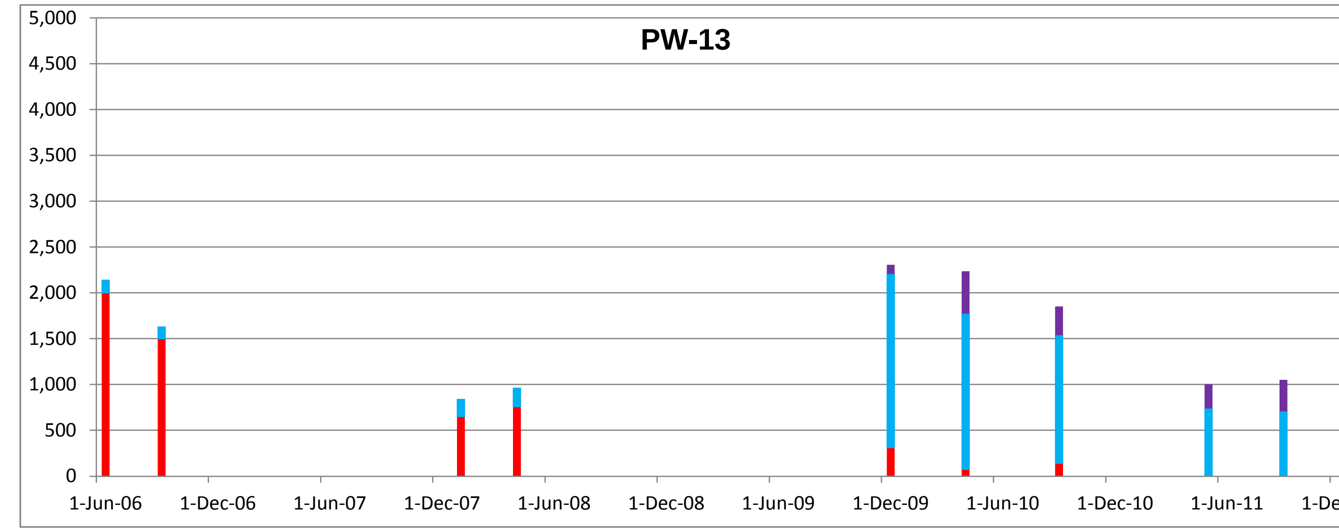
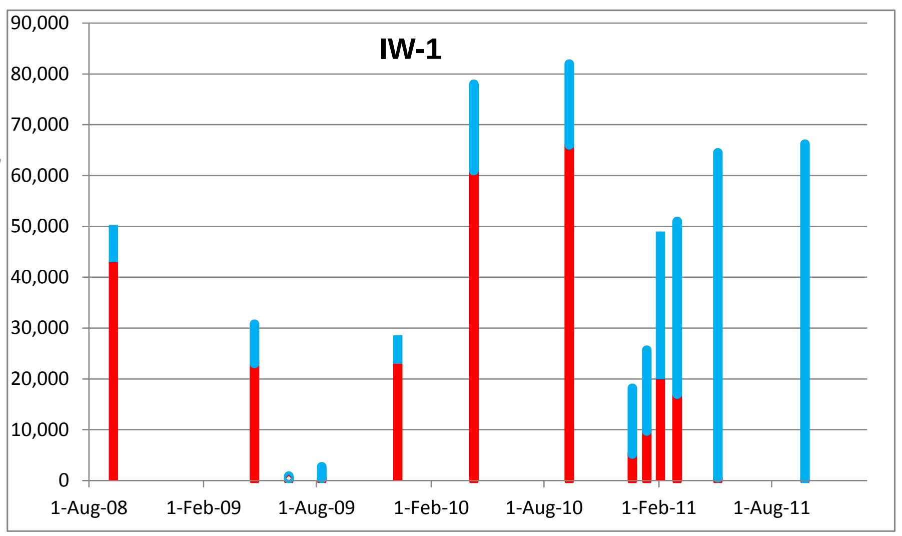
Figure 2:

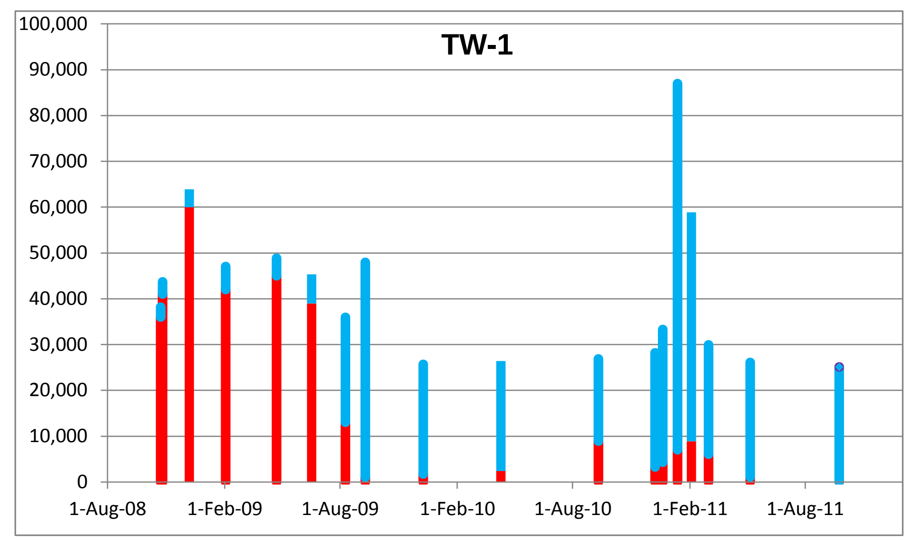
INJECTION AREA AND PILOT TEST MONITORING POINTS

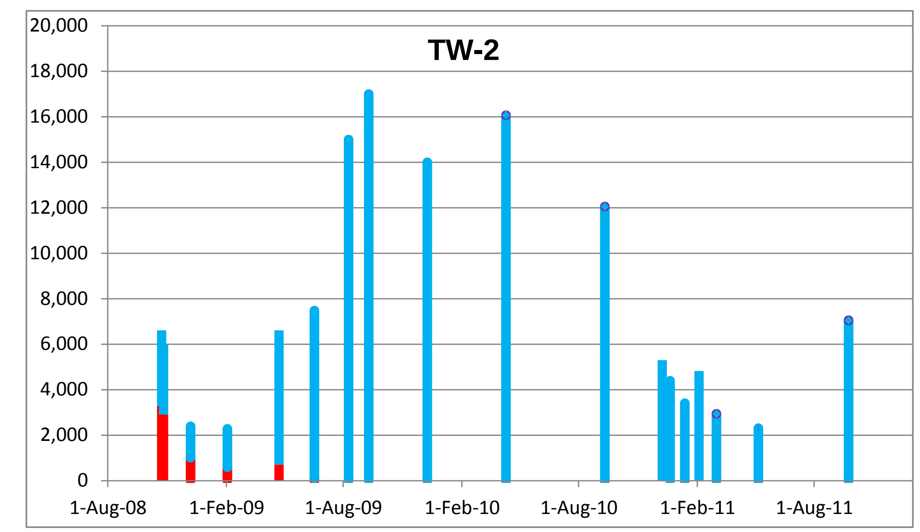


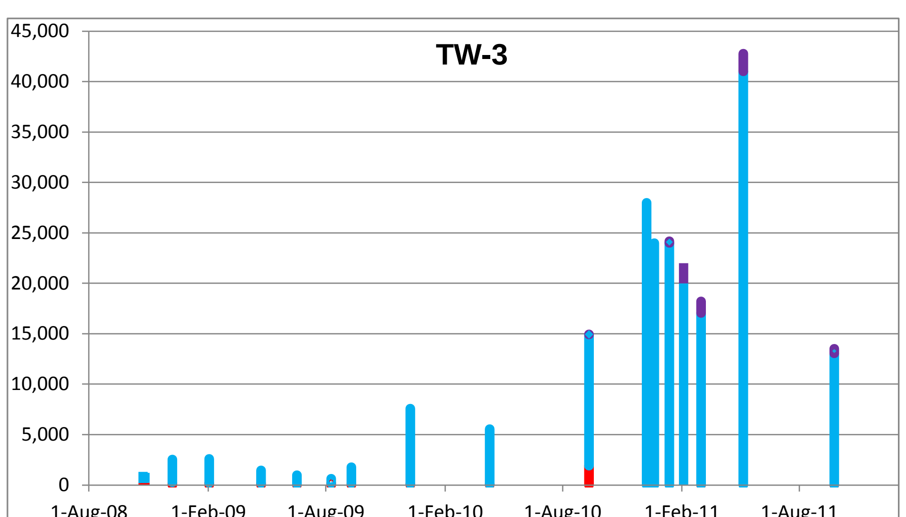


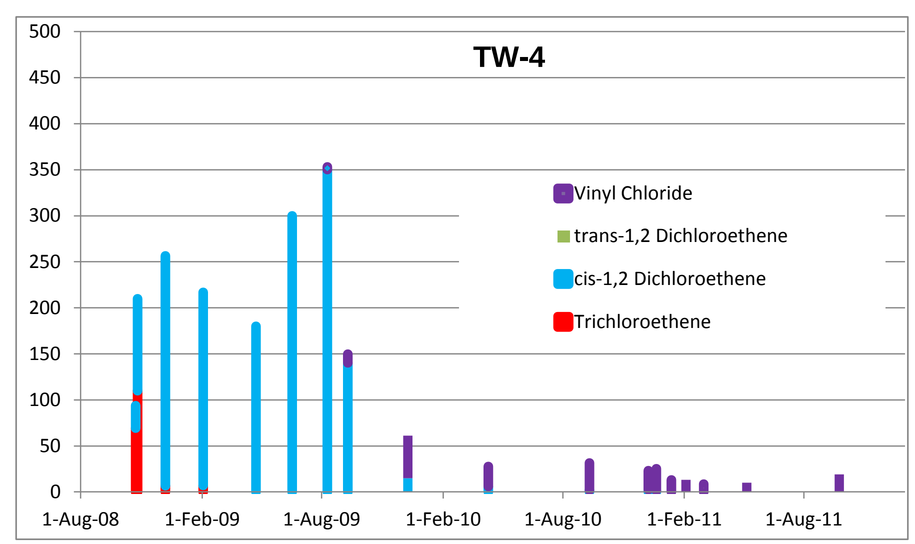
CONCENTRATION, MICROGRAMS PER LITER











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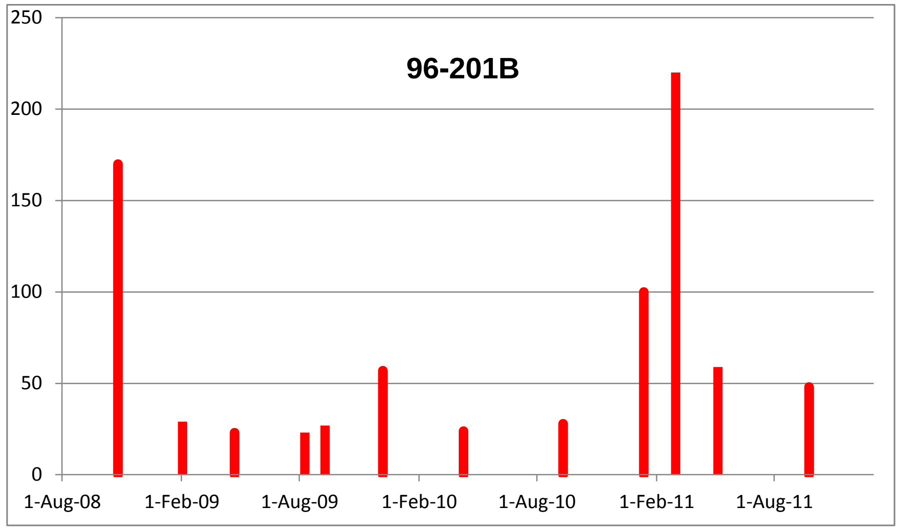
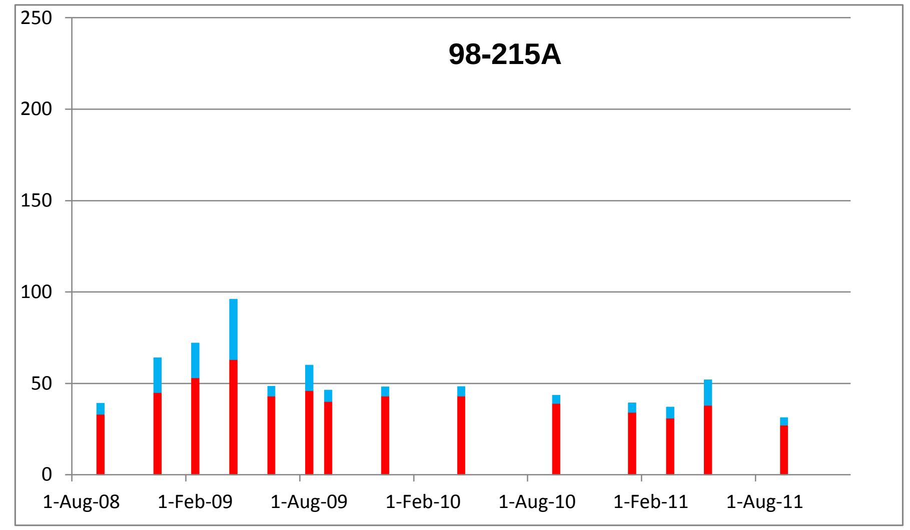
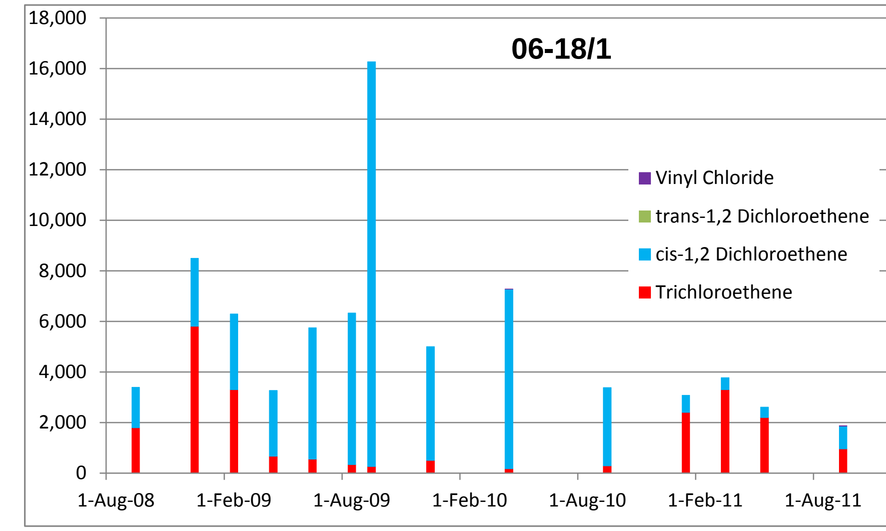
REPORT OF ABC+ PILOT TEST

FOR:
PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

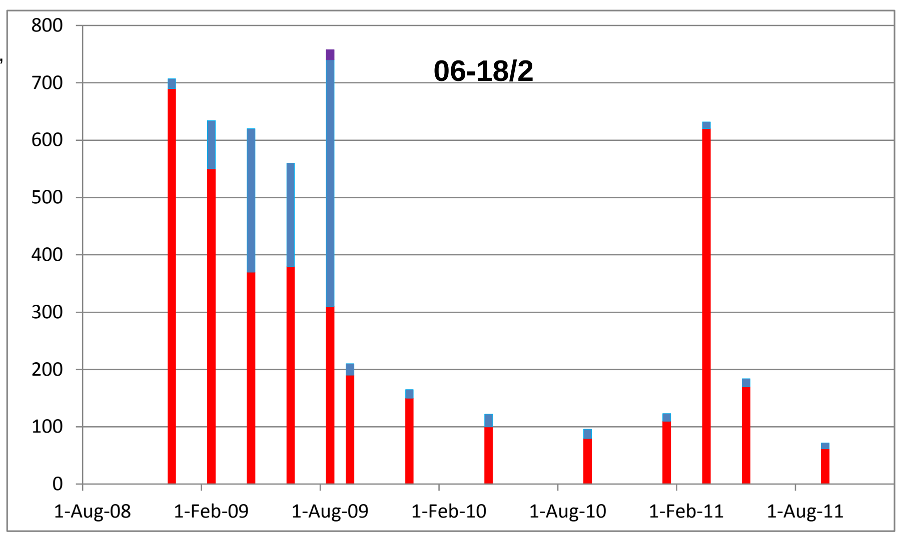
Figure 3:
TIME TREND DATA PLOTS FOR INJECTION AREA WELLS







CONCENTRATION,
MICROGRAMS
PER LITER



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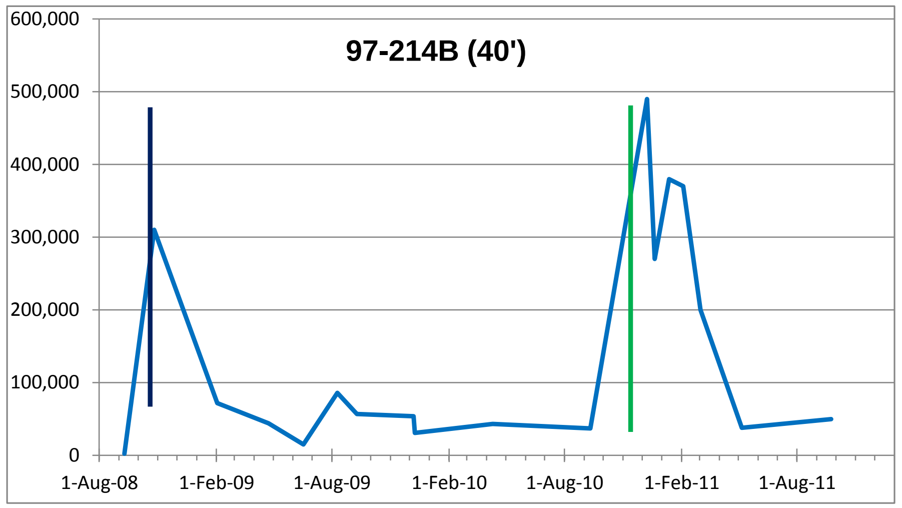
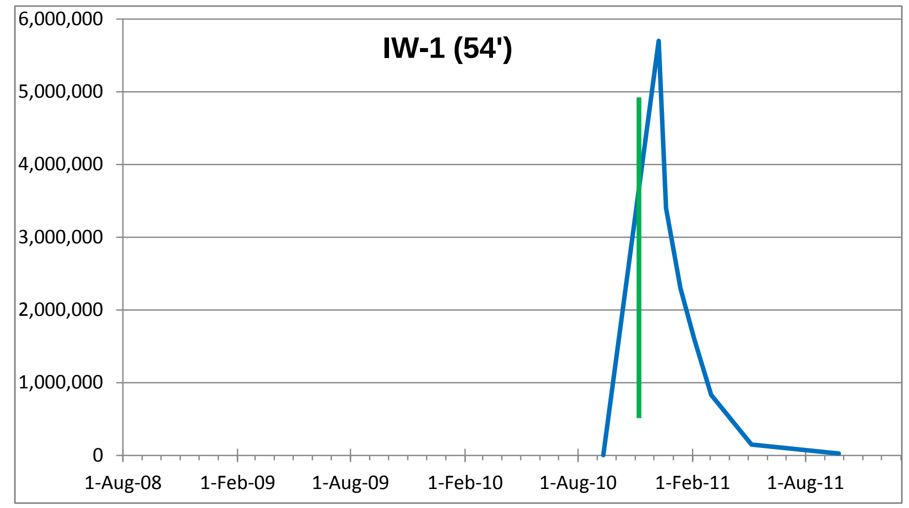
REPORT OF ABC+ PILOT TEST

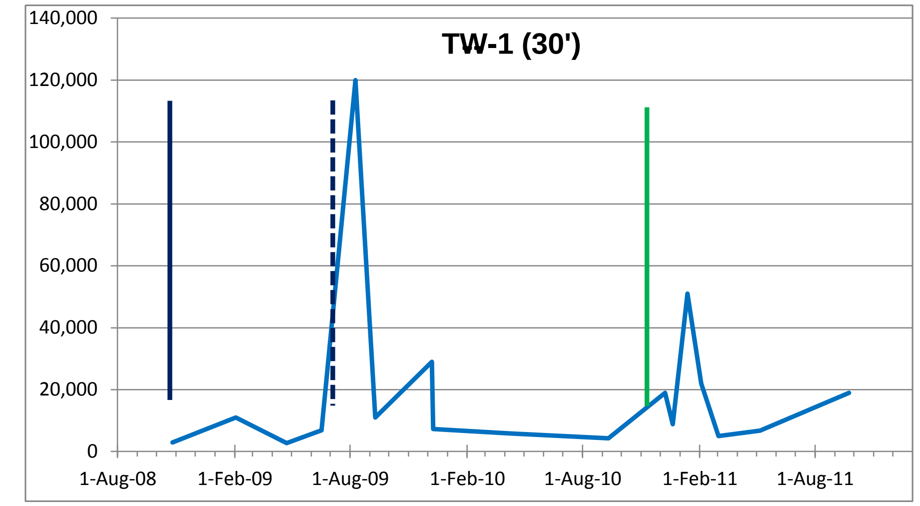
FOR:
PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 4:
TIME TREND DATA PLOTS
FOR WELLS OUTSIDE INJECTION AREA

WELLS INSIDE INJECTION AREA

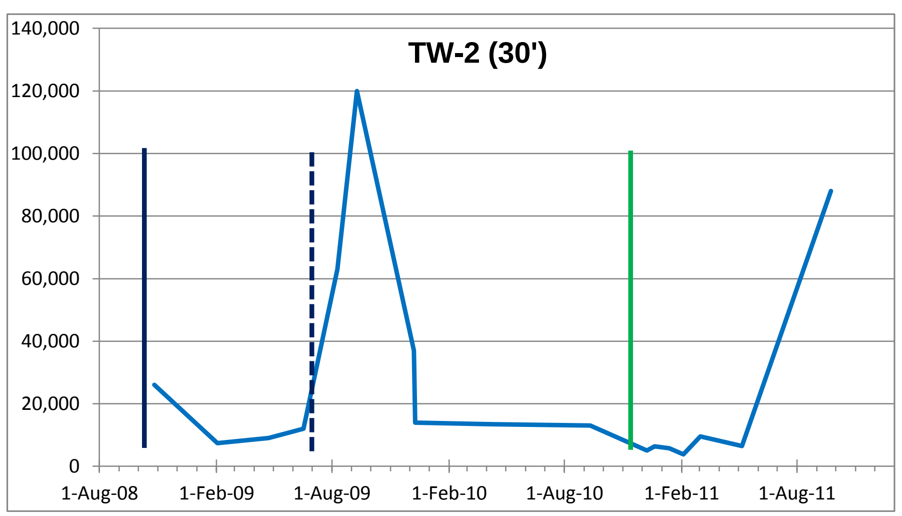


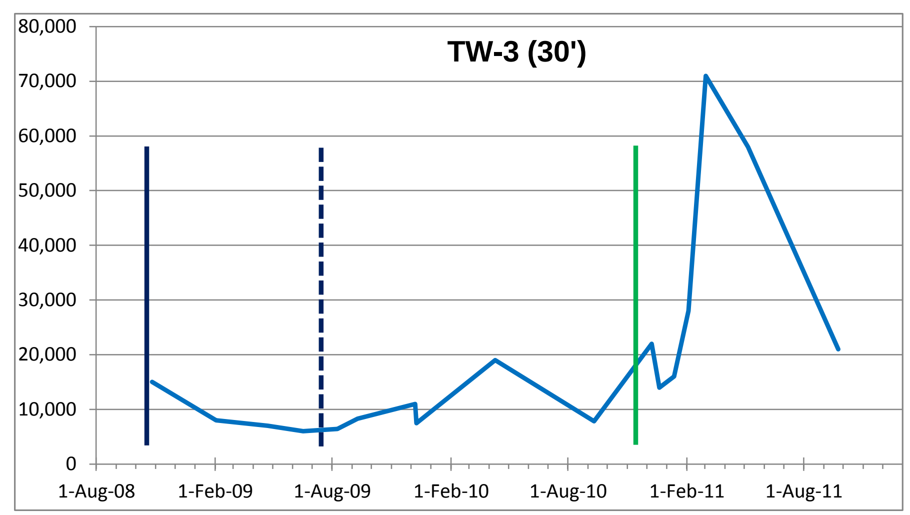


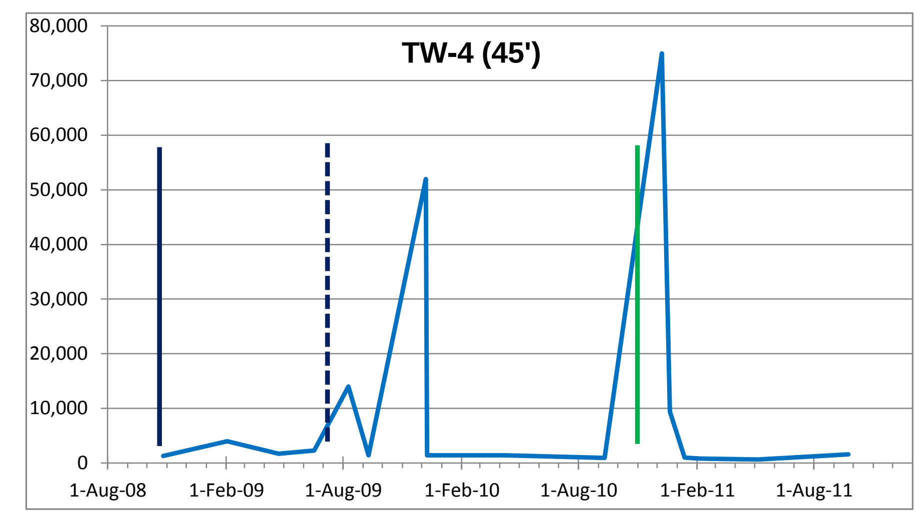


WELLS DOWNGRADIENT OF INJECTION AREA

CONCENTRATION, MICROGRAMS PER LITER







PHASE I INJECTION - OCTOBER 2008

PHASE I SUPPLEMENTAL INJECTION - JULY 2009

PHASE II INJECTION - NOVEMBER 2010

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REPORT OF ABC+ PILOT TEST

FOR:
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415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 5:
TIME TREND DATA PLOTS
FOR TOTAL ORGANIC CARBON

Appendix E

Corrective Action Monitoring Plan

FINAL

CORRECTIVE ACTION

MONITORING PLAN

~

Prairie Ronde Realty Company

Dowagiac, Michigan

Prepared For:

Mr. Tom Fox
Prairie Ronde Realty Company
201 Massey Building
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~

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~

April 10, 2013

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1.0 INTRODUCTION

This document presents a revised groundwater monitoring program for the Prairie Ronde Realty (PRR) property at 415 Prairie Ronde Street in Dowagiac, Michigan. This property site was acquired by PRR from the Sundstrand Corporation (UTC/Sundstrand) in 1995. The shallow soil and groundwater beneath this former copper tube mill are impacted by volatile organic compounds (VOCs), primarily trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), resulting from historical operations by UTC/Sundstrand. The contamination was discovered in 1983 and the impacted soil and groundwater has been actively remediated since 1984.

The plant area is underlain by glacial outwash deposits. In general, there is an upper layer of medium to fine sand grading to sandy gravel. This upper layer is typically 50 to 60 feet thick within the main plant area, and groundwater in this layer occurs under water table conditions. Underlying this upper layer is a variable but persistent aquitard layer consisting of inter-bedded clay, fine silty sand, clayey silt and clayey sand. The aquitard is typically several feet thick but in some areas it is tens of feet thick. The soil below the aquitard consists of inter-bedded sand and gravel that together form a semi-confined aquifer, and there is an upward hydraulic gradient across the aquitard layer at most of the monitored locations. Because of the aquitard layer and the upward gradient, there is limited VOC impact to the deep semi-confined aquifer.

The groundwater remediation program consists of a system of purge wells, which can capture up to 1,400,000 gallons of groundwater per day. The purged groundwater is treated through an air stripper and is then discharged to a surface stormwater drain at a permitted outfall. This system has been operating since 1984 under the terms of a Consent Judgment between UTC/Sundstrand (formerly Sundstrand Heat Transfer, Inc.) and the Michigan Department of Environmental Quality (MDEQ, formerly the Department of Natural Resources). In 2004, MDEQ requested that the US Environmental Protection Agency (USEPA) assume the regulatory lead for this site and PRR subsequently entered into a voluntary Consent Agreement with USEPA for completion of the site's environmental assessment and remediation.

Beginning in 1994, the plant voluntarily installed air sparging and soil vapor extraction (SVE) systems as interim measures to expedite the site remediation. These systems were shut down during the last quarter of 2008, as monitoring confirmed that they had accomplished their design objectives. During the operation of these systems, the regular corrective action monitoring program included activities related to these systems such as monitoring VOC levels in the SVE airstream, etc. The SVE system was re-configured as a sub-slab depressurization system (SSDPS) and returned to operation in the summer of 2012. The operation and monitoring of that system is described in the *Sub-Slab Depressurization System Operation and Monitoring Plan*.

In September 2009, PRR submitted a *Final Corrective Measures Proposal* (CMP) that outlines the proposed final site remediation program. USEPA and PRR are working on finalizing the CMP, and are currently revising the most recent version submitted in June of 2012.

The groundwater is presently monitored to track VOC concentrations in groundwater in general accordance with the *2007 Corrective Action Monitoring Plan* dated March 8, 2007 (the 2007 CAMP). However, due to shutdown of the SVE and sparge systems and additional or revised monitoring requirements related to the CMP, the 2007 CAMP is outdated. PRR submitted the *2012 Corrective Action Monitoring Plan* (2012 CAMP) to update the 2007 CAMP consistent with changing corrective action objectives. This Revised CAMP incorporates USEPA comments on the 2012 CAMP, which were received in a meeting at USEPA offices in December 2012.

2.0 SCOPE AND OBJECTIVES

This Revised CAMP outlines a program for routine corrective action monitoring of the groundwater remediation at the PRR plant in Dowagiac Michigan. The program includes sampling groundwater for analysis of contaminants on a regular schedule, soil vapor monitoring in residential areas, and operational checks on the purge well and PRR building SSDPS system components. As part of this plan, PRR is modifying the groundwater monitoring well network. The modifications include closing older monitoring wells; installing new monitoring wells; and converting selected sparge injection wells to groundwater monitoring wells.

The CMP outlines a program of groundwater remediation to interim and final goals. The interim goal is to protect surface water from groundwater emergence at levels above Michigan NREPA Part 201 Groundwater/Surface Water Interface (GSI) criteria. The final CMP goal is to remediate the groundwater to applicable standards using monitored natural attenuation (MNA). Interim and final remediation goals are listed in Table 2A of the CMP. The corrective action monitoring is designed to determine when the interim goals are met so that purge wells may be shut down, and to verify that the MNA is effectively reducing contaminant levels throughout the groundwater. The monitoring and sampling procedures to meet these requirements are described in this plan. Monitoring and sampling related to indoor air issues in the PRR building are described in the *Sub-Slab Depressurization System Operation and Monitoring Plan* dated February __, 2013 and appended to the CMP.

In developing the CMP during 2009, PRR addressed migration of VOCs to indoor air in residential areas and the impact of VOCs in the deep aquifer. No corrective measures are required for these issues. However, this Revised CAMP includes soil vapor sampling in residential areas and sentinel sampling of the deep aquifer to monitor for contaminant migration.

To monitor compliance with the remedial objectives, this Revised CAMP includes:

- Sampling groundwater at GSI compliance point wells on a quarterly basis, to assess compliance with GSI criteria and determine when the purge wells may be shut down as described in the *Revised Purge Well Shutdown Procedures* document appended to the CMP.
- Sampling groundwater at monitoring wells throughout the upper aquifer on a semi-annual basis, to monitor progress of the MNA.
- Sampling soil vapor at shallow vapor monitoring points (VMPs) in residential areas on quarterly to semi-annual frequency to monitor for possible residential VIA issues.
- Sampling groundwater from deep wells on a bi-annual basis, to monitor for possible future migration of contaminated groundwater into the deep aquifer.

In conjunction with the semi-annual sampling, the Revised CAMP includes measurement of potentiometric levels at monitoring wells, purge wells, and staff gauges and documentation of operation and maintenance (O&M) of the remedial systems.

In addition to the routine corrective action monitoring in this plan, PRR will sample groundwater and sub-slab soil vapor for evaluation of ABC+ injections for enhanced groundwater remediation. The specific sampling programs for each ABC+ injection will be described in work plans submitted for that interim remedial activity.

The corrective action monitoring program procedures are discussed in Section 3.0 of this work plan. The monitoring well network modifications are described in Section0 4.0.

3.0 MONITORING AND SAMPLING PROCEDURES

This Revised CAMP includes the following activities:

- Measure the depth to water at monitoring wells and purge wells on a semi-annual basis.
- Sample wells in the upper aquifer for VOC analysis on a semi-annual basis.
- Sample GSI Compliance Point monitoring wells for VOC analysis on a quarterly basis.
- Sample monitoring wells screened in the deep aquifer for VOC analysis on a bi-annual basis.
- Sample VMPs semi-annually to evaluate potential residential volatization to indoor air issues.
- Report the Monitoring data will be reported semi-annually.

The plant also performs sampling and monitoring related to MDEQ permits for discharge of air from the groundwater-treatment air stripper and the sub-slab depressurization system, and for discharge of treated groundwater to surface water. These data are reported directly to the relevant MDEQ divisions and the sampling is not part of this Revised CAMP.

As described in the CMP, PRR has completed a pilot test of ABC+ technology to enhance attenuation of VOCs in the groundwater. Based on the pilot test results, additional injections are proposed in the CMP. As these injections are performed, PRR will perform supplemental sampling and analysis as described in work plans that will be submitted specifically for those interim remedial actions.

The following sections describe the specific field and laboratory procedures that will be used for the monitoring program. Typical field data forms are included in Appendix A.

3.1 Potentiometric Surface Evaluation

The potentiometric surface will be evaluated on a semi-annual basis by measuring the depth to groundwater at the monitoring wells and purge wells and the elevation of the surface water at the staff gauges, using an electric water level probe. Using the data and the surveyed reference elevations, the water elevation at each measuring point will be determined and potentiometric surface maps for the upper and lower aquifers will be developed for the monitoring reports.

3.2 Groundwater Sampling

The groundwater quality will be monitored by sampling monitoring and purge wells for analysis of VOCs. Wells in the upper aquifer will be sampled on a semi-annual basis; GSI Compliance Point wells will be sampled quarterly; and wells screened in the deep aquifer will be sampled on a biannual basis.

The monitoring wells will generally be purged and sampled using low-flow methods as described in *Low Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, by Puls and Barcelona, EPA Ground Water Issue April 1996. Purge wells will be sampled directly from sampling taps at the wellheads.

In general, the monitoring wells to be sampled will be purged using a peristaltic pump and polyethylene tubing. Dedicated purge tubing will be set to the approximate midpoint of the screen in each well. The wells will be purged until water quality parameters including pH, conductivity, turbidity, dissolved oxygen, and temperature have stabilized, and the samples will then be collected. Purge water will be disposed on the ground surface near the well being sampled.

In some instances, the procedures outlined above may not be appropriate and alternative sampling techniques may be required as follows:

1. In some wells, the water level may occasionally be too deep for the use of a peristaltic pump; in these instances a variable-rate submersible 12-volt pump will be used.
2. In some wells, it may not be feasible to set the tubing to the midpoint of the well screen due to blockage in the well riser, or the rate of groundwater flow into the well may be too slow to allow use of the low-flow purging method. In these cases the wells will be purged until the well is dry or until three well volumes have been removed, using pumps or dedicated polyethylene bailers. The wells will then be allowed to recover and will be sampled by pumping through the purge tubing or by lowering a bailer to the well screen (or as deep as the blockage permits).
3. Some of the deep monitoring wells are flowing artesian wells. The artesian wells are sampled by inserting a stopper fitted with a polyethylene tube into the well riser, and sampling directly from the natural flow

The groundwater samples will be collected in 40-milliliter (ml) septum-lid sample vials with laboratory-added hydrochloric acid as a preservative, packed on ice and sent by courier to an approved analytical laboratory (such as Trimatrix Laboratories, Inc. in Grand Rapids, Michigan) to be analyzed for VOCs using EPA Method 8260. The sample handling will be documented with chain-of-custody forms. The laboratory will run multiple dilutions where required, so that non-detect results for target compounds are reported with detection limits at or below the target remediation goals outlined in the CMP.

As noted above, the CMP includes injection of ABC+ material to stimulate natural attenuation. For each injection, PRR will submit a work plan that includes groundwater monitoring. The ABC+ monitoring will include VOCs, dissolved gases, arsenic, total organic carbon, and other parameters as needed to track the ABC+ degradation and effectiveness.

The following quality assurance/quality control (QA/QC) procedures will be followed:

- The monitoring and sampling activities will be documented in a field logbook and on sampling data forms; a typical sampling data form is shown in Appendix A. The data forms will include the sample location, date, time, sampler, sampling method, field data and measurements, and any comments specific to the sample or data collection. The logbook will record general daily activities, calibration of measuring instruments if applicable, and general notes germane to the monitoring program as a whole.
- Sample handling will be documented with chain-of-custody protocol.
- Sampling equipment that is not dedicated to a particular well, pre-cleaned by the laboratory, or disposed after use will be cleaned using a non-phosphate soap wash, clean water rinse, and final rinse in de-ionized water. Whenever sampling equipment is cleaned in the field, the final rinse water will be sampled at least once per day as a field equipment blank, to check the adequacy of the cleaning. The field equipment blanks, when taken, will be managed and analyzed in the same manner as the monitoring samples.
- Laboratory-prepared trip blanks will be included with shipping containers that have samples to be analyzed for VOCs. The trip blanks will receive the same handling and analytical procedures as the monitoring samples.
- A duplicate sample will be obtained for each day of field sampling

The results of the trip blank analyses and other QA/QC samples, including any laboratory-prepared duplicate and spike samples, will be reviewed for data validation purposes.

3.3 Residential Area Soil Vapor Monitoring

PRR will sample existing VMPs designated as VMP-16, VMP-17, VMP-19, VMP-21 and VMP-23, which are located in the residential area west of Louise Avenue, on a semi-annual basis to monitor for potential VIA issues in the residential area. These VMPs, located on Figure 4, consist of 6-inch long by 0.5-inch diameter stainless steel screens set to a depth of 10 feet below ground surface and attached to ¼-inch polyethylene tubing which extends to the ground surface. The tubing at each VMP is protected at the surface by a manhole cover. These VMPs were installed in 2005; the installation and initial sampling of these points is documented in the *Current Conditions Report* (CCR) dated July 21, 2005.

The residential area VMP samples will be obtained using methods consistent with USEPA protocols for collecting air samples using TO-15 Summa™ canisters. The samples will be collected using 6-liter Summa canisters equipped with critical orifice flow regulators sized to collect the air sample over a 30-minute period. Each batch of canisters used for sampling will be certified clean by the laboratory according to USEPA Method TO-15. The samples will be analyzed for target VOCs, which are VOCs that are known to be present in the groundwater due to releases from the PRR property; specifically TCE, 111trichloroethane and degradation products of these two compounds.

Prior to sampling at each VMP, the sub-surface tubing will be purged using a hand vacuum pump to remove standing air in the tubing. The VMP tubing will then be connected to the Suma canister regulators and the flow regulators will be opened for the designated sampling period. The regulators will then be closed and the canisters will be shipped to the laboratory for analysis. The sampler will record the initial and final canister vacuum, barometric temperature, temperature, start and stop times, and the volume purged from the tubing prior to sample collection.

The sample results will be compared to both the initial VOC concentrations obtained in 2005 at each VMP and the USEPA Regional Screening Level (RSL) for Residential Air calculated according to the procedures listed at www.epa.gov/region9/superfund/prg/, adjusted for target risk of 1x10-5 and target hazard quotient of 1, divided by the USEPA -recommended attenuation factor (currently 0.03). The initial concentrations were as follows:

Initial (2005) concentrations of detected target VOCs at VMPs, micrograms per cubic meter

Vapor Monitoring Point	Trichloroethene	1,1,1-trichloroethane
VMP-16	107.4	4.6
VMP-17	59.1	8.7
VMP-19	6.4	5.4
AMP-21	1.8	<1.1
VMP-23	1.3	<1.1
Nov 2012 RSL/0.03*	70	173,333

*Residential indoor air screening level divided by an attenuation factor of 0.03

If any VMP has reported detections of target VOCs above the higher of: a) the current RSL divided by the EPA-recommended attenuation factor, or b) the initial value reported in the CCR as listed above, the point will be re-sampled within two months after receiving the data. If the re-sample continues to show elevated VOC concentrations PRR will obtain indoor air samples from the residence nearest to the VMP in question following the procedures described in the *Indoor Air & Sub-Slab Sampling Summary Report for March through September 2009* dated September 2009 and prepared by AECOM. The indoor air will be sampled monthly for three months.

If indoor air sampling at a residence pursuant to the conditions outlined above indicate a need for remedial measures due to migrating contamination, PRR will install a SSDPS or other mitigation measures as appropriate to the specific residence.

At the initial sampling event for residential area VMPs, the VMPs will be leak-tested using isopropyl alcohol (IPA) as a tracer. The IPA will be introduced into the air and ground surface in the vicinity of the VMP using a spray bottle.

3.4 Indoor Air and Sub-Slab Soil Vapor Monitoring in the Plant Building

The PRR building currently operates a SSDPS that includes a blower connected to former and new SVE wells inside the building. The purpose of the SSDPS is to reduce VOC concentrations in the sub-slab soil vapor and to control potential migration of sub-slab soil vapors into the building's breathing space above the floor slab. The system is operated, maintained and monitored as described in the *Sub-Slab Depressurization Operation and Monitoring Plan* included as an appendix to the CMP.

3.5 Remediation System Operation and Maintenance

PRR maintains an O&M program for the purge well and SSDPS systems. The purge wells are checked monthly by a well contractor, who inspects the well equipment, flow rate, wellhead pressure, and depth to water. The PRR staff checks the air stripper equipment daily, and also observes the operation of the SSDPS blower and condensation water knock-out system. Documentation of the purge well inspections and plant staff maintenance will be maintained at the plant for three years and will be available for inspection.

3.6 Reporting

The monitoring data will be presented in semi-annual reports that will include the field measurement data sheets, laboratory analytical reports, and graphical summaries of the data in tables and figures. The figures will include a map showing the sample and monitoring locations; a potentiometric surface map; a map of VOC distribution in groundwater; time trend graphs for VOC concentrations in groundwater at representative sample locations; and maps of indoor air and soil vapor analytical results.

All monitoring and other data that is obtained in any quarter, including (for example) data associated with monitoring of the SSDPS and data for monitoring of ABC+ injections that are described in separate work plans, will be included in the monitoring report for that quarter. In some instances, the data obtained in conjunction with separate work plans may also be included in separate reports for those activities.

The field sampling data sheets, laboratory reports and chain-of-custody forms will be included on computer media, in the form of Adobe Acrobat (*.pdf) files.

4.0 GROUNDWATER MONITORING WELL NETWORK

PRR presently has 126 groundwater monitoring wells (Figure 1). Fifty-nine of these monitoring wells were installed during the original site investigation in 1983/1985. These older wells (prefixed with "83-" or "85-") were generally constructed with steel pipe risers and screens. The risers and screens in many of these older wells are deteriorating and some wells have blockage in the risers, bent risers, and/or sediment deposits filling or partly filling the screens. PRR has attempted to clear wells that have had blocked risers and plugged screens; however these efforts have not been successful in all cases. In addition these older wells were generally installed as part of the original hydrogeological assessments, for the purpose of evaluating the extent and character of the contamination in 1983; therefore many of these wells are in locations that are not relevant for corrective action monitoring or for evaluating the current limits of impacted groundwater.

Between 1995 and 2005, PRR installed thirty-six new PVC monitoring wells. During 2006 an additional four temporary PVC monitoring wells were installed, along with five continuous multi-channel tubing (CMT) wells that have a total of twenty-seven sampling ports. These sixty-seven newer PVC wells and CMT points are in more secure locations and have more modern construction than the 1983-era steel wells, and they are generally better placed for remediation monitoring.

In addition to the 126 monitoring wells, PRR has installed twenty-five air sparge injection wells that have been used for groundwater sampling and monitoring. Some of these sparge wells are in locations that provide useful data for corrective action monitoring.

PRR has reviewed the existing network of wells and the monitoring requirements for effective evaluation of the CMP remediation program. Based on this review, PRR has developed a monitoring plan using the existing wells to the extent possible, so as to minimize the installation of more wells in the area. In order to provide effective coverage, however, PRR has determined that four new wells should be installed and six of the sparge injection wells should be retained as monitoring wells.

The plan includes sampling of the following monitoring wells on the indicated schedule.

1. GSI Compliance Point Wells (Figure 2) – twenty wells sampled quarterly:

83-17A and B	98-224B	05-16
83-19A and B	98-245A	06-17/1 and /2
83-21A and B	02-02	06-20/1 and /2
83-28A and B	02-03 and 04	
(New) 224A	05-15	

2. MNA Monitoring Wells (Figure 3) – thirty-one wells sampled semi-annually:

83-23A and B	98-244A	IW-14*
83-24A and B	00-216A	IW-18*
96-202B	05-14	IW-21*
96-203A	06-18/1 and 2	IW-24*
97-212B	06-19/1, /2 and /3	IW-25*
97-213B	06-20/3 and /4	
98-218B	06-21/1, /2, /3, /4	
98-223A and B	IW-11*	

*Retained sparge injection well

3. Deep Aquifer Monitoring Wells (Figure 5) – thirteen wells sampled bi-annually:

98-201C	02-01	06-19/7
98-215C	06-18/3, /4 and /7	06-20/5 and /6
98-217C	06-17/3, /4 and /7	

4. Source Area Monitoring Wells (Figure 6) – sampled for evaluation of ABC+ remediation injections per approved work plans, but at least annually:

96-201B	98-220A	TW-1, 2, 3 and 4
97-214B	98-225B	IW-1
98-215A	98-226A	

The existing monitoring, SVE and sparge wells that are not listed above will be abandoned. The wells to be abandoned are primarily older steel wells that are in deteriorating condition, temporary wells that are no longer needed, and air sparge injection wells that are no longer needed. PRR will also abandon two deep wells that were installed and left open by the MDEQ in 2002 (MDEQ-1 and MDEQ-2), and the SVE wells that are not being employed as part of the SSDPS system (these wells do not extend into the groundwater).

The wells to be abandoned will be filled with cement/bentonite grout and cut off below grade. Each well site will then be backfilled to the original grade using soil similar to the surrounding natural materials. After the abandonment has been completed well abandonment records prepared by the well driller performing the work will be submitted as part of the regular monitoring report for the quarter in which the work is performed.

The new GSI monitoring well at location 224 will be constructed of 2-inch PVC screen and riser. The well will have 5-foot long screens set to span the water table surface. The well will be completed with a sand pack around the screen extending at least 2 feet above the top of the screen; a 2-foot bentonite seal above the sand pack; and a grout seal from the top of the bentonite seal to the ground surface. After installation, the well will be developed by pumping and surging to clear the well bore and sand pack of disturbed soil, until water pumped from the well is cleared of sediment. The well will then be left undisturbed for at least two days before sampling to allow the aquifer in the vicinity of the wells to stabilize to normal conditions. Soil cuttings will be distributed on the ground surface near the wells. Water generated during well development will be collected and disposed through the PRR groundwater treatment system. Driller's logs and well completion reports will be submitted as part of the regular monitoring report for the quarter in which the well is installed.

TABLE 1: SUMMARY OF MONITORING WELLS (PAGE 1 OF 2)

LOCATION	WELL TYPE	SAMPLING FREQUENCY	REFERENCE ELEVATION, FEET NGVD	GROUND ELEVATION, FEET NGVD	COORDINATES NORTHING	COORDINATES EASTING	DATE INSTALLED	DRILLING METHOD	DEPTH BELOW TOC, FEET	SCREEN LENGTH, FEET	RISER AND SCREEN TYPE	RISER STICKUP FEET
83-17A	GSI/MNA	QUARTERLY/SA	743.36	741.28	185933.3175	12653303.3366	9/27/1983	HSA	17	3	2" GAL/SS	1.9
83-17B	GSI/MNA	QUARTERLY/SA	743.95	742.06	185926.3400	12653317.5320	9/27/1983	HSA	42	3	2" GAL/SS	1.8
83-19A	GSI/MNA	QUARTERLY/SA	743.88	742.04	185357.8430	12651668.0390	9/28/1983	HSA	16	5	2" GAL/SS	1.8
83-19B	GSI/MNA	QUARTERLY/SA	743.80	741.89	185358.0180	12651662.3390	9/28/1983	HSA	41	3	2" GAL/SS	1.9
83-21A	GSI/MNA	QUARTERLY/SA	741.51	738.62	186177.5810	12651872.3900	10/27/1983	HSA	21	3	2" GAL/SS	1.8
83-21B	GSI/MNA	QUARTERLY/SA	741.88	738.37	186176.0800	12651873.6730	10/27/1983	Rotary	47	3	2" GAL/SS	2.3
83-23A	MNA	SEMI-ANNUAL	742.80	739.86	185876.9440	12652969.8780	10/26/1983	HSA	17	2	2" GAL/SS	2.9
83-23B	MNA	SEMI-ANNUAL	743.21	740.10	185875.8470	12652966.7840	10/26/1983	HSA	40	3	2" GAL/SS	3.0
83-24A	MNA	SEMI-ANNUAL	752.02	749.49	185449.8610	12653541.6551	10/26/1983	HSA	16	3	2" GAL/SS	2.5
83-24B	MNA	SEMI-ANNUAL	752.43	749.51	185502.1520	12653543.4086	10/26/1983	HSA	39	3	2" GAL/SS	2.9
83-28A	GSI/MNA	SEMI-ANNUAL	737.42	736.24	186138.9640	12651520.3510	11/3/1983	HSA	21	3	2" GAL/SS	1.1
83-28B	GSI/MNA	SEMI-ANNUAL	737.47	735.81	186139.2530	12651518.1660	11/3/1983	HSA	57	3	2" GAL/SS	1.3
96-201B	SOURCE	PER WORK	769.95	--	184213.7041	12652416.6127	9/17/1996	HSA	50	10	2" PVC	MH
98-201C	DEEP	BI-ANNUAL	770.35	770.50	184207.4051	12652411.8256	5/5/1998	HSA	85	5	2" PVC	MH
96-202B	MNA	SEMI-ANNUAL	772.47	770.01	184731.4549	12652381.9119	9/18/1996	HSA	63	10	2" PVC	2.5
96-203A	MNA	SEMI-ANNUAL	757.72	755.18	185672.5070	12652728.5840	9/20/1996	HSA	26	15	2" PVC	2.5
97-212B	MNA	SEMI-ANNUAL	738.68	736.05	186617.2344	12651622.0427	4/9/1997	HSA	52.5	10	2" PVC	2.4
97-213B	MNA	SEMI-ANNUAL	742.15	740.08	186697.9177	12651603.1155	4/9/1997	HSA	42	10	2" PVC	1.9
97-214B	SOURCE	PER WORK	769.56	--	184089.4234	12652460.6242	4/14/1997	HSA	40	10	2" PVC	MH
98-215A	SOURCE	PER WORK	770.27	--	184061.9001	12652376.7641	4/28/1998	HSA	30	10	2" PVC	MH
98-215C	DEEP	BI-ANNUAL	770.16	770.50	184057.0350	12652376.3894	4/29/1998	HSA	80	5	2" PVC	MH
00-216A	MNA	SEMI-ANNUAL	769.53	--	185111.4427	12652129.2808	9/18/2000	HSA	35	10	2" PVC	MH
98-217C	DEEP	BI-ANNUAL	767.87	768.30	185252.4818	12652441.4996	2/20/1998	HSA	70	5	2" PVC	MH
98-218B	MNA	SEMI-ANNUAL	771.24	--	185377.2409	12652212.8950	4/23/1998	HSA	45	5	2" PVC	MH
98-220A	SOURCE	PER WORK	765.45	--	184835.4202	12652681.8795	9/9/1998	HSA	30	10	2" PVC	MH
98-223A	MNA	SEMI-ANNUAL	742.22	739.87	185882.5291	12652750.8813	9/15/1998	HSA	23	10	2" PVC	2.2
98-223B	MNA	SEMI-ANNUAL	742.33	739.82	185882.4451	12652755.8919	9/15/1998	HSA	47	10	2" PVC	2.3
(New) 224A	GSI/MNA	QUARTERLY/SA	--	--	--	--	--	--	*20*	*5*	*2" PVC*	--
98-224B	GSI/MNA	QUARTERLY/SA	749.64	747.20	185989.8590	12652531.9350	9/14/1998	HSA	42	10	2" PVC	2.5
98-225B	SOURCE	PER WORK	765.70	--	184720.0177	12652682.4537	9/16/1998	HSA	54	5	2" PVC	MH
98-226A	SOURCE	PER WORK	765.53	--	184720.0641	12652740.2522	9/16/1998	HSA	30	20	2" PVC	MH
98-244A	MNA	SEMI-ANNUAL	740.77	738.10	186834.9836	12651568.4101	12/4/1998	HSA	32	10	2" PVC	2.4
98-245A	GSI/MNA	QUARTERLY/SA	739.85	737.17	186266.0410	12651687.9410	12/8/1998	HSA	32	10	2" PVC	2.5
02-01	DEEP	BI-ANNUAL	759.62	759.90	184653.496	12651748.079	5/22/2002	HSA	119	5	2" PVC	MH
02-02	GSI/MNA	QUARTERLY/SA	759.83	760.30	184665.917	12651746.8850	5/29/2002	RotoSonic	32	5	2" PVC	MH
02-03	GSI/MNA	QUARTERLY/SA	758.46	758.80	186072.458	12652178.4710	5/28/2002	HSA	64	5	2" PVC	MH
02-04	GSI/MNA	QUARTERLY/SA	757.90	758.30	186072.983	12652173.7610	5/29/2002	RotoSonic	42	5	2" PVC	MH

SEE NOTES, PAGE 2

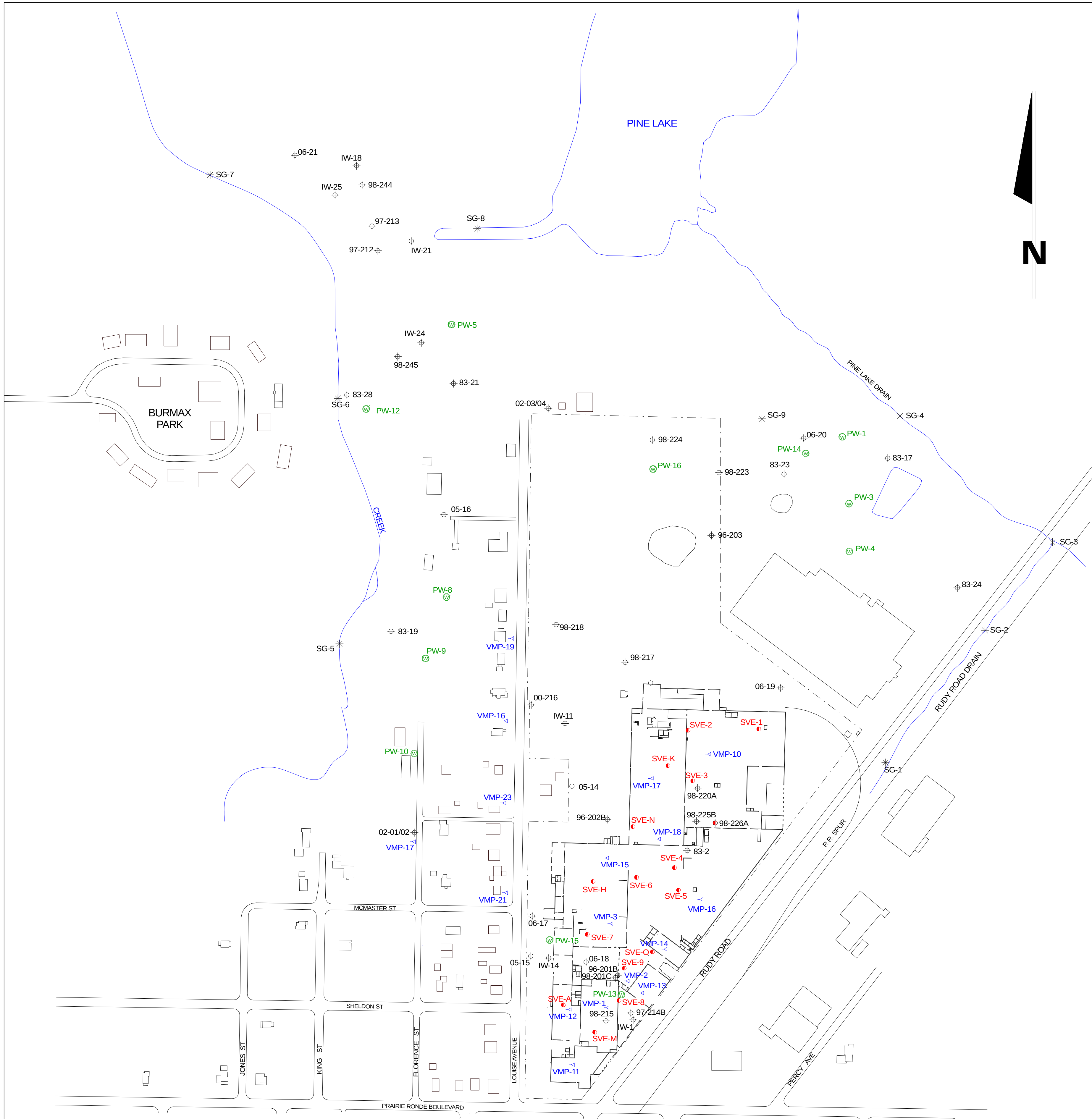
TABLE 1: SUMMARY OF MONITORING WELLS (PAGE 2 OF 2)

LOCATION	WELL TYPE	SAMPLING FREQUENCY	REFERENCE ELEVATION, FEET NGVD	GROUND ELEVATION, FEET NGVD	COORDINATES		DATE INSTALLED	DRILLING METHOD	DEPTH BELOW TOC, FEET	SCREEN LENGTH, FEET	RISER AND SCREEN TYPE	RISER STICKUP FEET
					NORTHING	EASTING						
05-14	MNA	SEMI-ANNUAL	771.15	771.29	184809.795	12652265.1992	2/22/2005	HSA	30	10	2" PVC	MH
05-15	GSI/MNA	QUARTERLY/SA	766.20	766.22	184323.120	12652133.3443	2/21/2005	HSA	25	10	2" PVC	MH
05-16	GSI/MNA	QUARTERLY/SA	758.08	758.27	185731.367	12651829.7234	2/21/2005	HSA	29	10	2" PVC	MH
06-17 - 1,2	GSI/MNA	QUARTERLY/SA	769.53	767.92	184404.2610	12652138.2443	7/25/2006	HSA	30, 50	0.25	CMT	1.6
06-17 - 3,4 7	DEEP	BI-ANNUAL	769.53	767.92	184404.2610	12652138.2443	7/25/2006	HSA	65, 80, 110	0.25	CMT	1.6
06-18 - 1,2	MNA	PER WORK	770.13	770.61	184231.8979	12652316.8362	7/26/2006	HSA	30, 50	0.25	CMT	MH
06-18 - 3,4,7	DEEP	BI-ANNUAL	770.13	770.61	184231.8979	12652316.8362	7/26/2006	HSA	65, 80, 110	0.25	CMT	MH
06-19 - 1,2,3	MNA	SEMI-ANNUAL	761.45	759.27	185160.0519	12652954.4798	7/26/2006	RotoSonic	25, 40, 55	0.25	CMT	2.2
06-19 - 7	DEEP	BI-ANNUAL	761.45	759.27	185160.0519	12652954.4798	7/26/2006	Roto-Sonic	120	0.25	CMT	2.2
06-20 - 1,2	GSI/MNA	QUARTERLY/SA	741.22	738.87	185981.7334	12653025.2375	8/1/2006	RotoSonic	15, 30	0.25	CMT	2.4
06-20 - 3,4	MNA	SEMI-ANNUAL	741.22	738.87	185981.7334	12653025.2375	8/1/2006	RotoSonic	45, 60	0.25	CMT	2.4
06-20 - 5,6	DEEP	BI-ANNUAL	741.22	738.87	185981.7334	12653025.2375	8/1/2006	Roto-Sonic	80, 120	0.25	CMT	2.4
06-21 - 1,2,3,4	MNA	SEMI-ANNUAL	741.54	738.40	186935.4475	12651349.8322	8/1/2006	RotoSonic	15, 30, 45, 60	0.25	CMT	3.1
IW-1	SOURCE	PER WORK	--	768.79	184062.7793	12652462.5768	4/11/1997	HSA	54	5	4" PVC	MH
IW-11	MNA	SEMI-ANNUAL	--	769.99	185050.5612	12652225.8097	4/21/1998	HSA	50	5	2" PVC	MH
IW-14	MNA	SEMI-ANNUAL	--	766.27	184273.6347	12652196.7006	4/24/1998	HSA	45	5	2" PVC	MH
IW-18	MNA	SEMI-ANNUAL	--	742.55	186902.4209	12651554.5736	12/1/1998	HSA	49	5	2" PVC	MH
IW-21	MNA	SEMI-ANNUAL	--	736.29	186610.87	12651718.3290	12/2/1998	HSA	70	5	2" PVC	MH
IW-24	MNA	SEMI-ANNUAL	--	735.97	186321.6390	12651731.4590	12/7/1998	HSA	60	5	2" PVC	MH
IW-25R	MNA	SEMI-ANNUAL	--	734.06	186804.8204	12651485.9966	9/20/2000	HSA	54	5	2" PVC	MH
TW-1	SOURCE	PER WORK	--	--	--	--	--	Geoprobe	30	5	1" PVC	MH
TW-2	SOURCE	PER WORK	--	--	--	--	--	Geoprobe	30	5	1" PVC	MH
TW-3	SOURCE	PER WORK	--	--	--	--	--	Geoprobe	30	5	1" PVC	MH
TW-4	SOURCE	PER WORK	--	--	--	--	--	Geoprobe	50	5	1" PVC	MH

NOTES:

NGVD = National Geodetic Vertical Datum
-- = Not measured or not applicable
GSI = Groundwater/surface water interface
MNA = Monitored natural attenuation
DEEP = Deep aquifer
SOURCE = Source area monitoring well
SA = Frequency changes to semi-annual af

TOC = Top of casing
HSA = Hollow stem auger
GAL/SS = Stainless steel screen with galvanized steel riser
PVC = PVC screen and riser
MH = Manhole cover
CMT = Solinst continuous multichannel tubing



LEGEND:

- PRAIRIE RONDE REALTY PROPERTY LINE
- PURGE WELLS
- STAFF GAUGE
- X SURFACE WATER SEEP SAMPLING POINT
- MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS
- SUBSLAB DEPRESSURIZATION VAPOR EXTRACTION WELLS
- SUBSLAB DEPRESSURIZATION VAPOR MONITORING POINT

GRAPHIC SCALE

0 100 200 400

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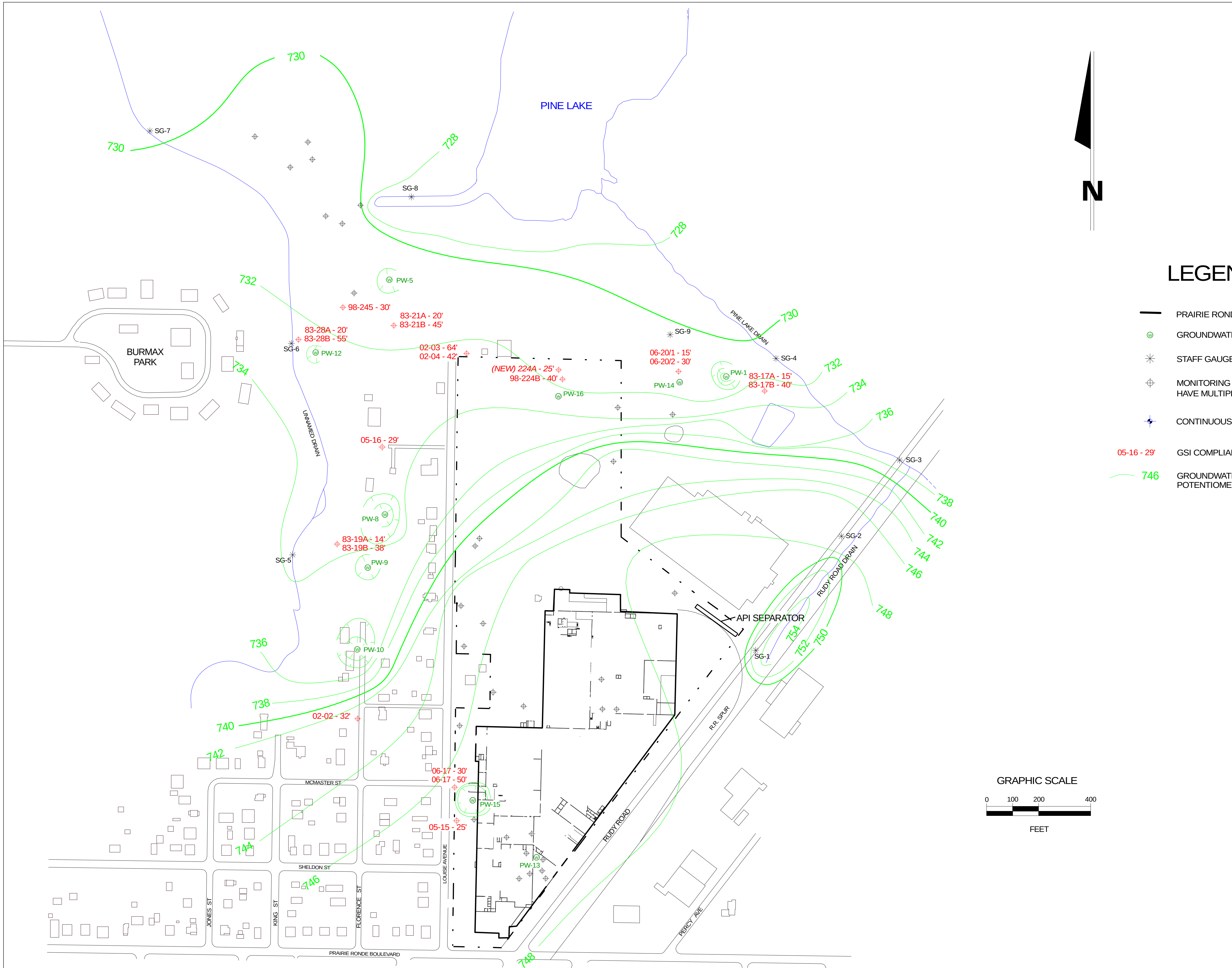
FINAL CORRECTIVE ACTION MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

SITE PLAN



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FINAL CORRECTIVE ACTION MONITORING PLAN

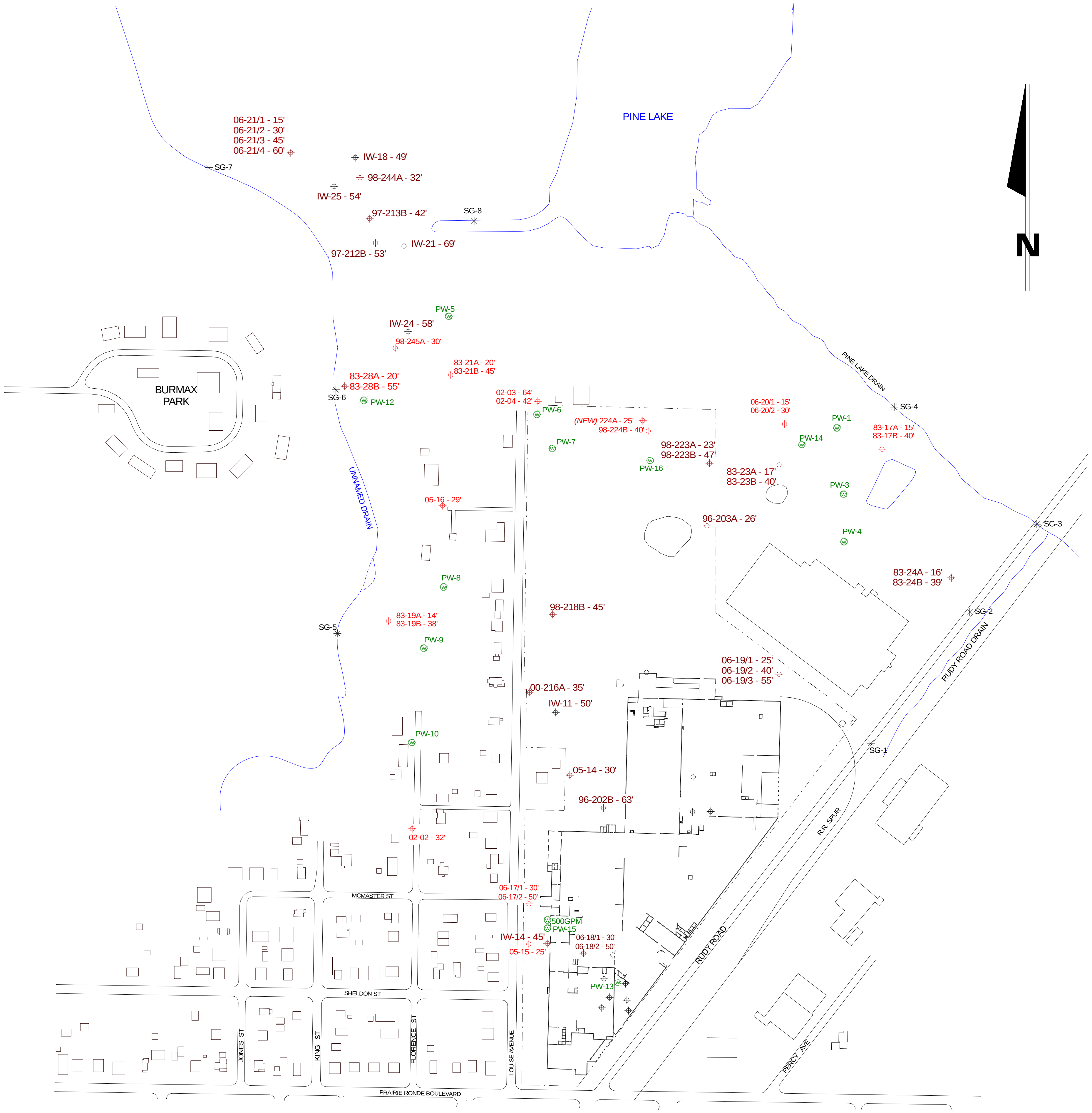
FOR:

PRAIRIE RONDE REALTY COMPANY

415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 2:

GSI COMPLIANCE POINT MONITORING WELL LOCATIONS



LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

GROUNDWATER REMEDIATION PURGE WELLS

STAFF GAUGE

MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS

05-16 - 29' GSI COMPLIANCE MONITORING WELL AND SCREEN DEPTH

06-20 - 15' MONITORED NATURAL ATTENUATION MONITORING WELL AND SCREEN DEPTH

GRAPHIC SCALE

0 100 200 400

FEET

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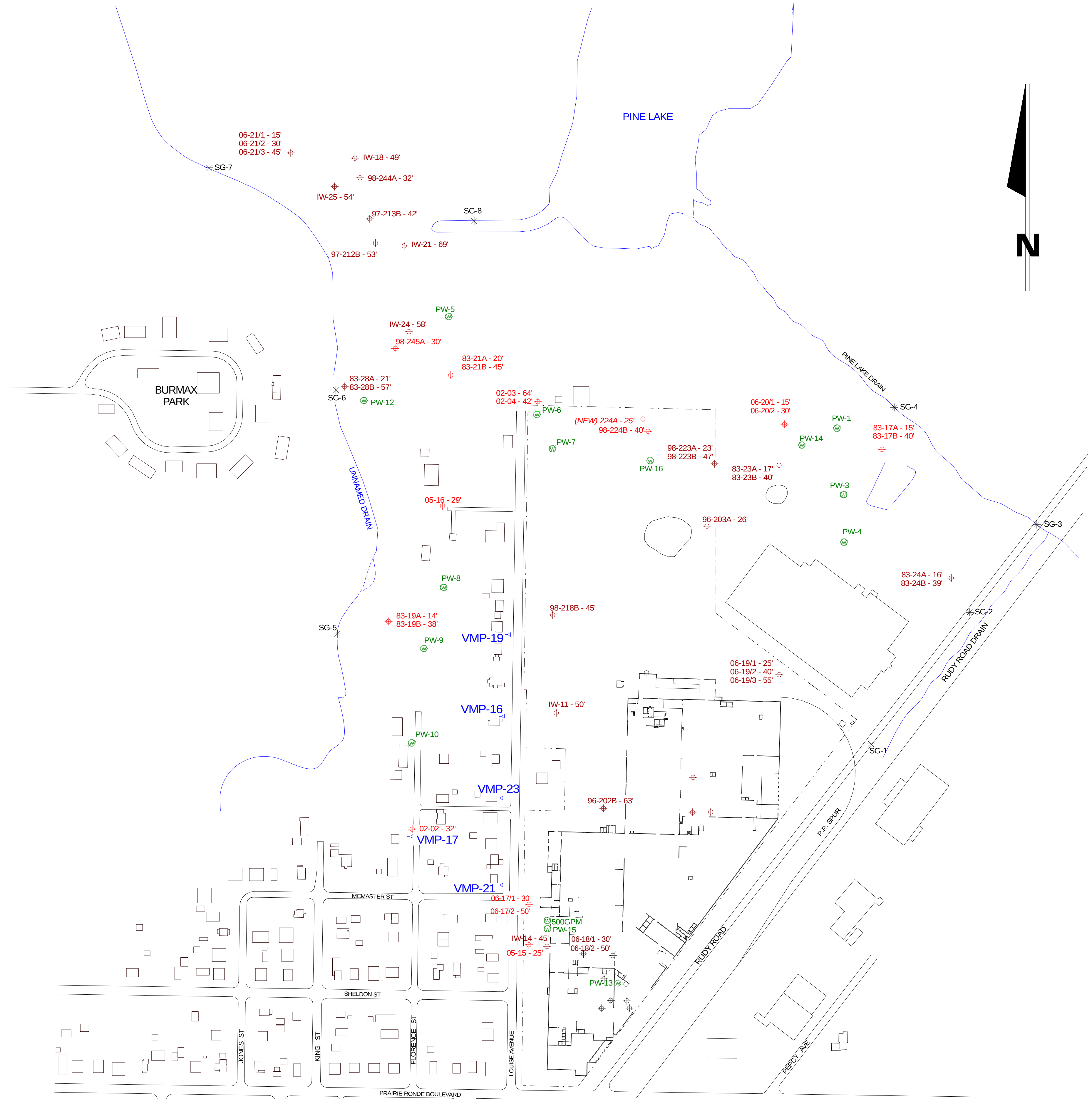
FINAL CORRECTIVE ACTION MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 3:

MONITORED NATURAL ATTENUATION MONITORING WELL LOCATIONS



LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

GROUNDWATER REMEDIATION PURGE WELLS

STAFF GAUGE

MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS

05-16 - 29' GSI COMPLIANCE MONITORING WELL AND SCREEN DEPTH

06-20 - 15' MONITORED NATURAL ATTENUATION MONITORING WELL AND SCREEN DEPTH

VMP-19 SOIL VAPOR MONITORING POINT

GRAPHIC SCALE

0 100 200 400

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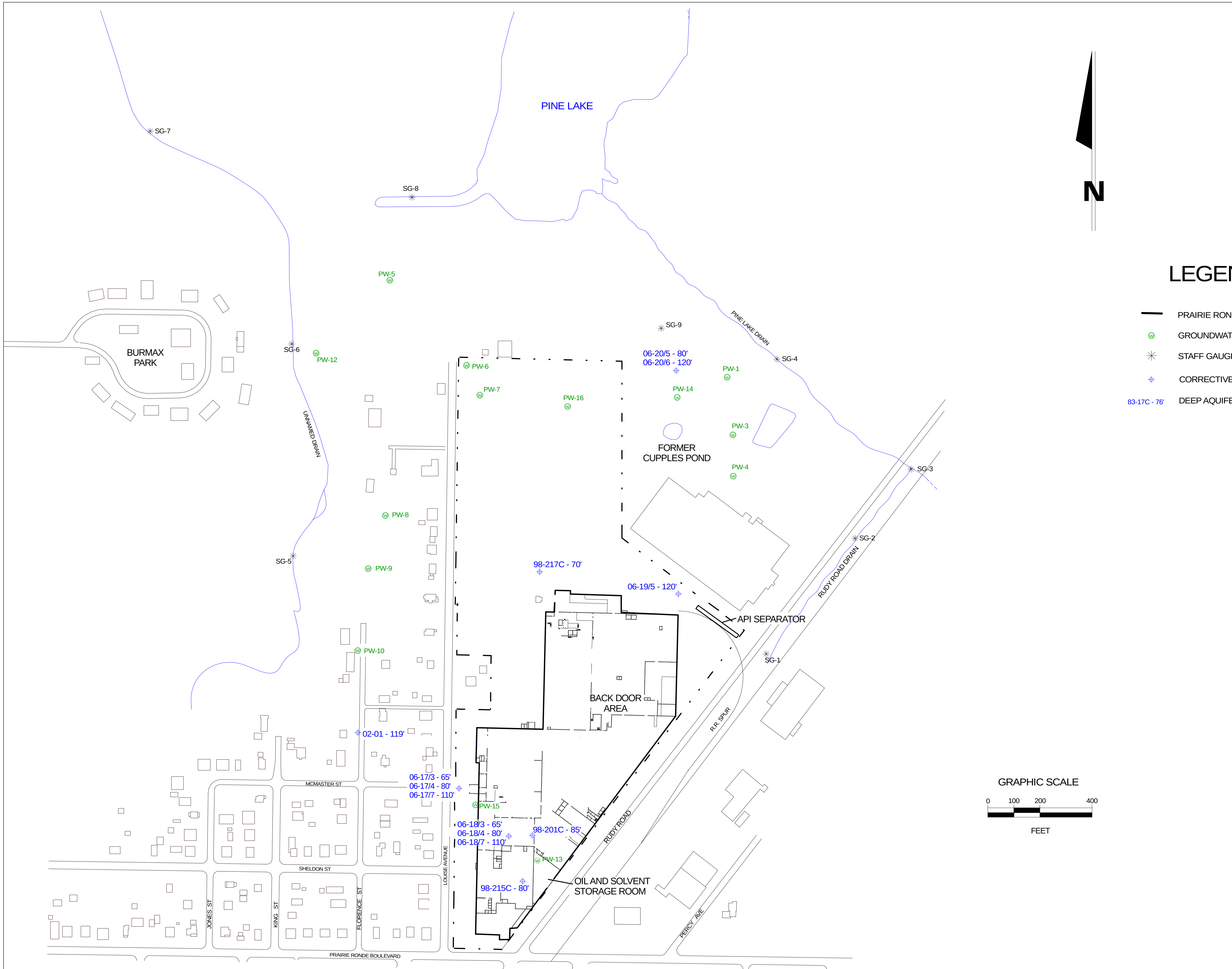
FINAL CORRECTIVE ACTION MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 4:

SOIL VAPOR MONITORING POINT LOCATIONS



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FINAL CORRECTIVE ACTION MONITORING PLAN

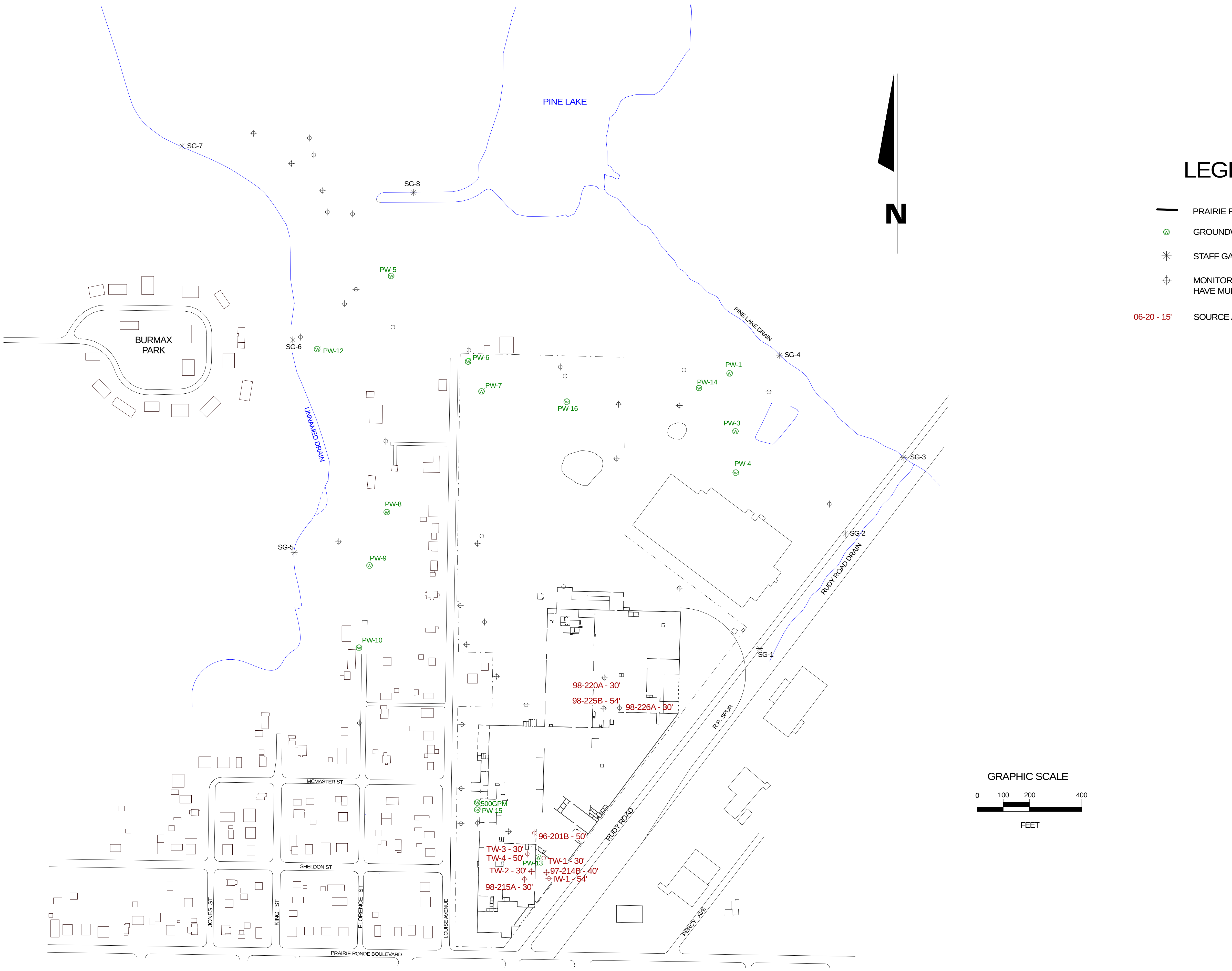
FOR:

PRAIRIE RONDE REALTY COMPANY

415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 5:

DEEP AQUIFER MONITORING WELL LOCATIONS



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FINAL CORRECTIVE ACTION MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 6:

SOURCE AREA MONITORING WELL LOCATIONS

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GROUNDWATER FIELD SAMPLING REPORT

Site Name: **Prairie Ronde Realty**
Location: **Dowagiac, MI**
Sampling Point:
Date:

WELL INFORMATION:

Total well depth (feet):
- Depth to water in well (feet):
= Water column (feet):
Screen length (feet):

Well diameter (inches):	2	4	6
Volume factor (gallons per foot):	0.16	0.65	1.47

Pump intake depth (feet): All depths are from top of well riser.

Purge Method and Materials: Low-flow purging with peristaltic pump

Purge Water Color:

FIELD MEASUREMENTS

Measuring Equipment: Horiba U-10, SN 404014

Time	Elapsed Time	Water Depth, ft	Total Volume Purged, ml	Purge Rate, ml/min	pH	Conductivity, µS/cm	Turbidity, NTU	Dissolved oxygen, mg/l	Temperature °C
			Criteria Range, ±:		0.1	3%	10%	10%	

SAMPLES OBTAINED

CONTAINER TYPE AND VOLUME	NUMBER	PRESERVATIVE	OTHER (FILTERING, ETC.)
40 - Milliliter VOA	2	HCL	

GENERAL

Weather:

Sample Handling/Shipment: To Trimatrix Laboratories in Grand Rapids, Michigan

Comments:

Sampler(s)/Signature:

Appendix F

Revised Purge Well Shutdown Criteria

REVISED PURGE WELL

SHUTDOWN CRITERIA

~

Prairie Ronde Realty Company

Dowagiac, Michigan

Prepared For:

Mr. Tom Fox
National Tube Holding Company
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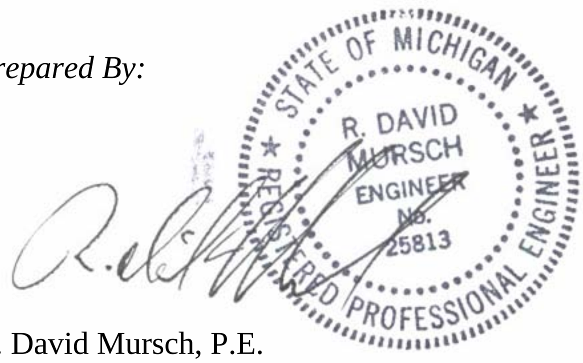
290 North 21st Street
Birmingham, AL 35203

Cc: James N. Tolbert (5)
Charles Denton
Scott Moyer (via Jim Tolbert)
USEPA (via Jim Tolbert)
MDEQ (via Jim Tolbert)

~

Prepared By:



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Connelly Springs, North Carolina 28612

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February 6, 2012

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TABLES

FIGURES

1.0 INTRODUCTION

The Prairie Ronde Realty Company (PRR) property in Dowagiac, Michigan has groundwater impacted by historical releases of solvents composed of volatile organic compounds (VOCs). The groundwater has been remediated since 1984 by a system of groundwater purge wells. Interim measures including air sparging and soil vapor extraction systems were installed in the 1990s; these interim systems were closed in 2008. By these efforts the extent and levels of groundwater contamination have been greatly reduced.

PRR submitted a Corrective Measures Proposal (CMP) in 2009 that included use of monitored natural attenuation (MNA) to complete the remediation of off-site groundwater to drinking water standards. The CMP also included chemical treatment in historical source areas to reduce the remaining source-area levels of VOC impact. The CMP also proposed to continue operating the purge wells on an interim basis to protect surface water until the contamination levels in designated monitoring wells are reduced below the groundwater-surface water interface (GSI) criteria as defined in NREPA Part 201. The CMP proposed that purge wells would be closed as contamination levels dropped below the GSI, but would be maintained in operating condition for two years after being shut down and could be put back into operation if the groundwater contamination levels rebounded to concentrations above the Part 201 GSI criteria during that two-year period.

After some discussions regarding the appropriate level of protection for surface water, the USEPA concurred with the use of the NREPA Part 201 GSI criteria for evaluating the closure of purge wells (letter from USEPA dated November 22, 2011).

Subsequent to submitting the CMP, PRR submitted a separate document outlining the proposed specific criteria for shutting down the purge wells. This document, titled *Purge Well Shutdown Procedures*, was submitted on October 4, 2010. EPA presented comments on the proposed shutdown procedures in a letter dated September 12, 2011. PRR is now submitting this revised document in response to those comments.

2.0 SHUTDOWN CRITERIA

As noted above, the CMP includes the continued operation of designated purge wells to protect surface water bodies from impact by groundwater that contains VOCs at levels above the GSI criteria. The purge wells will be operated until monitoring indicates that the groundwater at designated GSI monitoring locations does not exhibit impacts above the GSI, and will then be shut down as described in this plan.

To evaluate when the groundwater in the vicinity of a purge well no longer contains VOCs above the GSI, PRR proposes that designated GSI monitoring wells should be sampled on a quarterly basis for analysis of VOCs. When the wells at the two GSI monitoring locations closest to a purge well have no VOCs above GSI criteria for four consecutive monitoring events (including the historical semi-annual sampling events), PRR will submit a letter to the USEPA presenting the historical monitoring data for the relevant monitoring points; PRR will then shut down the purge well.

The relevant Part 201 GSI criteria for chemicals that have historically been detected at the site at levels above drinking water standards are as follows (micrograms per liter):

Trichloroethene	200
Cis-1,2-dichloroethene	620
Trans-1,2-dichloroethene	1,500
Vinyl chloride	13
1,1,1-trichloroethane	89
1,1-dichloroethane	740
1,1-dichloroethene	130

3.0 POST-SHUTDOWN MONITORING AND PURGE WELL CLOSURE

Each purge well that is shut down will be maintained in operable condition for a minimum period of two years after it is shut down. During this period, a purge well may be put back into operation if the nearest GSI compliance boundary monitoring well has a sample result that exceeds the GSI criterion for any one constituent for two consecutive quarterly sample events. If a GSI criterion is exceeded at a GSI compliance monitoring well in the last sampling event in this period (i.e. the eighth quarterly sample after shutting down the associated purge well), PRR will re-sample that GSI compliance monitoring well during the following quarter to determine if the associated purge well should be returned to operation. A purge well will be returned to operation if it again exceeds the GSI criterion for the same compound. If a purge well is returned to operation, it will remain in operation until the monitoring data show four consecutive quarterly sampling events with no constituents above GSI criteria.

PRR will continue to sample the designated GSI compliance boundary wells for each purge well for a period of two years after the purge well is shut down. If the VOC concentrations remain below the GSI in these wells for two years (minimum of eight sampling events) that purge well will then be closed and abandoned.

After a purge well is abandoned, the GSI wells associated with that purge well will be used for further MNA monitoring and will be sampled as described in the current corrective action monitoring plan for the site.

4.0 DESIGNATION OF GSI MONITORING WELLS

PRR proposes that specific wells in the vicinity of each purge well should be designated as GSI compliance monitoring wells. The following paragraphs present the rational for designating the GSI compliance wells.

The concept of a GSI compliance boundary that would be used to determine when purge wells could be shut down was initially developed by SECOR International, Inc (SECOR) during a phased site-wide assessment that they performed in 2002 under contract to Sundstrand, and under the on-site supervision of the Michigan Department of Environmental Quality (MDEQ). In the first phase of work (*Phase I Current Conditions Report*), SECOR recommended that a line of GSI compliance monitoring wells should be established and that these wells should be monitored as a compliance boundary between the plant and the surface water bodies. They proposed that this line of wells would be monitored to determine when purge wells could be closed as the groundwater achieved compliance with GSI criteria. In that report SECOR suggested specific existing monitoring wells to be used for the GSI compliance monitoring, and also proposed additional wells to be added to this network.

SECOR subsequently submitted a *Phase II Remedial Investigation Field Sampling Plan* (FSP) dated April, 2002 that (among other things) outlined the locations and construction of the proposed additional GSI compliance monitoring wells. After approval of the FSP by the MDEQ, the additional GSI compliance monitoring wells (designated as 02-01, 02-02, 02-03, 02-04, 02-05 and 02-06) were installed. SECOR's proposed final GSI compliance line monitoring well network was described in SECOR's *Phase II Remedial Investigation Report* (PIIRI) dated December 2002.

The wells that were designated as GSI compliance monitoring wells in the PIIRI were:

- 83-25A, B
- 02-01, 02-02
- 83-19A, B, C
- 02-05, 02-06
- 83-21A, B
- 02-03, 02-04
- 83-18A, B, C
- 83-23A, B
- 83-17A, B, C

Since completion of the PIIRI, wells 02-05 and 02-06 were abandoned at the request of a property owner and PRR has installed additional monitoring wells near the GSI compliance boundary line. Some of these new wells are better situated as GSI monitoring locations than the originally-designated GSI compliance wells and/or are screened at more appropriate depth intervals, as described below. In addition these newer wells are constructed using updated materials and technology and are preferred, where possible, for GSI monitoring over the galvanized-steel wells that were installed in 1983.

Considering this history and current site conditions, PRR proposes the following changes to the GSI monitoring well network that was outlined in the PIIRI:

- Add well 05-16 as a GSI compliance monitoring well.
- Omit well 02-01 because it is too deep (129 feet) to be relevant for GSI monitoring.
- Omit well 83-19C because it is too deep (60 feet) to be relevant for GSI monitoring.
- Add well 98-245A as a substitute for the abandoned wells 02-05 and 02-06.
- Substitute wells 05-15, 06-17/1 and 06-17/2 for wells 83-25A and B.
- Substitute well 98-224B and a new well, *(New)*-224A, for wells 83-18A, B and C.
- Omit well 83-17C, because it is too deep (79 feet) to be relevant for GSI monitoring.
- Substitute monitoring points 06-20/1 and /2 for wells 83-23A and B.
- Add wells 83-28A and B as GSI monitoring points, per request of EPA.

The proposed new well *(New)*-224A will be a 2-inch PVC well screened in the shallow part of the upper aquifer adjacent to existing well 98-224B.

The attached Table 1 lists the wells that PRR is proposing to designate for GSI compliance monitoring and the most recent monitoring data for each well. Table 2 lists the site's purge wells and shows the GSI compliance monitoring wells that are closest to each purge well. Figure 1 shows the PRR site and the GSI monitoring well locations.

Table 1 - Proposed GSI Compliance Monitoring Wells and Most Recent Sampling Data

MONITORING POINT	DEPTH, FEET	TRICHLOROETHENE	CIS 1,2-DICHLOROETHENE	TRANS-1,2-DICHLOROETHENE	VINYL CHLORIDE	1,1,1-TRICHLOROETHANE	1,1 DICHLOROETHANE
GSI CRITERIA:		200	620	1,500	15	200	740
05-15	25	1.8	<1	<1	<1	<1	<1
06-17/1	30	110	<1	<1	<1	2.2	<1
06-17/2	50	57	2.0	<1	<1	<1	<1
02-02	32	110	1.2	<1	<1	4.0	<1
83-19A	15	2.4	1.6	<1	<1	<1	<1
83-19B	41	57	5.9	<1	1.2	<1	<1
05-16	25	<1	<1	<1	<1	<1	<1
83-28A	20	<1	13	<1	<1	<1	<1
83-28B	55	6	15	<1	2.3	<1	<1
98-245A	33	**260**	38	4.3	<2.5	<2.5	<2.5
83-21A	20	<1	<1	<1	<1	<1	<1
83-21B	45	78	8.8	1.1	<1	<1	<1
02-03	64	2.3	<1	<1	<1	<1	<1
02-04	32	130	12	2.9	<1	<1	<1
(New) -224A	--	--	--	--	--	--	--
98-224B	42	92	9.4	<1	<1	<1	<1
06-20/1	15	<1	<1	<1	<1	<1	<1
06-20/2	30	35	17	<1	<1	1.5	2.6
83-17A	17	<1	<1	<1	<1	<1	<1
83-17B	42	45	44	2.8	<1	<1	<1

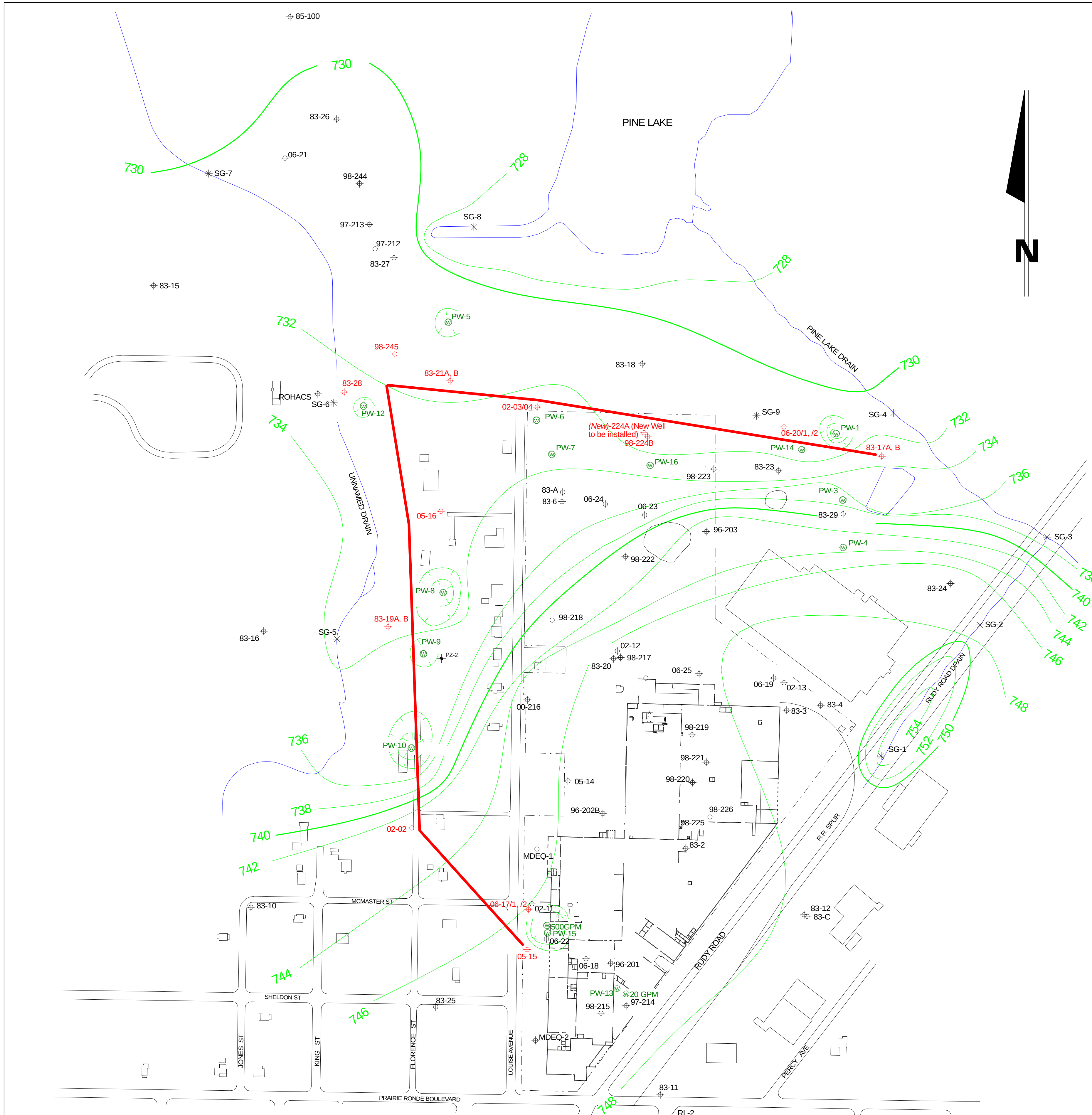
Notes:

GSI = Groundwater/Surface water Interface criterion as listed in Part 201 of Michigan Act 451
All units are micrograms per liter
< = Less than
Bold = Exceeds GSI criterion
-- = Proposed Well

Table 2: Purge Wells and Associated GSI Compliance Monitoring Wells

PURGE WELL	ASSOCIATED GSI MONITORING WELLS
PW-1	83-17A, B; 06-20/1, 06-20/2
PW-3*	--
PW-4*	--
PW-5	83-21A, B; 98-245A
PW-6*	--
PW-7*	--
PW-8	83-19A, B; 05-16
PW-9	83-19A, B; 02-02
PW-10	02-02; 06-17/1, 06-17/2
PW-12	05-16; 83-28A and B
PW-13**	Not relevant for GSI protection
PW-14	06-20/1, /2; 83-17A, B
PW-15	05-15; 06-17/1, /2
PW-16	*(New)*- 224A; 98-224B; 02-03, 02-04
20GPM**	Not relevant for GSI protection
500GPM**	Not relevant for GSI protection

* These wells have been replaced and are not presently operating.
** These purge wells are not relevant to GSI protection of surface water



LEGEND:

- PRAIRIE RONDE REALTY PROPERTY LINE
- PURGE WELLS (PW-NO.)
- STAFF GAUGE (SG-NO.)
- MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS (NO.)
- GSI COMPLIANCE MONITORING POINT (SOME POINTS HAVE MULTIPLE DEPTHS)
- GSI COMPLIANCE BOUNDARY LINE (FROM MDNRE/SECOR PHASE II REMEDIAL INVESTIGATION REPORT, DECEMBER 2002)
- 746 POTENTIOMETRIC SURFACE CONTOUR, FEET MSL, SEPTEMBER 2011

GRAPHIC SCALE

0 100 200 400

FEET

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REVISED PURGE WELL SHUTDOWN CRITERIA

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

GSI MONITORING POINTS

Appendix G

Toilet Flush and Wash Water Use Model

Appendix G

Toilet Flush and Washwater Use
Model

Variable Description	Value	Units	Comment
Volume of Toilet tanks (Vt)	0.123	m3	Assume high volume flush at 3.5 gallons/flush
Toilet tank water exchange rate	30	Day-1	Average US holdhold uses approximately 400 gallons of water per day, 26.7% for toilet flushes (30 flushes assuming a 3.5 gallon toilet tank) and 21.7% for washing. (U.S. EPA Office of Wastewater Management, http://www.epa.gov/WaterSense/pubs/indoor.html).
Flow rate Toilet tanks (Ftank)	193.6	gallons/day	Based on 3.5 gallons being flushed approximately 30 times per day (106.8 gallons per day) plus 86.8 gallons/day for washwater (400 gallons/day total household use x 21.7% = 86.8 gallons/day) = 193.6 gallons/day
Total groundwater volume used per day (Vgw)	0.73568	m3/day	0.0038 m3/gallon x 193.6 gallons/day
Building structure volume	18	m3	Estimated volume of bathroom/laundry room with eight foot finished ceiling (8 ft x 10 f tx 8 ft).
Bathroom Air Exchange Rate (AER)	6	Day-1	USEPA 2004. Johnson and Ettinger Model, Default residential AER equals 0.25 hr-1
Total air volume used per day (Vair)	108	m3	18m3 x 6 Day-1 = 108 m3

	Henry's Law Constant (H) [1]	Residential Regional Screening Level [4]	Concentration in groundwater (Cgw) [3]	Concentration of "toilet flush/wash water derived" COPC in bathroom[2] (C g-air) = (C gw * H * Vgw)/(H * Vair + Vgw)
	(unitless)	(ug/m3)	(ug/L)	(ug/m3)
Trichloroethene	0.206	2.20E-01	1	8.57E-04
1,1,1-Trichloroethane	0.7	2.20E+03	1	6.59E-06
cis-1,2-Dichloroethene	0.17	3.50E+01	1	2.44E-04
trans-1,2-Dichloroethene	0.38	7.00E+01	1	6.59E-06
Vinyl chloride	1.1	2.80E+00	1	6.59E-06

(1) EPA 2004. Johnson and Ettinger Model

(2) Sanders, P.F (2002) A screening model for predicting concentrations of volatile organic chemicals in shower stall air. Division of Science, Research and Technology., New Jersey Department of Environmental Protection., Trenton, NJ

(3) Concentrations in MW 05-16 in September 2011. All concentrations <1 ug/l; 1 ug/L used as model input.

(4) EPA 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils.

Appendix H

Summary Review of Metals Issues

SUMMARY REVIEW OF

METALS ISSUES

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Prairie Ronde Realty Company

Dowagiac, Michigan

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February 22, 2012

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1.0 INTRODUCTION

The Prairie Ronde Realty Company (PRR) property in Dowagiac, Michigan (Figure 1) has groundwater impacted by historical releases of solvents composed of volatile organic compounds (VOCs). The groundwater has been remediated since 1984 by a system of groundwater purge wells. Interim measures including air sparging and soil vapor extraction systems were installed in the 1990s; these interim systems were closed in 2008. By these efforts the extent and levels of groundwater contamination have been greatly reduced.

PRR submitted a Corrective Measures Proposal (CMP) in 2009 that included use of monitored natural attenuation (MNA) to complete the remediation of off-site groundwater to drinking water standards supplemented with chemical treatment in historical source areas to reduce the remaining source-area levels of VOC impact. The CMP also proposed to continue operating the purge wells on an interim basis to protect surface water until the contamination levels in designated monitoring wells are reduced below the groundwater-surface water interface (GSI) criteria as defined in Michigan Natural Resource and Environment Protection Act (NREPA) Part 201.

In comments to the CMP, EPA requested that PRR prepare, as an attachment to the CMP, a separate summary of metals evaluations that have been performed at the plant including a review of historical assessments, delineation of areas where metals have been detected above relevant criteria, and a discussion of metals pathways and potential impacts.

PRR has prepared this document in response to the EPA’s request.

2.0 BACKGROUND OF SITE HISTORY AND METALS SOURCE AREAS

The operational and environmental history of the property currently owned by PRR was investigated in 1990 (*Environmental Assessment – Phase I and II*, by Delta Environmental Consultants, Inc. dated December 6, 1990 – the DELTA ESA) and in 1995 by Benchmark Engineering Inc. (*Baseline Environmental Assessment* dated October, 1995 – the BEA).

These reports document that the property was originally developed for industrial operations around 1916, when it was occupied by the Rudy Furnace Company. The Rudy Furnace Company produced furnaces and operations generally included casting and machining. Shortly after World War II the plant began converting to manufacturing of heat exchangers and air conditioning. Beginning in the early 1950s, the plant began to form and shape copper tubing in support of the heat exchanger production and also installed chromium and zinc plating lines. By 1966, the plant had a fully integrated copper mill, making tubing from refined raw copper. The plant continued manufacturing condensers and evaporator equipment until 1973. In 1973, the PRR property was purchased by Sundstrand Corporation (Sundstrand) and renamed Sundstrand Heat Transfer (SHT); by 1983 the plant was producing aluminum fin and copper heat transfer surfaces, as well as copper tubing. Modine Heat Transfer, Inc. (Modine), a subsidiary of Modine Manufacturing Company, became the operator and lessee of the plant in 1990 and the operations were shifted to production of copper tubing only. SHT maintained ownership of the property until October 1995, when PRR purchased the property and leased the plant to National Copper Products, Inc., which continued the plant as a copper tube mill until it went out of business in 2008.

The primary historical manufacturing operations at the plant have included machining, metal casting, soldering, degreasing, and plating. The site-wide environmental assessments referenced above identified a number of locations where historical operations may have created a potential for metals impact to the subsurface as follows (Figure 1):

- Chrome plating line
- Zinc plating line
- Oil and solvent storage room (OSSR)
- Main pit degreasers
- Cooling water retention lagoons/API Separator
- Old borrow pit / furnace brick disposal area (OBP)

The plating lines generally operated from the early 1950s to the early 1970s. The plating was performed in tanks supported above the concrete slab, and wastes were discharged to the city sewer. These locations were considered as potential sources of copper, chromium, zinc, and/or cyanide releases to the subsurface.

The OSSR is actually not considered a likely metals source area; however it was a major source of solvent releases at the plant and some metals analyses were performed in conjunction with various assessments of solvent releases.

The pit degreasers were considered a potential source of metals releases because solvent was found in the soil beneath the degreasers and it was considered that there could be metals, particularly copper, associated with the waste solvent.

The cooling water retention lagoons and the API separator received non-contact cooling water from the plant, along with storm-water discharges from various areas of the plant. The lagoons were considered a possible source of metals impact due to possible “back-door” dumping of spent solvents or other wastes that could contain metals.

The OBP was a large pit that had been used as a source of borrow soil that was used to fill in the cooling water ponds during a plant expansion after SHT purchased the property in the late 1960s. After the construction was complete, the pit was used for several years for disposal of barrels of degreaser sludge and soil removed from periodic cleanout of the API separator. These waste materials and the underlying impacted soil were generally removed during the plant remediation in 1984. However the 1984 remediation was focused on solvents, and it was considered that there could be residual metals remaining in the pit and surrounding area.

An area adjacent to and partly within the OBP was used for several years for disposal of used refractory brick from the plant’s copper melting furnace. This area is designated as the Furnace Brick Remediation Area. The used brick was removed for off-site disposal in 1997.

3.0 REVELANT CRITERIA

The metals data described in this document are compared to criteria in Part 201 – Environmental Remediation of Public Act 451 of 1994 as amended (Part 201) for soil and groundwater. These criteria were developed specifically for Michigan soil, groundwater and surface water and they are the default criteria for assessment and remediation activities at facilities throughout Michigan.

3.1 Part 201 Criteria for Soil

Part 201 lists criteria for nonresidential soil in Table 3 of Attachment 1. This table lists twelve types of criteria, including the default background levels. Five of these are not applicable to metals because metals are solid and not likely to volatize. The residential and non-residential drinking water protection criteria are the same for all of the metals considered in this report with the exception of silver; however the property has a deed restriction in place that limits the property to industrial uses and therefore the non-residential criteria apply. The Part 201 GSI protection criteria are not applicable for soil at the property because the source areas are at least 800 feet from a surface water emergence point and the criteria are based on soil at the point of emergence. Also, the site's groundwater has a pH in the range of 7 to 9; within this range metals are not mobile in groundwater and their concentrations tend to attenuate rapidly.

The relevant Part 201 soil criteria for metals are:

- Non-residential drinking water protection
- Groundwater contact protection
- Particulate soil inhalation
- Direct contact

Table 1 shows the relevant Part 201 soil criteria.

3.2 Part 201 Criteria for Groundwater

The Part 201 criteria for groundwater are listed in Table 1 in Attachment 1 to Part 201. The table lists nine types of criteria. Two of these (residential and non-residential volatization to indoor air) are not applicable because metals are not likely to volatize. In addition, the water solubility criteria are not applicable to metals; and the Flammability and Explosivity criteria and the Acute Inhalation Criteria are listed as "insufficient data" for all metals.

For the groundwater on the property, the Part 201 GSI criteria are not applicable due to distance from surface water. Therefore the groundwater data were compared to the Part 201 drinking water criteria, although as noted above the groundwater is not used as a drinking water source. The relevant Part 201 drinking water criteria for metals are shown on Table 1.

3.3 Part 201 Criteria for Surface Water

For surface water, The Part 201 GSI criteria were used. The criteria were calculated using procedures contained in Part 31, Rule 57 and corrected for hardness.

3.4 Part 201 Criteria for Sediment

The data identified for this review includes analyses of sediments from drains and Pine Lake. For purposes of this review, the sediment data was compared to the Part 201 GSI protection criteria for soil as the most nearly appropriate criteria.

4.0 ASSESSMENT OF SOIL ON SITE

Areas on the PRR property that could potentially have been a source for past releases of metals have been assessed and a large amount of soil analytical data has been collected. A detailed summary of these assessments, along with figures and tables showing the sampling locations and data obtained, was presented in the *Summary of Historical Metals Data* dated December 31, 2005 (Historical Metals Summary). This section presents an abbreviated summary of the past assessment. Sample locations are shown on Figure 2.

As previously noted, there have been several assessments aimed at determining if there was a release of metals to the environment at the PRR property as summarized below:

1. During the initial site investigations related to the solvent releases in 1983, one composite sample from the OSSR was analyzed for metals in order to characterize the soil for off-site disposal. No Part 201 criteria were exceeded.
2. In the 1990 DELTA ESA, the plant's history and operations were reviewed and potential sources of metals release were identified in a Phase I study; subsequently, three soil samples from the OBP were analyzed for total metals and no metals were reported above the Part 201 criteria.
3. In the 1995 BEA a site-wide investigation was performed in accordance with the requirements of Michigan Act 451 for a baseline environmental assessment. The data included analysis of thirty-six soil samples obtained from identified potential metals release locations on the PRR property for chromium, copper and lead. Some soil samples had concentrations above the Part 201 default background but none of the samples exceeded the Part 201 criteria.
4. In 1997, PRR removed the old furnace brick from the former disposal area near the OBP in accordance with a work plan approved by the MDEQ. The work was summarized in the *Report of Furnace Brick Removal*, by R. David Mursch, P.E., dated August 31, 1997. This remediation included analysis of twenty-three soil samples on a grid pattern established as outlined in the MDEQ's *Verification of Soil Remediation* guidance document (VSR). The samples had copper ranging from 5,500 to 19,000,000 µg/kg.

   Four of the twenty-three samples had copper concentrations exceeding the Part 201 criterion for protection of drinking water. However, the remediation goal established by the MDEQ for this remediation in 1997 was the Part 201 generic direct contact criterion, which is currently 73,000,000 µg/kg. Based on the MDEQ remediation goal, the VSR sampling confirmed that remediation of the furnace brick area was successful and the remediated area was covered with topsoil and seeded as directed by the MDEQ.

   In an email dated October 10, 2010, EPA questioned whether copper and/or other metals could have migrated from the furnace brick disposal/OBP area into Pine Lake via surface runoff or erosion. PRR responded with a detailed discussion in the *Response to EPA Comments on Metals Issues* dated November 17, 2010. In summary; the furnace brick and old borrow pit areas are at the edge of or within a large closed depression (Figure 2) that was formed by excavation of soil for plant construction in the 1940s (this older borrow pit is separate from the "Old Borrow Pit", which was used during a later plant expansion). Because of this closed depression, there is no pathway from the furnace brick or OBP area for surface flow to any stream, fen or surface water body. Rainwater falling on or near the former furnace brick disposal area or the OBP is captured within this depression and subsequently drains internally through the sand soil.

5. In 2000 the MDEQ obtained a soil samples from one geoprobe located on the PRR property, in the vicinity of the old cooling water retention lagoons. A soil sample from this probe was analyzed for total metals and no Part 201 criteria were exceeded.

6. In 2002 PRR performed studies for a planned plant expansion that included analysis of thirteen soil samples for total metals. The data were submitted in the *Report of Subsurface Exploration – Phase I Plant Modernization*, by R. David Mursch, P. E. dated October 30, 2002. One sample contained arsenic at a concentration above the Part 201 protection of drinking water criterion, and another one sample contained silver at a concentration above the residential protection of drinking water criterion but below the non-residential drinking water protection criterion. The plant operational history did not include use of arsenic or silver and these detections are considered anomalous. Both samples were in the upper 3 feet of soil and are beneath the building's concrete slab.

7. Also in 2002, SECOR International, Inc. performed a site-wide assessment under the direction of the MDEQ. SECOR's *Phase II Remedial Investigation Report*, dated December 2002, included analysis of six soil samples on the PRR property for total metals. Three of the six samples were obtained from inside the plant building and three samples were obtained from the general area of former cooling water retention lagoons. None of the samples had metals above the Part 201 criteria.

8. During 2004 the MDEQ obtained soil and groundwater samples from DPT borings on the PRR property. The data were reported in the *Integrated Geophysical Investigation Summary Report*, by Weston Solutions of Michigan, Inc. dated August 2004. The data included analysis of eleven soil samples for total metals and none of these samples exceeded the Part 201 criteria.

In summary, past investigations have included a review of the plant's history and operations to identify locations where metals might have been released and these areas have been assessed for indications of releases. Seventy soil samples have been analyzed for total metals; twenty-one samples were analyzed for metals in TCLP extract; and twenty-three samples were analyzed for copper at the former furnace brick disposal area. Of these samples, fifteen had detections of one or more metal above the Part 201 default background.

One sample from the upper 3 feet of soil beneath the plant's building slab had an apparently anomalous detection of arsenic above the Part 201 non-residential protection of drinking water criterion. No other soil samples have exceeded relevant Part 201 criteria. (Note; four soil samples from the former furnace brick disposal area had copper concentrations above the Part 201 criterion for protection of drinking water, however the MDEQ determined at the time of the remediation of this area that the relevant criterion was direct contact and no samples exceeded this criterion).

5.0 ASSESSMENT OF GROUNDWATER

The PRR property and adjacent areas have been assessed several times for possible metals impact to groundwater and a large amount of data has been collected. A detailed summary of these assessments, along with figures and tables showing the sampling locations and data obtained, was presented in the Historical Metals Summary report. This section presents an abbreviated summary of the past assessment. Sample locations are shown on Figure 3.

1. During the 1983 site investigations, the MDEQ sampled seven residential wells down-gradient of the plant and analyzed total metals from these wells. No metals were reported in these samples. Also during these assessments, a groundwater sample was obtained from one well near the center of the plant for total metals analysis. This sample contained cadmium, lead, nickel and zinc at levels above the Part 201 drinking water criteria; however this well has a galvanized steel screen so the data are not reliable.

2. In the 1995 BEA, groundwater was analyzed for total chromium, copper and lead at seventeen geoprobe boring locations and fourteen existing monitoring wells. None of these samples had copper above the Part 201 drinking water criterion. Two geoprobe samples had relatively elevated levels of chromium; these locations were re-sampled and the re-samples did not contain chromium. All but seven of the samples had lead at concentrations above the Part 201 drinking water criterion; however the two highest lead detections, 120 µg/l and 148 µg/l, were obtained at monitoring wells upgradient of the PRR property. It was concluded that the lead concentrations were not due to an on-site release but could be due to high natural lead or sampling/analytical error. In summary, the BEA groundwater data did not identify a release of metals to the groundwater.

3. In 2001, at the request of the MDEQ, samples from eight monitoring wells and two purge wells were analyzed for total and dissolved metals. The data were reported in the *Fall Quarter 2001 Monitoring Report*, by R. David Mursch, P.E. dated October 2001. The sampled locations were within or down-gradient of previously – identified potential source areas for metals on the PRR property. The data obtained are consistent with the data obtained in the 1995 BEA investigation previously described, and none of the detections exceeded Part 201 drinking water criteria.

4. In 2005 four monitoring wells were sampled at the request of the USEPA to obtain supplemental data on metals in groundwater. The data were reported in the *Third Quarter 2005 Monitoring Report* by R. David Mursch P.E., dated October 14, 2005. Three of the wells are constructed with PVC screens and risers and these wells had no metals above Part 201 drinking water criteria. One well (83-8) had a galvanized screen and riser, and this well had detections above Part 201 criteria for cadmium, lead and zinc. This well was subsequently re-sampled and no metals were detected above Part 201 criteria.

5. Also in 2005, PRR submitted the Historical Metals Summary report previously cited. In response to EPA comments and discussions of the historical data presented in that document, PRR installed additional monitoring wells and obtained additional data on

metals in groundwater in order to formally complete an evaluation of whether there was a metals impact to groundwater on the property. The USEPA reviewed the work plan for this assessment and specified the locations for the new wells. The data was reported in the *Third Quarter 2006 Monitoring Report* dated December 31, 2006. The work included sampling eleven on-site wells and one up-gradient MDEQ well for analysis of total metals. None of the samples on PRR property had detections above Part 201 criteria. The up-gradient MDEQ well (RL-2) contained lead and zinc above Part 201 criteria.

The data were also compared to naturally-occurring levels in the groundwater as reported in the USGS publications *Hydrology and Land Use in Van Buren County, Michigan*, Water Investigation Report 84-4112, 1984; and *Natural Ground Waters in Michigan: 1974-1987*, Open File Report 89-259, 1989. All of the on-site groundwater samples were near or below the naturally-occurring levels defined in these studies.

In summary, the groundwater at the PRR property has been extensively assessed for metals impact, and the data demonstrate that there has not been a release of metals to groundwater at the property.

6.0 ASSESSMENT OF SURFACE WATER AND SEDIMENT OFF SITE

Although the available data do not indicate that there is metals impact in soil or groundwater at the PRR property above relevant risk-based Part 201 criteria, MDEQ and EPA have expressed a concern that surrounding surface water and/or sediment in creeks and drains could have been affected by runoff or discharge from the PRR property. Specific surface water/sediment receptors are:

- Un-named drain west of the PRR property
- Rudy Road/Pine Lake drain
- Pine Lake
- Pine Lake seeps northwest of the PRR property
- Seeps along a tributary to Pine Lake northeast of the PRR property

The surface water and sediments in these areas have been assessed in two related studies. The MDEQ performed a screening assessment in 2000, and SECOR International subsequently performed a more extensive assessment under the MDEQ's direction in 2001 and 2002. The MDEQ data was provided to PRR in the form of data tables with a location map; the SECOR assessment was documents in their *Phase I Current Conditions Report* dated March 2002. The data is provided in detail within the Historical Metals Summary report submitted by PRR in 2005. The sample locations are shown on Figure 4.

The data collected in the five areas of interest listed above are summarized and evaluated in the following sections.

6.1 Un-Named Drain West of the PRR Property

The un-named drain is a natural creek running north-south west of the residential area that is west of the PRR property (Figure 2). This drain is groundwater-fed, and also receives stormwater runoff from the City of Dowagiac.

1. **MDEQ Sampling:** Surface water was sampled at two locations along the un-named drain (UD-2 and UD-3); neither sample had detections above Part 201 GSI criteria.

   Surface water at two seeps along the un-named drain, UT-1 and UT-2, was analyzed for total metals and both locations were sampled twice. In the initial sampling event UT-2 had detections of chromium and copper above Part 201 GSI criteria; the re-sample showed no detections above criteria in either seep.

2. **SECOR Sampling:** Ten surface water samples from the un-named drain were analyzed for total metals, and none had detections above the Part 201 GSI criteria.

   In addition, SECOR re-sampled surface water at the MDEQ seep locations UT-1 and UT-2 (SECOR locations SP-1 and SP-2) and no metals were detected in either of these locations above criteria.

A third seep along the un-named drain, at SP-4, had reported detections of copper, lead and mercury in surface water slightly above Part 201 GSI criteria; this location is near the head of the un-named drain and is not down-gradient of the PRR property topographically or hydrologically. Therefore these detections originate from other sources (e.g. stormwater flow from the City of Dowagiac, a turbid sample, or laboratory error etc.) not related to the PRR property.

SECOR also analyzed three sediment samples from the un-named drain at DR-1, DR-2 and DR-3. Locations DR-2 and DR-3 had selenium in sediment above the Part 201 GSI protection criterion; selenium was also detected at a similar level in a SECOR sediment sample at DR-19, which is located on the north side of the Pine Lake finger northwest of PRR. There is no migration pathway from the PRR property to location DR-19 so this detection must be un-related to the PRR property. Because of this, and because there is no history of known use of selenium at the PRR property, the selenium detections in the un-named drain are not attributable to PRR.

In summary, the extensive available data do not show a metals impact to surface water or sediments in the un-named drain that are attributable to the PRR property.

6.2 Rudy Road and Pine Lake Drains

The City of Dowagiac also discharges stormwater into a man-made ditch along Rudy Road known as the Rudy Road Drain; this drain connects to another man-made drain know as the Pine Lake drain which discharges into Pine Lake. A number of industries, including the former operations at the PRR property, have NPDES-permitted discharges into this drain. The drains have been sampled as follows:

1. **MDEQ Sampling:** Surface water at two locations in the Rudy Road drain (RR-1 and RR-2) were sampled for total metals analysis. Both samples had detections of copper slightly above the Part 201 GSI criterion; RR-2 also had lead reported above the criterion. RR-1 was re-sampled and no metals were detected in the re-sample above criteria. (Note: RR-2 is not shown on drawings furnished to PRR by the MDEQ, and therefore the location of this sample point is not known).

2. **SECOR Sampling:** Eight surface water samples from the Rudy Road/Pine Lake drain were analyzed for total metals; no detections above Part 201 GSI criteria were reported.

   SECOR also analyzed eight sediment samples from the Pine Lake drain for total metals. One sample (DR-11) had a detection of zinc above the Part 201 GSI protection criterion. The zinc detection was in the most up-gradient sample location and appears anomalous compared to other sediment data from this drain. As described above, the NPDES discharge from the PRR property is treated groundwater, some of which was formerly used for non-contact cooling water, with no added chemicals or contact with products or chemicals in the plant.

In summary the data do not show an impact of metals in the Rudy Road and Pine Lake drains that are attributable to the PRR property. Isolated detections of metals in surface water samples above criteria were not repeated in re-samples; the sediment samples showed one anomalous detection of zinc that does not appear to be related to the PRR property.

6.3 Pine Lake

Pine Lake is a natural privately-owned shallow pond located north of the PRR property. The lake is surrounded by private property and has no public access. It has been receiving stormwater and industrial discharges from the City of Dowagiac since the mid 1800s. The lake has been sampled as follows:

1. **MDEQ Sampling:** Twenty-two surface water samples were obtained from Pine Lake for analysis of total metals. Two of these samples contained copper at levels slightly above the Part 201 GSI criterion with copper concentrations of 54 and 31 µg/l compared to the criterion of 21 µg/l. Both samples were obtained from just above the bottom of the lake and could have been influenced by disturbed sediment. These locations were re-sampled by SECOR as discussed below and no copper was detected above the Part 201 GSI criteria.

2. **SECOR Sampling:** SECOR analyzed twenty-four surface water samples from Pine Lake for total metals, re-sampling the MDEQ locations described above. Four of the samples had apparent mercury detections above the Part 201 GSI criterion; no other metals were detected above criteria. The mercury detections were at the laboratory method detection limit (0.2 µg/l) and the samples were obtained using a device that is not recommended for mercury analyses, as discussed in the *Screening Level Risk Assessment*, dated by AECOM.

   SECOR also analyzed twelve sediment samples from the bottom of Pine Lake for total metals. Five of these samples (PN-3, PM-3, PM-4, PS-3 and PS-4) had copper concentrations slightly above the Part 201 GSI protection criterion.

In summary; forty-six surface water samples from Pine Lake have been analyzed for total metals. Two samples obtained from just above the bottom sediments by MDEQ contained low levels of copper (54 and 31 µg/l compared to the Rule 57 criterion of 21 µg/l); re-samples at these locations by SECOR showed copper levels below laboratory method detection limits. Four SECOR samples, which were obtained using a device that is not recommended for mercury analysis, had detections of mercury at the laboratory method detection limit. The mercury detections are anomalous and clearly not attributable to the PRR property, where no historical or current operations have included use of mercury.

Twelve sediment samples from the bottom of Pine Lake were analyzed for total metals by SECOR and five of these samples had copper concentrations above the Part 201 GSI protection criterion. The only apparent pathway by which copper discharges from the PRR property might enter Pine Lake would be via the Pine Lake Drain; the groundwater on the PRR property has been shown to have no metals impact and there is no surface runoff/erosion pathway from the PRR property to Pine Lake. PRR does have an NPDES-permitted discharge for water that flows through an API Separator into the Rudy Road drain; this flow enters the Pine Lake drain and then Pine Lake. However this discharge consists of groundwater that has been recovered from the remediation purge well system. The water is aerated to remove VOCs before discharge but receives no other treatment or additive. Some of the pumped water was used for non-contact cooling water in the plant prior to 2009, but this water, which was a small part of the total water flow, did not contact any plant materials or chemicals and did not receive any additional treatment other than aeration. Therefore the discharge at the NPDES outfall could not have significant amounts of copper or other metals from plant operations. This is reflected in the fact that Michigan does not require metals analysis as part of the NPDES permit requirements.

As reported in the *Summary of Historical Metals Data* report (Table 1), the NPDES outfall was sampled by the Michigan Department of Natural Resources in 1977, 1979 and 1982 and these samples were analyzed for several metals. The metals were generally below Michigan Part 201 GSI criteria. In addition, the NPDES outfall was sampled for metals analysis by Delta Environmental as part of a site assessment reported in the *Environmental Assessment-Phase II* report dated December 6, 1990; these data are summarized in Table 4 of the *Summary of Historical Metals Data* report and do not show any detections above Part 201 GSI criteria. The MDEQ sampled the Rudy Road drain at the NPDES outfall in 2000 and their results show copper levels generally below or very slightly above the Part 201 GSI criteria; these data are shown in Table 9 of the *Summary of Historical Metals Data* report. And finally, the outfall was sampled in December of 2002 for analysis of total metals for the purpose of estimating emission for SARA reporting, and these data show no metals detections above Part 201 GSI criteria. Therefore there exists a historical body of analytical data that does not show significant levels of metals in the plant's NPDES discharge.

The Rudy Road and Pine Lake drains are man-made storm-water ditches that convey stormwater runoff from the City of Dowagiac to Pine Lake. The lake has been the receptor of stormwater runoff from industrial and commercial areas of the city for over many decades.

The five sediment samples in Pine Lake that had higher copper concentrations are on the west and north sides of the lake. The Pine Lake drain discharges into Pine Lake at the southeastern corner. If the source of copper in the Pine Lake sediments is from discharges from Pine Lake drain, there should be correspondingly high copper levels in the sediment in the Pine Lake drain, and the sediment samples in Pine Lake that are closest to the Pine Lake drain entry point should have the highest copper content. However, in fact the data show no elevated copper in Pine Lake drain sediments, and the sediment samples in Pine Lake that are closest to the Pine Lake drain inlet (PS-1 and PS-2) have some of the lowest copper concentrations of any of the sediment samples in the lake. Since these sediments are composed of heavily organic peat, the copper could be naturally-occurring.

In summary it is not possible to determine the source of the copper detected in the Pine Lake sediments, and it is unlikely that they are attributable to PRR based on the information currently available.

6.4 Pine Lake Seeps Northwest of PRR Property

The southern edge of Pine Lake northwest of the PRR property is a low-lying marshy area that has several seepage areas where groundwater emerges to drain into Pine Lake. These seeps have been sampled as follows:

1. **MDEQ Sampling:** Surface water samples were obtained from three seeps along the edge of Pine Lake (PL-1, PL-3 and PL-6) for analysis of total metals; all of these were sampled twice. PL-1 and PL-6 had no detections above Part 201 GSI criteria. PL-3 contained barium, cadmium, copper, lead, nickel, zinc and cyanide above criteria.

2. **SECOR Sampling:** SECOR re-sampled the seeps at MDEQ locations PL-3 and PL-6. No metals were reported above Part 201 GSI criteria.

   A sediment sample obtained from the north side of the Pine Lake finger (DR-19) was analyzed for total metals. Selenium was reported at a concentration above the Part 201 GSI protection criterion. This detection cannot be related to the PRR property as there is no soil migration pathway from the plant to this location.

In summary, three seeps along the southern margin of Pine Lake north and northwest of the PRR property have been sampled for total metals analysis in the seep water. All three were sampled twice by MDEQ, and two of them were re-sampled by SECOR. The surface water at seep PL-3 had detections above criteria in the MDEQ samples but the SECOR re-samples at this seep did not have detections above criteria. In addition this seep is over 1,000 feet from potential metals source areas on the PRR property, and there is no history of the use of many of these metals at the PRR property.

In summary the data show there is no impact above criteria that can be attributed to the PRR property.

6.5 Pine Lake Tributary Northeast of PRR Property

Within the marshy area south of Pine Lake to the northeast of the PRR property, and north of the adjacent Creative Foam Products Inc. manufacturing facility, is a small natural branched tributary to Pine Lake. The MDEQ and SECOR sampled seepage water and sediments along this tributary.

1. **MDEQ Sampling:** Surface water was sampled twice at two seeps along a small tributary to Pine Lake northeast of PRR property (PT-2 and PT-5) for analysis of total metals. Both samples at PT-2 had detections above Part 201 GSI criteria for arsenic, barium, cadmium, chromium, copper, lead, zinc, and cyanide. At PT-5 the copper concentration was above criteria in both samples and lead exceeded criteria in the second sample.

The MDEQ also analyzed five sediment samples (HASB-5 through HASB-9) from a former manufacturing waste lagoon on the property now occupied by Creative Foam Products northeast of the PRR property. This lagoon was formerly used by Cupples Manufacturing Company for disposal of water from its metal-working and finishing operations. Four of these samples reported very high detections of arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc. These data are significant because the pond historically discharged to the tributaries that were sampled by MDEQ at PT-2 and PT-5, and the metals that MDEQ detected in the pond sediments are the same ones that MDEQ detected in the seepage water at PT-2 and PT-5.

2. **SECOR Sampling:** Surface water samples were obtained from four locations along the tributary northwest of the PRR property (SP-5, SP-8, SP-9 and SP-10) for analysis of total metals. The sample from SP-10 had reported detections of arsenic, copper, lead, mercury zinc and cyanide above Part 201 GSI criteria. This location corresponds to the MDEQ location PT-2 described above.

In summary, the surface water from seeps along the tributary has been sampled for metals analysis. The MDEQ analyzed surface water samples at two seeps, PT-2 and PT-5, along this tributary. SECOR subsequently re-sampled the surface water at these two locations (SECOR locations SP-5 and SP-10), and also sampled at additional locations SP-8 and SP-9 along this same tributary. At PT-2/SP-10, both the MDEQ and SECOR detected metals above Part 201 GSI criteria including arsenic, barium, cadmium, chromium, copper, lead, zinc and cyanide. At PT-5/SP-5 the MDEQ detected copper and lead above Part 201 GSI criteria, however the SECOR resample did not have any detections above criteria. The SECOR samples at SP-8 and SP-9, which are between PT-2/SP-10 and PT-5/SP-5, also had no detections above criteria.

The metal detections at these seeps are highly unlikely to be related to the PRR property. The groundwater at the PRR property upgradient from this area has been shown to be free of metals impact, and there is no surface runoff or erosion pathway from PRR source areas to this area. Also, the detected metals include metals that are not known to have been used at the PRR plant. However; this tributary is down-gradient of the former Cupples lagoon, where MDEQ sediment samples had very high concentrations of the same metals that were detected in the PT-2/SP-10 surface water. It is also noted that seep PT-2/SP-10 is near the discharge point for overflow water from a commercial minnow tank operated by the owner of that property, and is also within an area where watercress was farmed in the past. Either of these operations might include the use of fertilizers, algaecides etc. that could be a source of metals.

There is no complete soil erosion pathway from the PRR property to the Rudy Road drain. Historically all metal raw materials, operations, and product storage have been under roof; and rainfall at the property generally infiltrates through the soil directly to the groundwater.

7.0 CONCLUSIONS

The PRR property has been an industrial property since about 1916 and past operations have included casting, machining, plating, soldering and other metalworking operations as well as casting and extruding copper tubing. Due to this history, assessment data show areas of metals impact, primarily copper, above natural background levels in soil at the plant. The detections above background are generally beneath the building slab and at the former furnace brick disposal area, which was remediated to criteria established by MDEQ. However, detailed site assessments have shown that the levels of impact are below relevant Michigan risk-based criteria as listed in Act 451 Part 201.

The past assessments have also demonstrated that there is no impact by metals in the site's groundwater above naturally-occurring levels.

Finally, past assessments have shown that there are isolated instances of various metals in sediments within Pine Lake, as well as in associated seeps and drains located off of the PRR property. These surface water features have all been used since the mid-1800s for discharge of stormwater runoff and industrial discharge from the City of Dowagiac; the former operations history of the PRR property does not include many of the metals that have been detected above relevant criteria; and the distribution of copper in lake sediments is inconsistent with the source being a discharge from the PRR property in Rudy Road drain. Therefore the metals detected in the sediments of Pine Lake and related seeps are not attributable to PRR. Additionally, the data have shown high metals concentrations in sediment within a former wastewater cooling lagoon at the adjacent Creative Foam Products property, and these detections have included all of the metals that have been detected at elevated concentrations in sediments of Pine Lake and the associated seeps. Therefore this lagoon is much more likely than the PRR property to be a source of the noted metals impacts in Pine Lake and associated seeps.

In summary, based on the available data and site conditions, there has been no metals impact to on-site soil or groundwater, nor to surrounding surface water and sediments, that can be attributed to the PRR property.

TABLE 1 - RELEVANT MICHIGAN ACT 451 PART 201 GENERIC CRITERIA

	Part 201 Generic Criteria for Soil - Nonresidential, micrograms per kilogram[1]						Part 201 Generic Criteria for Groundwater, micrograms per Liter[2]
	Default Statewide Background	GSI Protection[3]	Drinking Water Protection	Direct Contact	Particulate Soil Inhalation	Groundwater Contact Protection	Drinking Water
Arsenic	5,800	[5,800]	[5,800]	37,000	910,000	2,000,000	10
Barium	75,000	840,000	1,300,000	130,000,000	150,000,000	1,000,000,000	2,000
Cadmium	1,200	5,700	6,000	2,100,000	2,200,000	230,000,000	5
Copper	32,000	120,000	5,800,000	73,000,000	59,000,000	1,000,000,000	1,000
Chromium	18,000	1,000,000,000	1,000,000,000	1,000,000,000	150,000,000	1,000,000,000	100
Lead	21,000	5,300,000	700,000	900,000	44,000,000	id	4
Mercury	130	[130]	1,700	580,000	8,800,000	47,000	2
Nickel	20,000	130,000	100,000	150,000,000	16,000,000	1,000,000,000	100
Selenium	410	[410]	4,000	9,600,000	59,000,000	78,000,000	50
Silver	1,000	[1,000]	13,000	9,000,000	2,900,000	200,000,000	98
Zinc	47,000	280,000	5,000,000	630,000,000	id	1,000,000,000	5,000
Cyanide	390	[390]	4,000	250,000	250,000	250,000	200

Notes:

All values are in micrograms per kilogram

(1) = Part 201, Attachment 1, Table 3; updated March 25, 2011

(2) = Part 201, Attachment 1, Table 1; updated march 25,2011

(3) = GSI Protection criteria for {G}-footnoted hazardous substances in the Part 201 table were calculated using the spreadsheet provided on the MDEQ web site for this purpose (*Calculation of Generic Facility-Specific Part 201 Groundwater Surface Water Interface (GSI) Criteria for {G} Footnoted Hazardous Substances,* dated December 10, 2004). The calculations were based on an average hardness of 275,000 ug/kg, as obtained by SECOR in the *Phase I Assessment of Current Conditions Report* dated March 2002. The GSI for surface water bodies that are not protected for drinking water use was used for the GSI protection criteria.

id = Insufficient data

[ ] = The calculated value is less than the default background, and therefore the default background concentration is the criterion

TABLE 2 - SOIL SAMPLES EXCEEDING RELEVANT CRITERIA

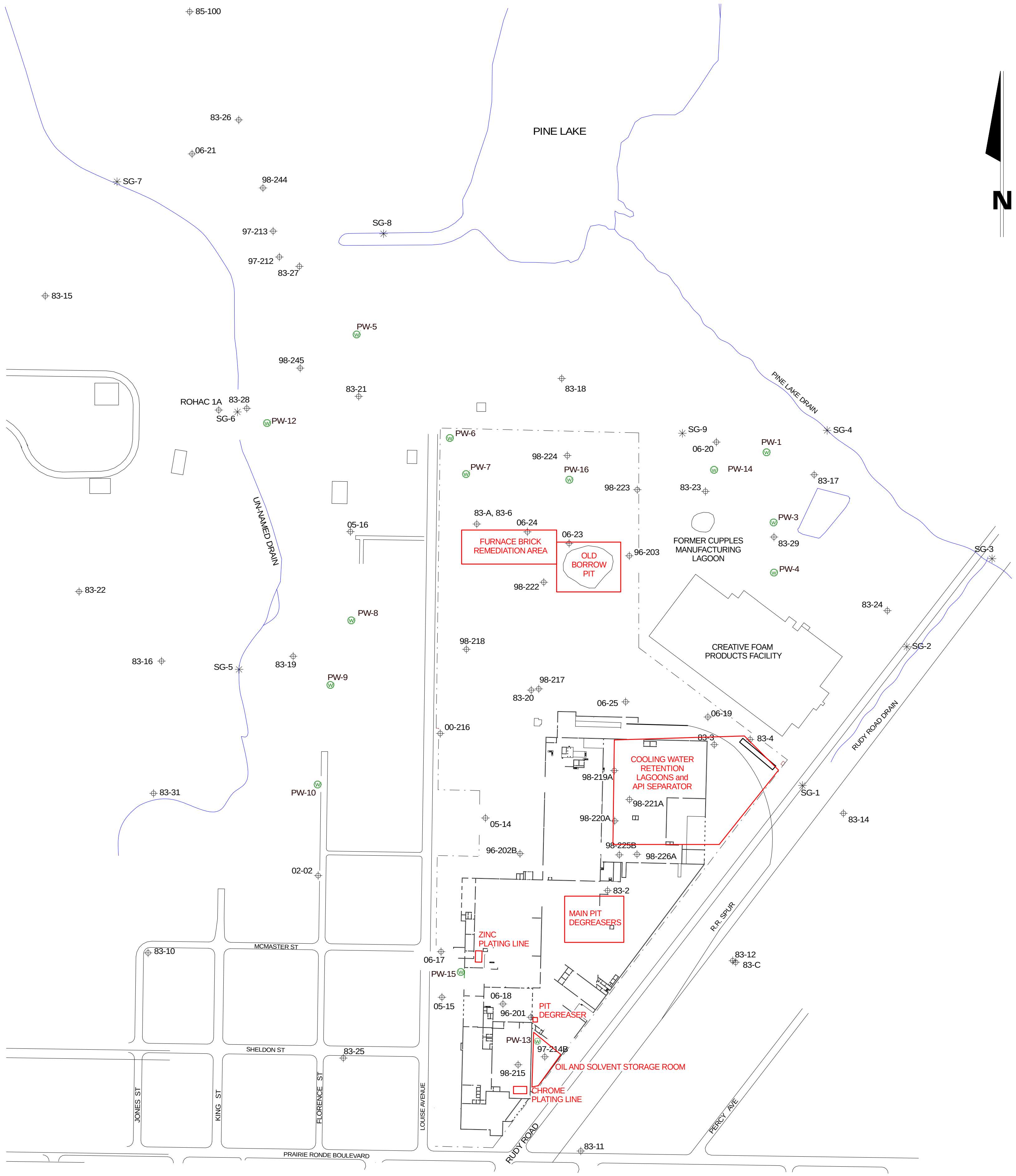
	Number of Source Area Samples	Highest Reported Detection	Default Statewide Background	Number of Samples Above Background	Part 201 Drinking Water Protection Criterion	Number of Samples AboveDrinking Water Protection Criterion	Location of Samples Above Drinking Water Protection Criterion
Arsenic	25	12,000	5,800	1	5,800	1	Boring 02-254, 2002; Center of plant building, 2 to 3 feet below floor slab
Barium	35	52,000	75,000	0	1,300,000	0	
Cadmium	36	4,500	1,200	5	6,000	0	
Copper	95	19,000,000	32,000	39	5,800,000	4	Verification of Soil Remediation samples in former furnace brick disposal area, 1997
Chromium	72	265,200	18,000	8	1,000,000,000	0	
Lead	72	90,000	21,000	6	700,000	0	
Mercury	25	170	130	1	1,700	0	
Nickel	23	34,000	20,000	1	100,000	0	
Selenium	25	nd	410	0	4,000	0	
Silver	36	8,400	1,000	2	13,000	0	
Zinc	36	475,000	47,000	9	2,400,000	0	
Cyanide	5	nd	390	0	4,000	0	

Notes:

All values are in micrograms per kilogram

nd = None detected

[ ] = The calculated value is less than the default background, and therefore the default background (



FACILITY LOCATION
not to scale

LEGEND:

- PRAIRIE RONDE REALTY PROPERTY LINE
- PURGE WELLS
- STAFF GAUGE
- MONITORING WELL LOCATION: SOME LOCATIONS HAVE MULTIPLE WELLS
- POTENTIAL METALS SOURCE AREAS BASED ON HISTORICAL OPERATIONS

GRAPHIC SCALE IN FEET

0 100 200 400

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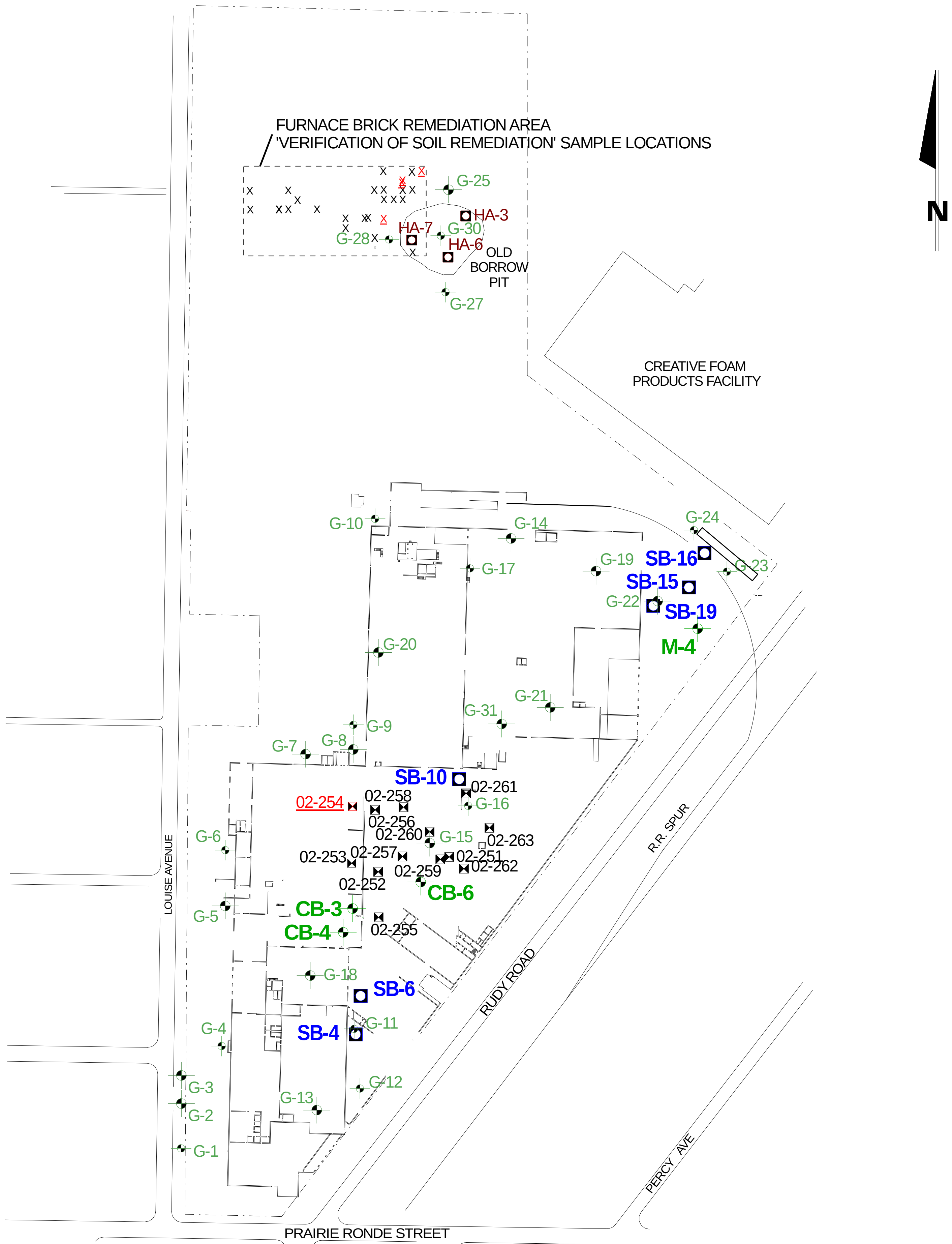
SUMMARY REVIEW OF METALS ISSUES

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

SITE LOCATION AND POTENTIAL METALS SOURCE AREAS



LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

SOIL SAMPLING LOCATION FROM *ENVIRONMENTAL ASSESSMENT - PHASE II*, BY DELTA ENVIRONMENTAL CONSULTANTS INC., DECEMBER 6 1990

DIRECT PUSH BORING LOCATIONS FROM *BASELINE ENVIRONMENTAL ASSESSMENT*, BY BENCHMARK ENGINEERING INC., OCTOBER 31 1995

x SAMPLING LOCATION FROM *REPORT OF FURNACE BRICK REMOVAL*, BY R. DAVID MURSCH P.E., AUGUST 31, 1997

SAMPLING LOCATIONS WITH METALS DATA FROM *PHASE II REMEDIAL INVESTIGATION REPORT* BY SECOR INTERNATIONAL INC., DECEMBER 2002

SOIL SAMPLING LOCATION FROM *REPORT OF SUBSURFACE EXPLORATION - PHASE I PLANT MODERNAZATION*, BY R. DAVID MURSCH, P.E, OCTOBER 30, 2002.

SAMPLING LOCATIONS WITH METALS DATA FROM *INTEGRATED GEOPHYSICAL INVESTIGATION SUMMARY REPORT*, BY WESTON SOLUTIONS OF MICHIGAN, INC., AUGUST 2004

x SOIL SAMPLE WITH COPPER CONCENTRATION ABOVE MDEQ PART 201 CRITERION FOR PROTECTION OF DRINKING WATER

02-254 SOIL SAMPLE WITH ARSENIC CONCENTRATION ABOVE MDEQ PART 201 CRITERION FOR PROTECTION OF DRINKING WATER

GRAPHIC SCALE IN FEET
(ESTIMATED)

0 100 200 400

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SUMMARY REVIEW OF METALS ISSUES

FOR:

PRAIRIE RONDE REALTY COMPANY
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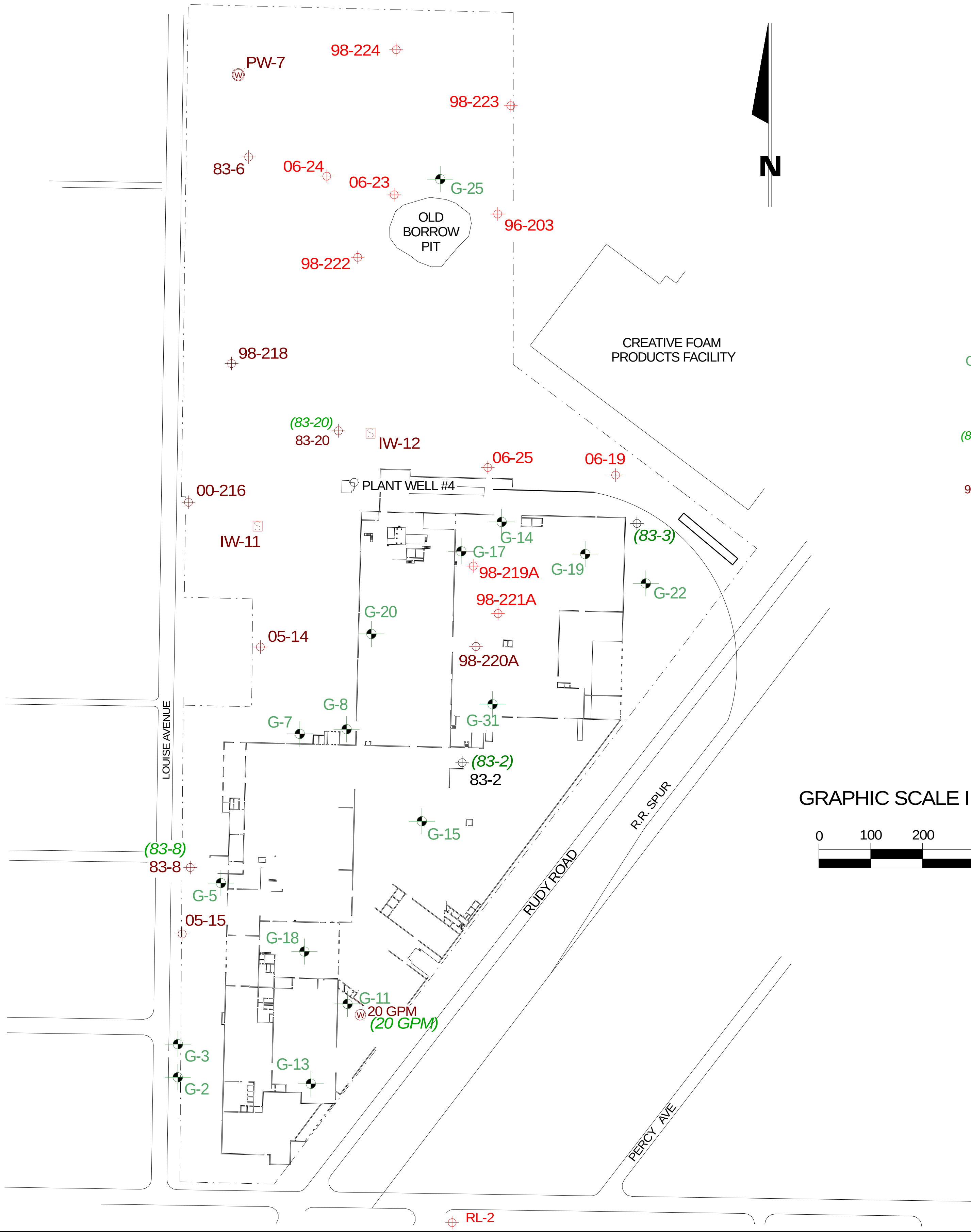
Figure 2:

ON-SITE SOIL SAMPLE LOCATIONS



LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

83-2 — MONITORING WELL SAMPLED IN 1983 INVESTIGATION

G-22 — DIRECT PUSH BORING LOCATIONS FROM *BASELINE ENVIRONMENTAL ASSESSMENT*, BY BENCHMARK ENGINEERING INC., OCTOBER 31, 1995

(83-20) — MONITORING WELL SAMPLED FOR TOTAL METALS IN *BASELINE ENVIRONMENTAL ASSESSMENT*, BY BENCHMARK ENGINEERING INC., OCTOBER 31, 1995

98-218 — MONITORING AND PURGE WELLS SAMPLED IN APRIL 2005 AND AUGUST/SEPTEMBER 2005

06-24 — MONITORING WELLS SAMPLED IN *THIRD QUARTER 2006 MONITORING REPORT*, BY R. DAVID MURSCH, P.E., DECEMBER 31 2006

GRAPHIC SCALE IN FEET

0 100 200 400

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SUMMARY REVIEW OF METALS ISSUES

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 3:

ON-SITE GROUNDWATER SAMPLE LOCATIONS

N

LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

SP 5 MDEQ SURFACE WATER SAMPLE LOCATION, 2000

SP 5 SECOR SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS; *PHASE I CURRENT CONDITIONS REPORT*, MARCH 2002

GRAPHIC SCALE (ESTIMATED)

0 100 200 400

FEET

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FOR:

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Figure 4:

TOPOGRAPHY AND SURFACE WATER FEATURES

Appendix I

Review of Burmax Park Residential Well Status

REVIEW OF BURMAX PARK

RESIDENTIAL WELL STATUS

~

Prairie Ronde Realty Company

Dowagiac, Michigan

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Charles Denton
Scott Moyer (via Jim Tolbert)
USEPA (via Jim Tolbert)
MDEQ (via Jim Tolbert)

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~

June 10, 2013

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TABLES

FIGURES

1.0 INTRODUCTION

The Prairie Ronde Realty Company (PRR) property in Dowagiac, Michigan (Figure 1) has groundwater impacted by historical releases of solvents composed of volatile organic compounds (VOCs). The groundwater has been remediated since 1984 by a system of groundwater purge wells. Interim measures including air sparging and soil vapor extraction systems were installed in the 1990s; these interim systems were closed in 2008. By these efforts the extent and levels of groundwater contamination have been greatly reduced.

PRR submitted a Corrective Measures Proposal (CMP) in 2009 that included use of monitored natural attenuation (MNA) to complete the remediation of off-site groundwater to drinking water standards supplemented with chemical treatment in historical source areas to reduce the remaining source-area levels of VOC impact. The CMP also proposed to continue operating the purge wells on an interim basis to protect surface water until the contamination levels in designated monitoring wells are reduced below the groundwater-surface water interface (GSI) criteria as defined in Michigan Natural Resource and Environment Protection Act (NREPA) Part 201.

In comments to the CMP, EPA requested that PRR provide additional information related to possible impact of contaminated groundwater at certain residential wells in the Burmax Park subdivision located west of the PRR property.

PRR has prepared this document in response to the EPA’s request.

2.0 HISTORICAL GROUNDWATER ANALYSES

In 1983, the property now owned by PRR was found to be impacted by VOCs in soil and groundwater. Subsequent investigations determined that the groundwater impact extended to the west and northwest. The western boundary of impact was determined to be roughly the un-named drain located between Louise Avenue and M-51. The investigation determined that the VOC plume extended slightly past the un-named drain in the vicinity of the Burmax Park residential subdivision (Figure 1). In this subdivision ten private water supply wells were tested in 1983 and one well, serving the property of Dr. Mathews at 27785 Burmax Park, contained trichloroethene (TCE) at a concentration of 109 micrograms per liter (µg/l). The other nine wells did not have VOCs above the laboratory detections limits (1 µg/l for TCE). Subsequent sampling showed the TCE level in the Mathews was 1.3 µg/l in 1997 and non-detect in 2012. Table 1 summarizes the available well information and sampling history for the Burmax park residential wells and the data are depicted on Figure 2.

In addition to sampling the Burmax Park wells, the 1983 investigations included installing several groundwater monitoring wells west of the un-named drain. These wells included four-well clusters at locations 83-15 and 83-16, a two-well cluster at 83-22, and a three-well cluster in Burmax Park at a residence owned by Mr. Rohacs that are referred to as Rohacs-1, Rohacs-2 and Rohacs-3. All of these thirteen wells were sampled during the initial investigations. In 1995 the wells were cleared and redeveloped for further sampling. Three wells, 83-22B, 83-15D and 83-16B, had been vandalized and plugged. The rest of these wells were sampled for several years after 1995 and all of the wells were non-detect for all VOCs except for the Rohacs well cluster, which is discussed below.

The Rohacs well cluster is located about 40 feet west of the un-named drain in the back yard of the residence at 27787 Burmax Park. When initially installed in 1984, these wells had VOC detections with TCE as high as 25,000 µg/l. The Rohacs' residential supply well located 125 feet to the west was sampled at the same time and was non-detect for all VOCs.

In 1986, purge well PW-11 was installed slightly west of the Rohacs monitoring well cluster and this purge well operated until 1998. While PW-11 was in operation, the VOC levels in the three Rohacs monitoring wells declined significantly, and after 1990 the VOC concentrations were consistently close to but slightly above federal and state drinking-water standards (MCLs). In 1998 PW-11 was abandoned and replaced by purge well PW-12, which is located on the Walker property east of the un-named drain. After PW-11 was replaced by PW-12, the VOC levels at the Rohacs monitoring wells continued to decrease and were below MCLs in all semi-annual sampling events from the spring of 2000 to the fall of 2008. After 2008 sampling of these wells was discontinued.

In summary the data demonstrate that there was only a very limited area of VOC impact west of the un-named drain at Burmax Park and remediation efforts reduced the impacted groundwater to levels below MCLs by 2000.

3.0 HISTORICAL POTENTIOMETRIC EVALUATIONS

The potentiometric surface of the PRR property and the entire impacted area, including the area west of the un-named drain and Burmax Park, has been monitored since 1983. An initial set of water level readings was obtained in 1983, before the purge well system was installed, and these data are plotted on the map in Figure 3. Since 1995, potentiometric plots that included the western wells were included in the regular quarterly and semi-annual monitoring reports and these maps have shown similar flow patterns to the 1983 map. A map showing the potentiometric surface measurements in May 2013 is shown in Figure 4; the purge well system was not operating at the time these measurements were obtained.

The potentiometric maps show that the groundwater west of the un-named drain generally flows toward the northeast. Groundwater from the PRR property generally flows toward the north and northwest. The two flows merge along the vicinity of the un-named drain, and the combined flow generally goes northward to the area west of Pine Lake. The dominant groundwater flow direction in the area east of Burmax Park along the un-named drain is toward the north/northeast, away from Burmax Park.

The 1983 potentiometric surface maps in Figures 3 demonstrates that groundwater from the Oil and Solvent Room source area at the PRR property flowed toward a wide, flat area at the southern part of the drain, and then turned north and northeast as it merged with groundwater flowing from the area west of the un-named drain. The contaminated groundwater plume in 1983 apparently impinged slightly on the Mathews well, which is located significantly further to the east than the rest of the Burmax Park wells. This is consistent with the residential well testing that was performed in 1983; only the Mathews well was found to have detectable levels of VOCs while the other nine Burmax Park wells were non-detect for all VOCs. One possible reason for the contaminated water to have impacted the Mathews well is combined pumping from all of the residential wells (such as for lawn watering during dry seasons) may have pulled contaminated water over from the un-named drain.

PRR has reviewed the Cass County Health Department records for logs of residential water supply wells in the areas west of the PRR property, including Burmax Park. The original well logs for several residential wells in Burmax Park were located. According to the public record, the Wray well is set to a depth of 48 feet and had an initial static water level of 23 feet below ground surface. Based on the USGS topographic contours reproduced on the map in Figure 3, the ground surface at the Wray residence is approximately elevation 760; so the groundwater level measured at the time the Wray well was installed was approximately 737 feet. This elevation correlates well with the 1983 potentiometric surface contours shown in Figure 3, which shows the Wray well is not down-gradient of impacted groundwater from the PRR property.

4.0 DISCUSSION AND CONCLUSION

As discussed in this review, the data show that groundwater flows east from the Burmax Park subdivision, merges with the groundwater coming from the PRR property in the vicinity of the un-named drain, and from there the groundwater flow is toward the north and northeast away from Burmax Park. Therefore the subdivision is not down-gradient of the PRR property, and the Wray well should not be adversely affected by groundwater flowing from the PRR property. The historical and current analytical data confirm this as the well has been sampled three times and no VOCs have been detected in any of these events.

Past assessment and monitoring data have demonstrated that some VOC impact along the un-named drain migrated across the un-named drain as far as the Mathews well prior to 1983. This migration could possibly have resulted from occasional combined pumping from all of the Burmax Park residences in dry seasons. Monitoring data have shown that the Mathews well has not had TCE above the MCl since at least 1997, and the well was non-detect for VOCs in 2012.

Following the 1983 assessment, the City of Dowagiac extended the public water supply to Burmax Park and all of the residents except the Wrays connected to the public water. The Wrays continue to use the well water as their sole source of water; as discussed above sampling data demonstrate that the Wray well is not impacted by VOCs and the Burmax Park area is not down-gradient of the PRR property.

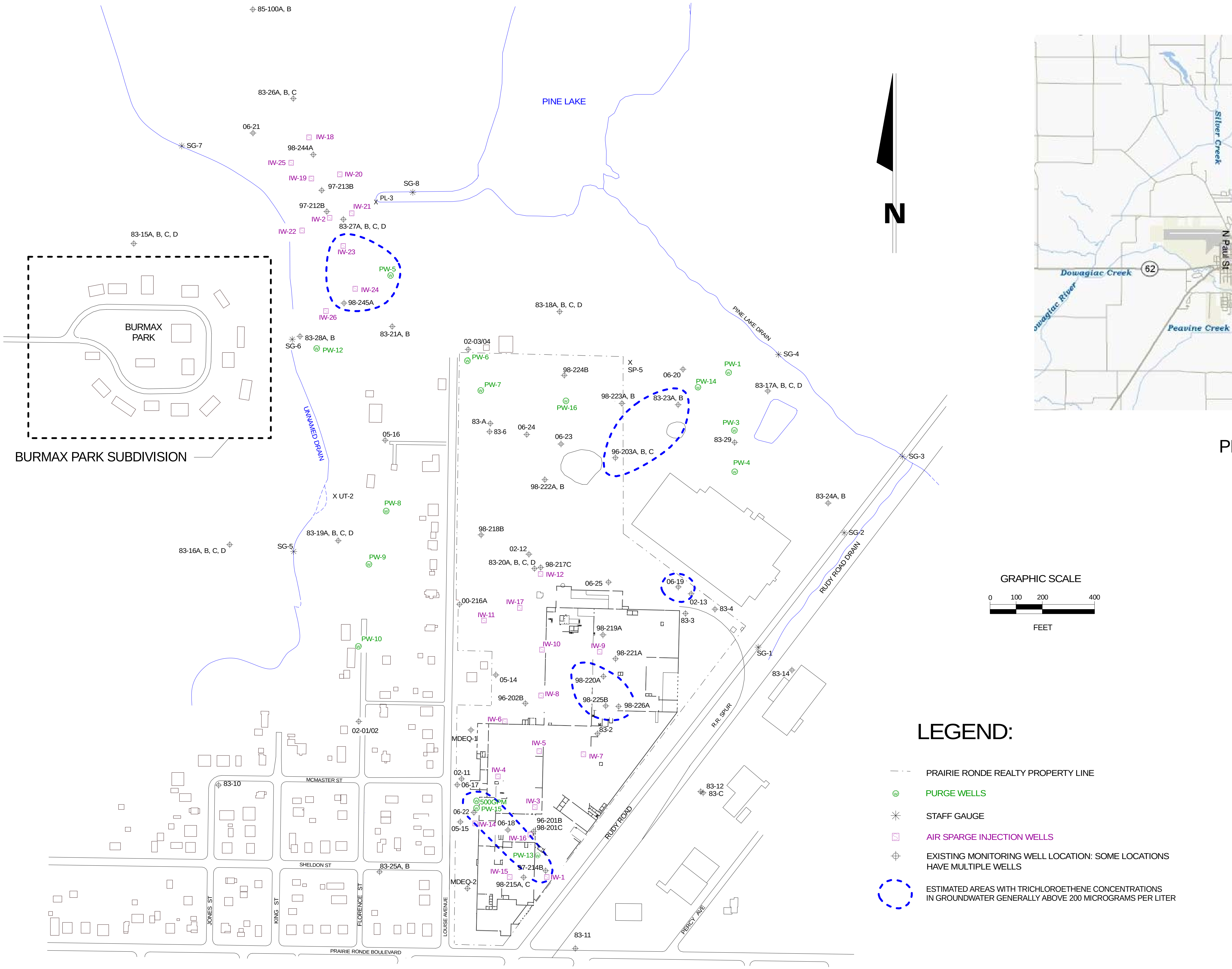
PRR has recently contacted the Wrays and offered to reimburse them to connect to the public water system, however they have declined.

TABLE 1; BURMAX PARK WELL SURMMARY

STREET	NUMBER	OWNER - per City of Dowagiac Records	KNOWN WELLS?	INFORMATION FROM OWNER IN 1997 SURVEY	COMMENTS	VOC in 1983, ug/L	VOC in 1997, ug/L	VOC in 2008, ug/L	VOC in 2012, ug/L
Burmax Court	27785	Dr. Fred Mathews	YES	Formerly used for drinking water; presently use for lawn sprinkling; connected to outside faucets	Well was sampled in 1983, re-sampled in 10997, 2008 and 2012	TCE = 109	TCE = 1.3 cis-1,2DCE=5.9	--	ND
Burmax Court	27825	Robert Mullen	YES	Never put into use; the pump is not working and the screen is plugged.	This well was sampled in 1983.	ND	--	--	--
Burmax Court	27787	Jeffry Ismay	YES	Formerly used for drinking water, disconnected in 1983.	Well was sampled in 1983, attempted to re-sample September 26, 1997. Well pipe enters basement from wall, is cut off and capped. Could not access.	ND (Rohacs)	--	--	--
Burmax Court	27806	Tom Ashley	YES	Presently use for lawn sprinkling; connected to outside faucets.	This well was sampled in 1983, re-sampled in 1997.	ND	ND	--	--
Burmax Court	27887	Lee Zelner	--	--	This well was sampled in 1983.	ND	--	--	--
Burmax Court	27880	Dennis Heimbuch	--	--	This well was sampled in 1983.	ND (Carmony)	--	--	--
Burmax Court	27811	William Wray	YES	This well is the sole water source for the house - no connection to the city water supply.	Cass County records show a well installed in 1974, screened to 48 feet and with a depth to water of 23 feet. This well was not sampled in 1983, but was sampled in 1997, 2008 and 2012.	--	ND	ND	ND
Burmax Court	27831	Timothy West	--	--	This well was sampled in 1983.	ND (Eckman)	--	--	--
Burmax Court	27826	William Hammer	YES	Formerly used for drinking water, disconnected in 1983.	This well was sampled in 1983. Checked in 1997; the pump is in place but the electric is disconnected and it could not be sampled.	ND (Each)	--	--	--
Burmax Court	27858	Max Maxey	--	--	--	--	--	--	--
Burmax Court	27800	Gordon Tyler	YES	Never put into use - Mr. Tyler runs it occasionally to keep it operable, may eventually connect it for watering lawn.	Cass County records show a well was installed in 1967, with a total depth of 44 feet and a depth to water of 25 feet. The well was not sampled in 1983 but was sampled in 1997.	--	ND	--	--
Burmax Court	27795	Lydia Godisak	--	--	--	--	--	--	--
Burmax Court	27853	Edith Clarke	--	--	--	--	--	--	--
Burmax Court	27871	Timothy Gleeson	--	--	--	--	--	--	--
Burmax Court	27899	Diane Alexander	--	--	This well was sampled in 1983.	ND (Walker)	--	--	--
Burmax Court	27850	Edward Witrykowski	--	--	This well was sampled in 1983.	ND (Citappes)	--	--	--

NOTES:

VOC = Volatile Organic Compounds: trichloroethene (TCE), cis-1,2 dichloroethene (cis-12DCE), 1,1,1-trichloroethane, 1,1-dichloroethene, 1,1-dichloroethane and vinyl chloride
ug/l = micrograms per liter
ND = No VOC reported above laboratory detection limit of 1 ug/l
( ) = Owner in 1983
-- = No information available or not sampled



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REVIEW OF BURMAX PARK RESIDENTIAL WELL STATUS

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

SITE MAP AND LOCATION

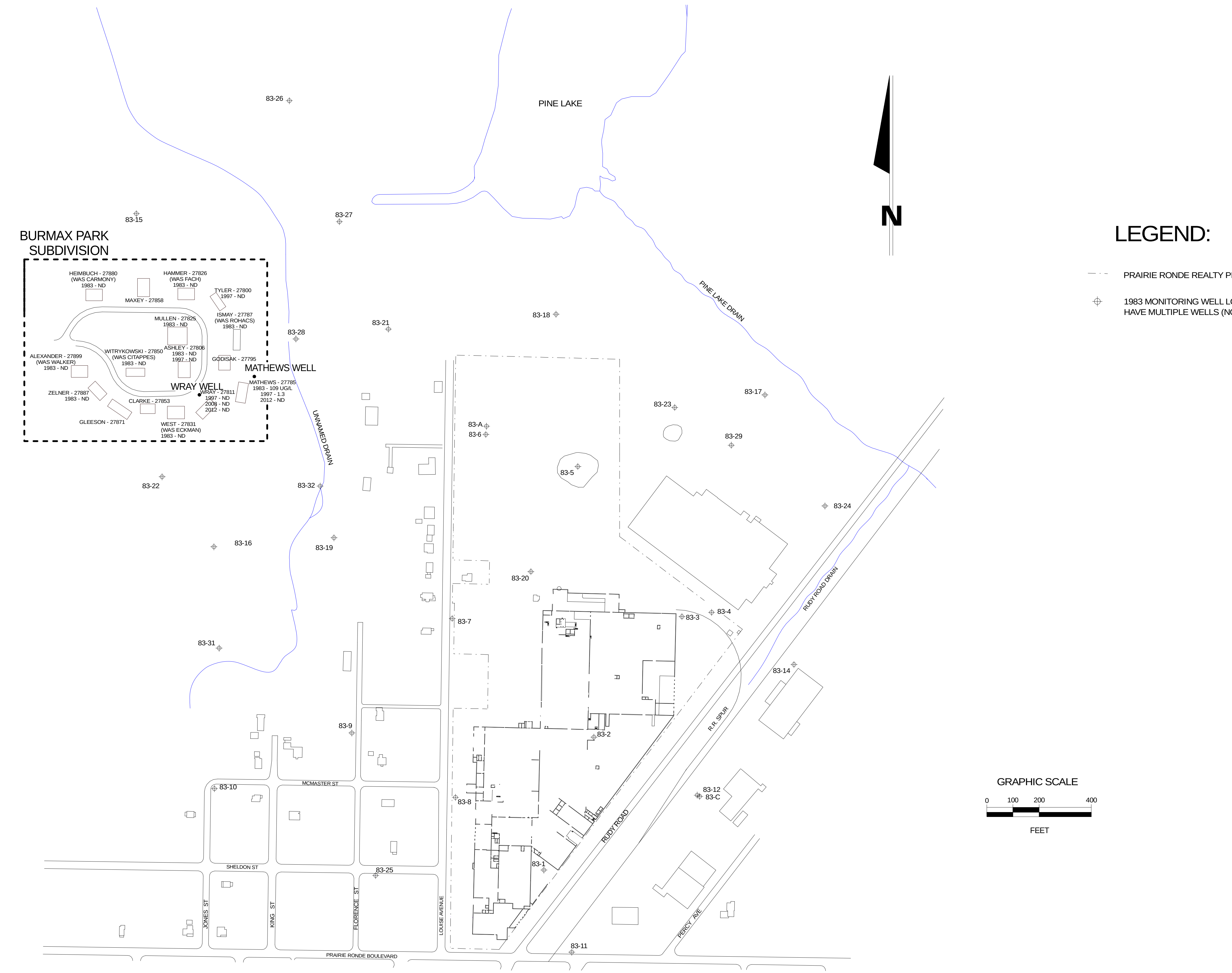

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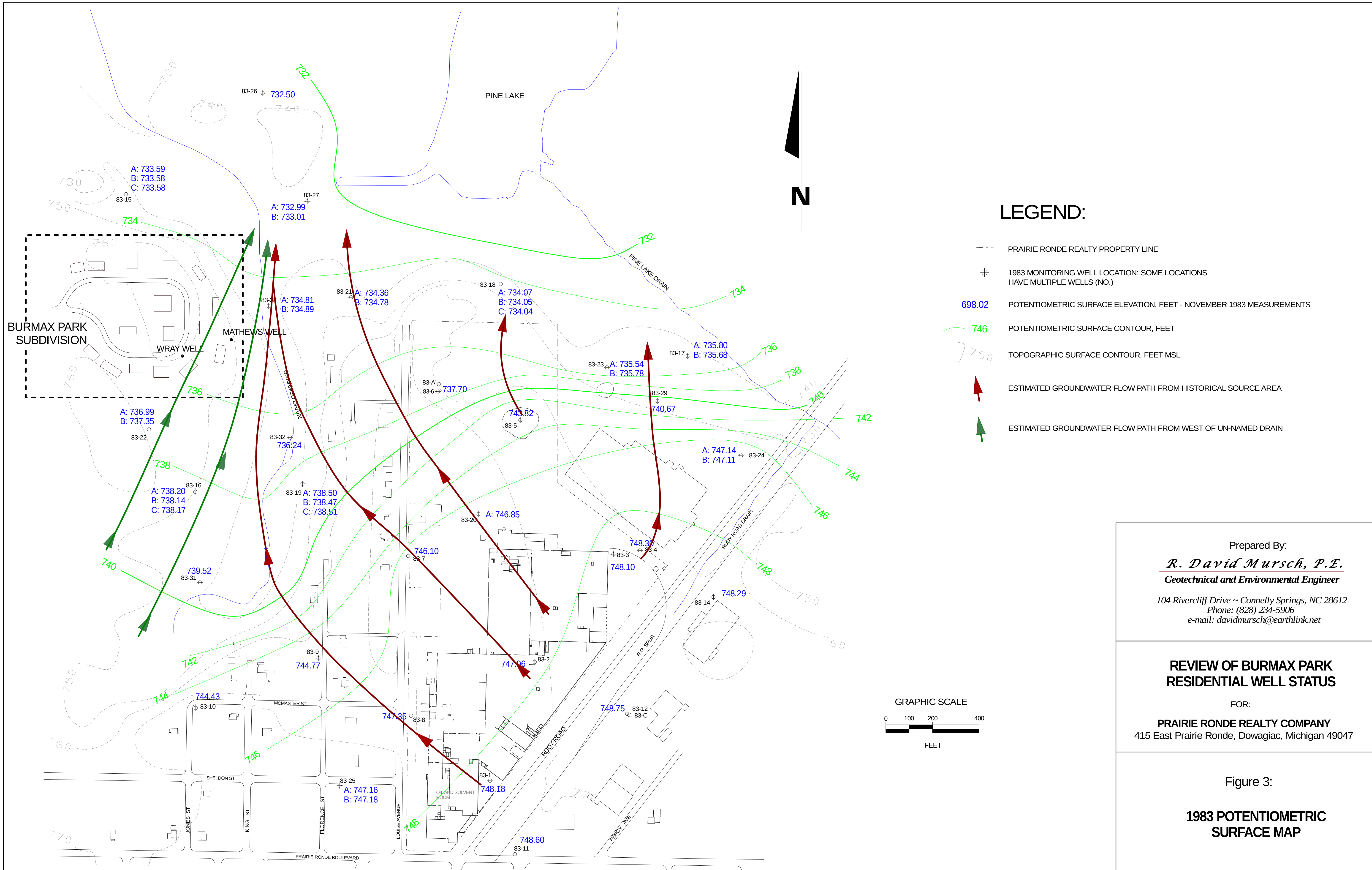
Figure 2:

BURMAX PARK RESIDENTIAL WELL SAMPLING HISTORY



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REVIEW OF BURMAX PARK RESIDENTIAL WELL STATUS

FOR:

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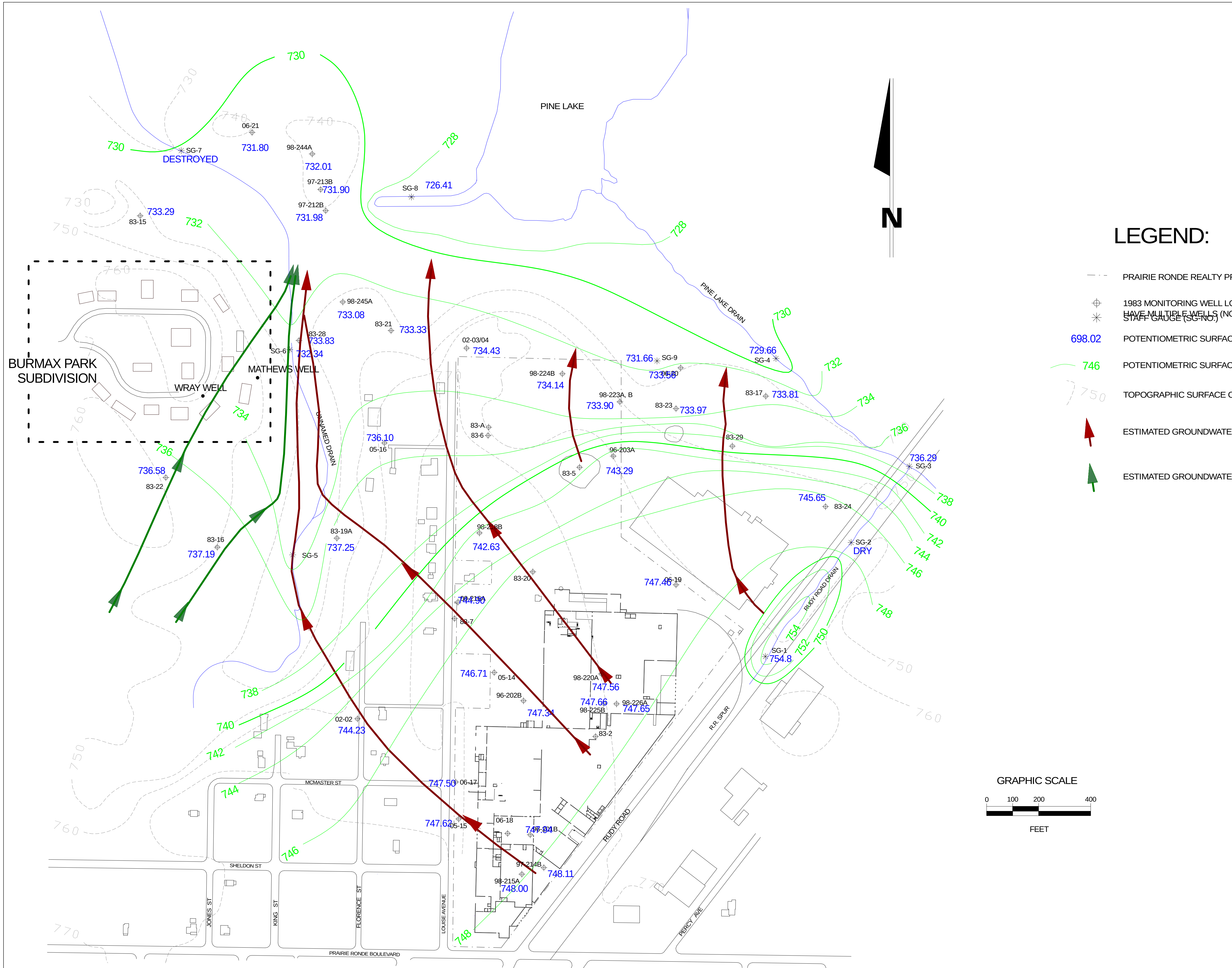
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 3:

1983 POTENTIOMETRIC SURFACE MAP



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REVIEW OF BURMAX PARK RESIDENTIAL WELL STATUS

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Figure 4:

2013 POTENTIOMETRIC SURFACE MAP (PURGE WELLS OFF)

Appendix J

Sub-Slab Depressurization System Operation and Monitoring Plan

SUB-SLAB

DEPRESSURIZATION SYSTEM OPERATION AND MONITORING PLAN

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Prairie Ronde Realty Company

Dowagiac, Michigan

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June 12, 2013

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1.0 INTRODUCTION

This document presents a work plan for operating and monitoring of a sub-slab depressurization system (SSDPS) for the Prairie Ronde Realty (PRR) building at 415 Prairie Ronde Street in Dowagiac, Michigan. This property was acquired by PRR from the Sundstrand Corporation (UTC/Sundstrand) in 1995. The shallow soil and groundwater beneath this former copper tube mill building are impacted by volatile organic compounds (VOCs), primarily trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), resulting from historical operations by UTC/Sundstrand. The contamination was discovered in 1983 and the impacted soil and groundwater has been actively remediated since 1984.

The groundwater remediation program consists of a system of purge wells. The purged groundwater is treated through an air stripper. Beginning in 1994, the plant also installed air sparging and soil vapor extraction (SVE) systems as voluntary interim measures to expedite the site remediation. The air streams from the groundwater air stripper and the SVE systems have been discharged under terms of an air emissions permit. In 2008, the sparge and SVE systems were shut down with notice to USEPA.

In September 2009, PRR submitted a *Final Corrective Measures Proposal* (CMP) that outlines the proposed final site remediation program. USEPA and PRR are working on finalizing the CMP. As part of the evaluation of the CMP, PRR sampled the air inside the industrial building on the property in March, 2012. The sampling included both indoor air and sub-slab samples, and both sets of samples included TCE at levels above USEPA screening levels. Those data were submitted to USEPA in the *Indoor Air and Sub-Slab Soil Gas Sampling Report* dated April 2012.

In response to the TCE concentrations above screening levels, PRR increased ventilation in the building and notified tenants. Subsequent re-sampling of the indoor air confirmed that the building ventilation was effective at reducing indoor air concentrations. In addition, PRR has installed and is operating a SSDPS for the entire building. The SSDPS consists of a blower that extracts air from beneath the plant’s floor slab using the former SVE wells as the extraction points. The system is designed to create and maintain a vacuum or null pressure gradient beneath the floor slab.

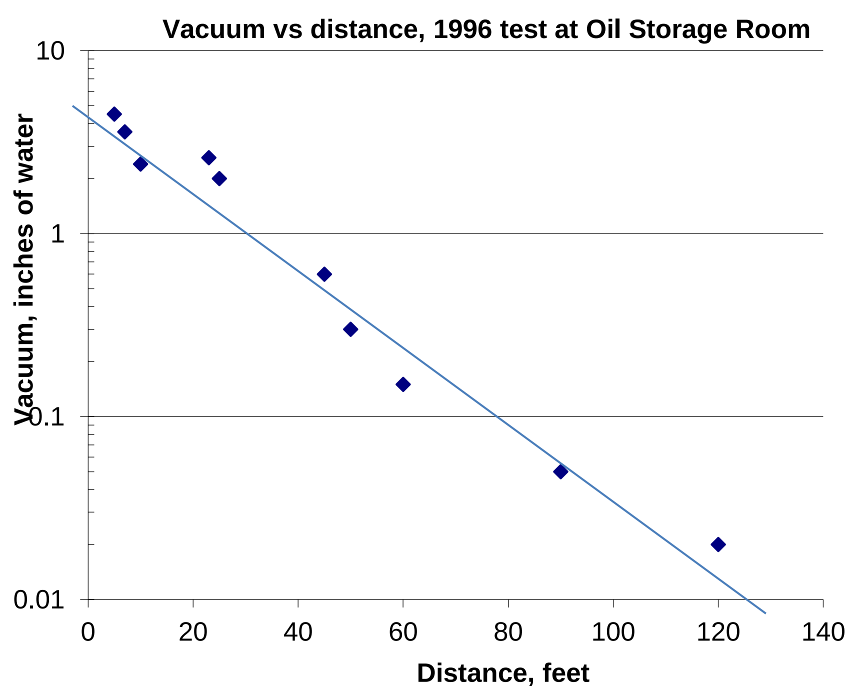
This work plan describes the installation and operation of the SSDPS, along with the performance monitoring procedures and shut-down criteria.

2.0 SYSTEM INSTALLATION AND STARTUP

As discussed above, sampling at the PRR building in March 2012 showed TCE concentrations in some indoor air and sub-slab soil gas samples at levels exceeding the USEPA screening levels. Figure 1 shows the locations of the sub-slab samples. In response, PRR improved ventilation of the building by opening large overhead doors on the west and east sides of the building. PRR also placed fans in areas that were not directly ventilated by the doors, and initiated a survey to locate and repair cracks or penetrations in the slab that may allow migration of VOCs from the soil into the indoor air space.

In addition to these short-term response measures PRR operates a SSDPS as an interim measure, designed to be consistent with the final remedy. The SSDPS uses the existing SVE wells and transmission piping that were formerly used for the remedial SVE system, plus a new SVE well that was installed in January of 2013. Figure 2 shows the layout of the SVE system in the plant, including the SVE wells and the vacuum monitoring points (VMPs) that are used as part of the SVE performance monitoring program.

The SVE system was originally installed in 1994 and operated until late 2008. The system was designed on the basis of field vacuum-flow tests and the SVE system performance was re-evaluated several times during its operation. A typical vacuum-distance graph for the system is shown below:



These past tests confirmed that the SVE system produced a vacuum on the order of 0.01 inches of water at a radius of 130 feet. The induced vacuums are additive, so that for example a point that is 130 feet from two separate SVE wells would have a total vacuum on the order of 0.02 inches of water.

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Figure 3 shows the locations of the SVE wells. The extraction wells are clustered at historical source areas and generally cover all the areas of known subsurface VOC impact. Since the TCE vapors most likely originate only from these source areas, operation of the SVE wells as part of a SSDPS should prevent migration of TCE vapors from impacted soil and groundwater to other areas beneath the plant building.

With the existing coverage the SVE system should generate a vacuum at all monitored area of the building. Since the system was put into operation in mid-2012 measurements have consistently shown a net vacuum below the floor slab; this confirms that the system should adequately control potential soil gas vapor migration up through the slab.

The SVE system formerly operated at a total air flow rate on the order of 1,000 cubic feet per minute (cfm). Since the objective of the SSDPS will only be to maintain a null pressure gradient or vacuum under the slab and not to strip VOCs from the soil, the actual air flow rate can be lower than the flow rate required for soil remediation via SVE. In addition, the former SVE system included eight SVE wells outside the building that will not be operated as part of the SSDPS. Therefore PRR has installed a blower with a lower rated flow capacity than the former SVE blower, so that the new system can maintain a depressurized sub-slab environment with minimal TCE emissions to ambient air. Information on the blower, including vacuum/flow-rate charts, is appended.

At the expected operating conditions the blower is generating a total airflow on the order of 450 cfm with a vacuum at the blower on the order of 2.5 to 3 psi. The blower system includes a water knockout tank and particulate filter at the blower, to prevent water or particles from entering and damaging the blower. A photograph of the blower system is appended.

The SVE wells are vertical 2-inch diameter steel or PVC wells with slotted well screens set to depths on the order of 20 feet or just above the water table. A photograph of a typical SVE well, along with a schematic detail of the wellhead, is appended. Each well is connected to PVC or steel overhead transmission pipes that are manifolded together and connected to the blower. The transmission piping layout and blower location are shown on Figure 4.

The recovered soil vapor is discharged through the existing permitted air emission stack, which is a 24-inch diameter 80-foot tall vertical stack. The plant has maintained this stack as the discharge point for air emissions since 1984 and presently the air emissions from the groundwater treatment air stripper are discharged through this stack. The stack was also used for discharge of emissions from the SVE system during the period of 1994 through 2008; however the permit was modified in 2009 to remove the SVE discharge. PRR has obtained a modification to the MDEQ air permit to include the discharge from the SSDPS, and a copy of the new permit is attached. A photograph of the discharge stack is appended.

3.0 MONITORING AND SAMPLING

The SSPDS will be monitored to verify that it is effective at maintaining a null or negative pressure gradient across the building's floor slab, and to verify that air emissions from the system comply with the air permit requirements. In addition, air samples will be analyzed periodically to evaluate when the system can be shut down.

3.1 Effectiveness Monitoring

The effectiveness will be evaluated by measuring the differential vacuum across the floor slab at eleven VMPs located inside the building. These include VMP 1, 2, 3 and 10 from the former SVE monitoring system, as well as eight VMPs that were installed in March 2012 and January 2013 designated as VMP-11 through 18. These VMP locations and the locations of the SVE wells that will be used for the SSDPS are shown on Figure 3 and a photograph of a typical VMP is appended.

The VMP vacuum measurements will be obtained monthly and will be submitted to USEPA as part of the regular groundwater monitoring reports. If the measurements for any one month show a positive gradient upwards through the slab, an additional set of measurements will be taken after one week. If the upward gradient persists, PRR will evaluate options to increase the system vacuum, such as adding additional SVE wells or installing a larger blower/motor. A plan describing proposed system modifications will be submitted to USEPA before performing the work.

The emissions from the SSDPS will be monitored as required in the attached MDEQ air permit for the discharge. The airflow rate and VOC concentration in the discharge from the system will be measured quarterly at a sampling point in the discharge pipe downstream from the blower. The airflow rate will be measured using a hot-wire anemometer. The air sample will be obtained using the syringe method. A syringe will be inserted into the airstream and 40 cubic centimeters (cc) of air will be drawn into the syringe. The air will then be injected into an evacuated 20-cc septum vial. The sample will be sent to Microseeps Inc. in Pittsburgh, Ohio for analysis using ASTM Method AM 4.02 for:

- Trichloroethylene
- Cis-1,2-Dichloroethylene
- 1,1,1-Trichloroethane

The concentrations and flow rate will be used to estimate the system's VOC emission rate in pounds per hour. These data will be reported to the MDEQ as required in the air permit, and will also be included in PRR's regular monitoring reports to the USEPA.

The SSDPS blower will be serviced in accordance with the manufacturer's recommendations. The service personnel will also clean the particulate filter and drain the water knockout tank as necessary. Water from the knockout tank will be discharged for treatment into the groundwater air stripper system.

During operation of the SSDPS, the blower will be observed by PRR staff on a daily basis during regular business days, excluding weekends and holidays, to ensure that the blower is operating properly. The observation will include checking the vacuum at the blower; high or low vacuums could indicate problems such as blockage or broken lines. In the event the blower operation is not normal, the maintenance personnel will be contacted.

The daily observations, regular maintenance and non-routine outages or repair will be documented in a log sheet and copies of the logs will be included in the monitoring reports.

PRR will sample and analyze indoor air and sub-slab soil vapor in occupied areas of the building, to evaluate the need for continued operation of the SSDPS. A minimum of five and a maximum of ten co-located sample sets will be obtained during each sampling event, with the number of samples depending on the building occupancy at the time of sampling. The sampling was initially performed on a monthly basis; during this initial sampling period the SSDPS performance was evaluated and an additional extraction well (SVE-O) was added at the Michigan Precision shop to improve sub-slab vapor recovery in this area. In addition, a seventh VMP was added in the North Recreation Vehicle area (VMP-18). On approval of the USEPA the sampling frequency will be reduced to quarterly.

The methods used will be consistent with USEPA protocols for collecting air samples using TO-15 Summa™ canister sampling and analysis methods (*Compendium of Methods for the Determination of Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GCMS)* EPA/625/R96/01b, 1999). Each batch of canisters will be certified clean by the selected laboratory according to USEPA Method TO-15. The samples will be analyzed for:

- Trichloroethene
- 1,1,1-Trichloroethane
- Cis-1,2-dichloroethene
- 1,1-Dichloroethane
- Vinyl chloride
- Tetrachloroethene

Each sample will be collected using a Summa™ canister (6-Liter capacity) equipped with a critical orifice flow regulation device sized to allow an air sample to be collected over a 24-hour sampling period. The canisters will be deployed away from the direct influence of any forced air emanating from air conditioning units, central air conditioning vents, furnaces or heaters. The sampling procedure is as follows. Indoor air samples will be obtained at approximately 5 feet above the floor slab; the sub-slab soil vapor samples will be obtained by connecting the canisters to the VMPs with tubing.

- Air sample canisters will be labeled with a unique sample designation number. The sample number and location will be recorded in the field log book.
- The canister vacuum will be measured using an integrated vacuum gauge immediately prior to canister deployment, and recorded in the field log book. The critical orifice flow controller will be installed, the canister will be opened fully at the beginning of sample collection period, and the start time will be recorded.
- Other data recorded will include: outside and interior temperatures at the start and end of the sample period, equipment serial numbers, sampler name, and any comments.
- The canister valve will be closed fully at the end of the sample period (after 24 hours) and the end time recorded. If there is evidence of canister disturbance during the sample collection, this will also be recorded.

- The canister vacuum will be measured and recorded immediately after canister retrieval at the end of the sample period. Any samples where the canister reached atmospheric pressure will be rejected, and the canisters returned for cleaning. Once the vacuum is measured, the safety cap will be securely tightened on the canister inlet. Field data will be verified as correctly entered into field books prior to shipment; and canisters will be shipped to the laboratory under a chain-of-custody.
- Building occupants will be requested to keep out of the sampling area, if possible, during the sampling event.

The data will be reported to USEPA in the regular PRR monitoring reports, along with maps showing the sample locations, copies of the field records and laboratory analytical reports.

3.2 Shut-Down Criteria

The SSDPS will be operated to mitigate infiltration of soil vapor into the building and as a soil vapor remediation system. The SSDPS will be operated until sub-slab monitoring data show that VOC concentrations in the soil vapor are below the corrective measure goals identified in the Corrective Measures Proposal for four consecutive quarterly events. PRR will then shut down the SSDPS and continue quarterly monitoring of the indoor air and sub-slab vapors using the procedures outlined above. If any VOC detected in sub-slab soil vapor subsequently rebounds above its respective corrective measure goal in two consecutive sampling events, the SSDPS will be re-started. If the sub-slab soil vapor samples have no reported detections of VOCs with concentrations above the corrective measure goals for one year (four consecutive quarterly samples) after the system is shut down, the air monitoring will be discontinued.

4.0 EVALUATION OF EMISSIONS AND AMBIENT AIR IMPACT

PRR has measured emissions from the SSDPS since the system was put into operation in July 2012. The emissions rate measured in July 2012, immediately after the SSDPS system was put into operation, was 0.084 pounds per hour (pph). Subsequently the emissions rate has declined and the rate measured in November 2012 was 0.016 pph.

The air permit for the plant allows total air emissions of 2.28 pph. The emissions generated by the groundwater treatment are on the order of 0.13 pph. The additional emissions generated by the SSDPS are negligible compared both to the permitted emissions rate and the current level of emissions by the groundwater treatment system.

The impact of the ongoing permitted emissions from the groundwater treatment system and the past SVE operations to ambient air have been evaluated several times. Ambient air samples have been obtained from locations around the plant property while the systems were in full operation on ten occasions, with a total of sixteen ambient air samples analyzed. The dates and TCE concentrations obtained in these ambient air samples are summarized below (see Figure 5 for locations).

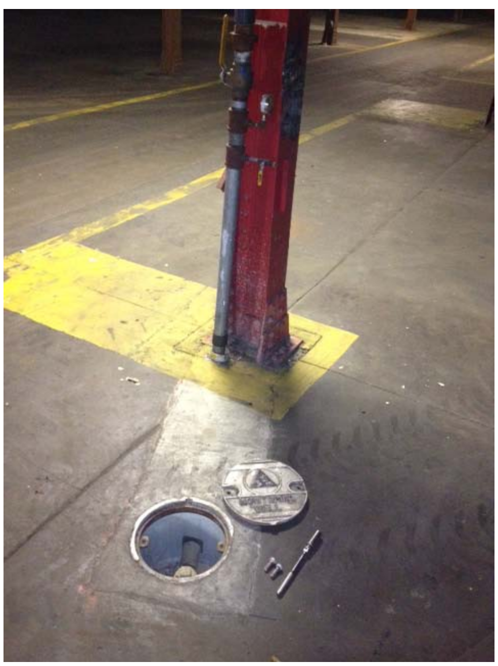
Summary of Historical Ambient Air Sampling Data

DATE	LOCATION	TRICHLOROETHENE, $\mu g/m^3$	STACK EMISSION RATE, pph
2/10/2006	API Separator	0.26	0.29
7/6/2006	Northwest of Air Stripper	0.60	0.23
3/31/2009	Upwind	Less than 2.1	0.13
3/31/2009	Downwind	Less than 2.1	0.13
4/1/2009	Upwind	Less than 2.1	0.08
4/1/2009	Downwind	Less than 2.1	0.08
4/7/2009	Upwind	Less than 2.1	0.08
4/7/2009	Downwind	Less than 2.1	0.08
7/22/2009	Upwind	Less than 2.1	0.18
7/22/2009	Downwind	Less than 2.1	0.18
8/4/2009	Upwind	Less than 2.1	0.18
8/4/2009	Downwind	Less than 2.1	0.18
8/6/2009	Upwind	Less than 2.1	0.18
8/6/2009	Downwind	Less than 2.1	0.18
3/21/2012	East side	0.14	0.13
10/25/2012	Northeast of Air Stripper	Less than 0.11	0.13

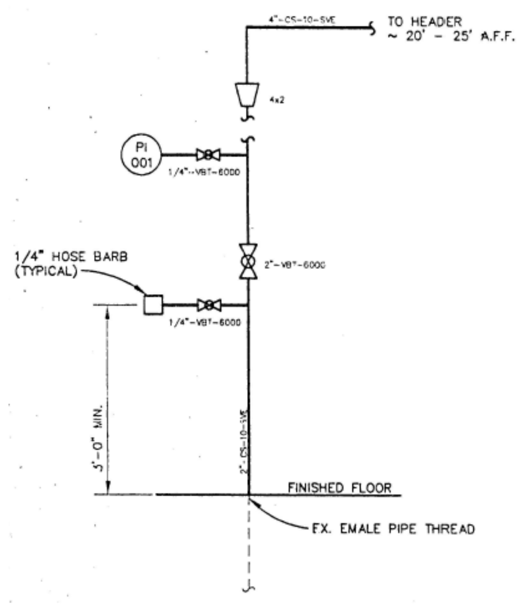
None of the ambient samples have exceeded USEPA screening levels for ambient air, and most of the samples were obtained during periods of time when total emissions from the permitted stack were higher than the total emissions generated with the SSDPS in full operation. Therefore the emissions resulting from the SSDPS will not have an adverse impact on the ambient air quality.

PHOTOGRAPHS

Blower, filter and knockout tank



Typical soil vapor extraction well and schematic

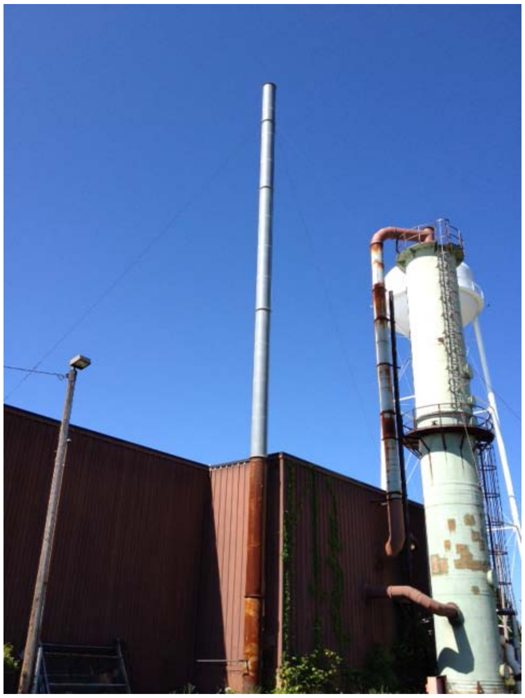


TYPICAL WELL HEAD DETAIL

NOT TO SCALE

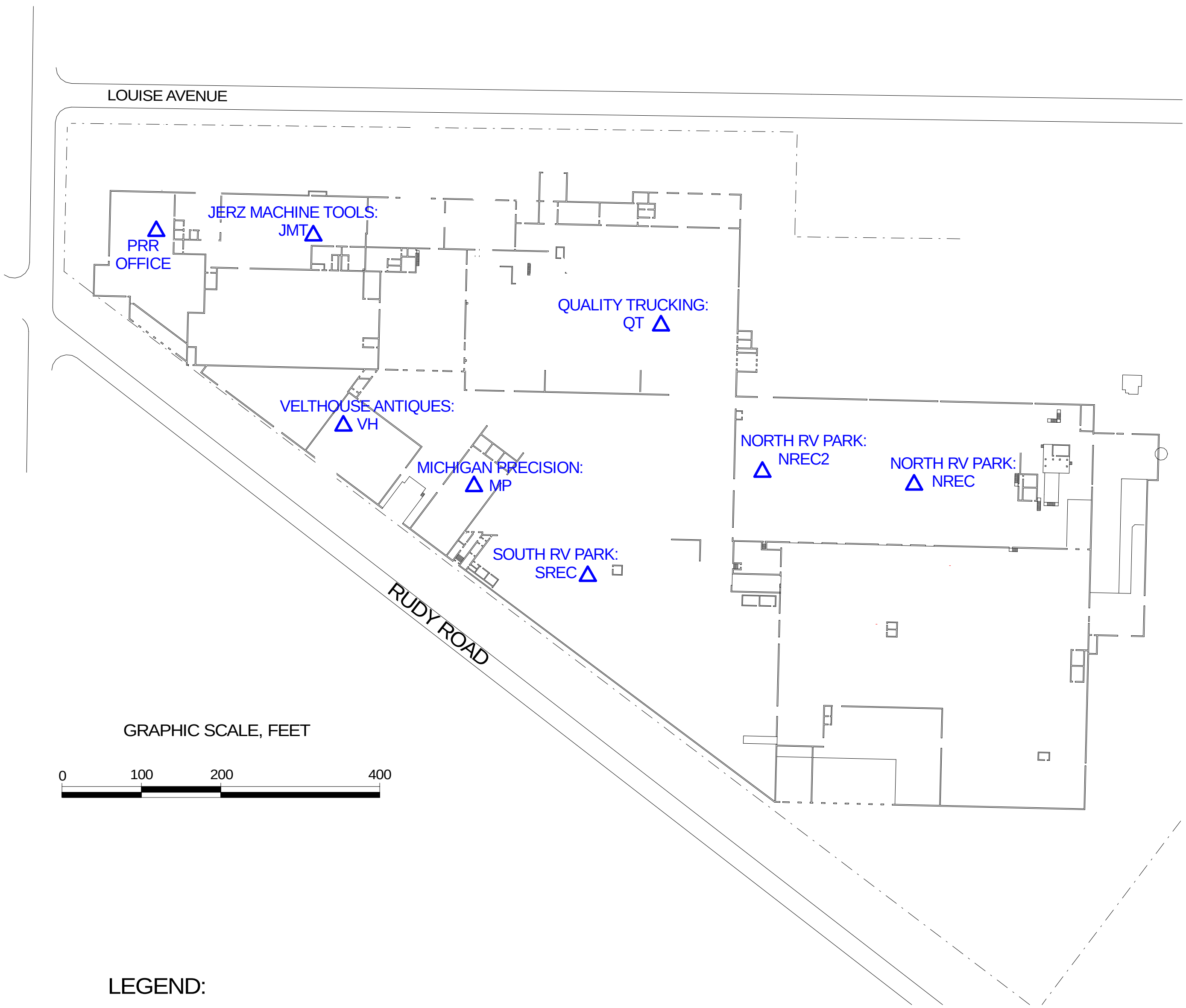
Vapor monitoring point; typical of VMP-1, 2, 3 and 10

Vapor monitoring point; typical of VMP 11 - 17



Air discharge stack and groundwater air stripper

FIGURES



LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

INDOOR AIR AND SUB-SLAB SAMPLING LOCATION

Prepared By:

R. David Mursch, P.E.

Geotechnical and Environmental Engineer

104 Rivercliff Drive ~ Connelly Springs, NC 28612
Phone: (828) 234-5906
e-mail: davidmursch@earthlink.net

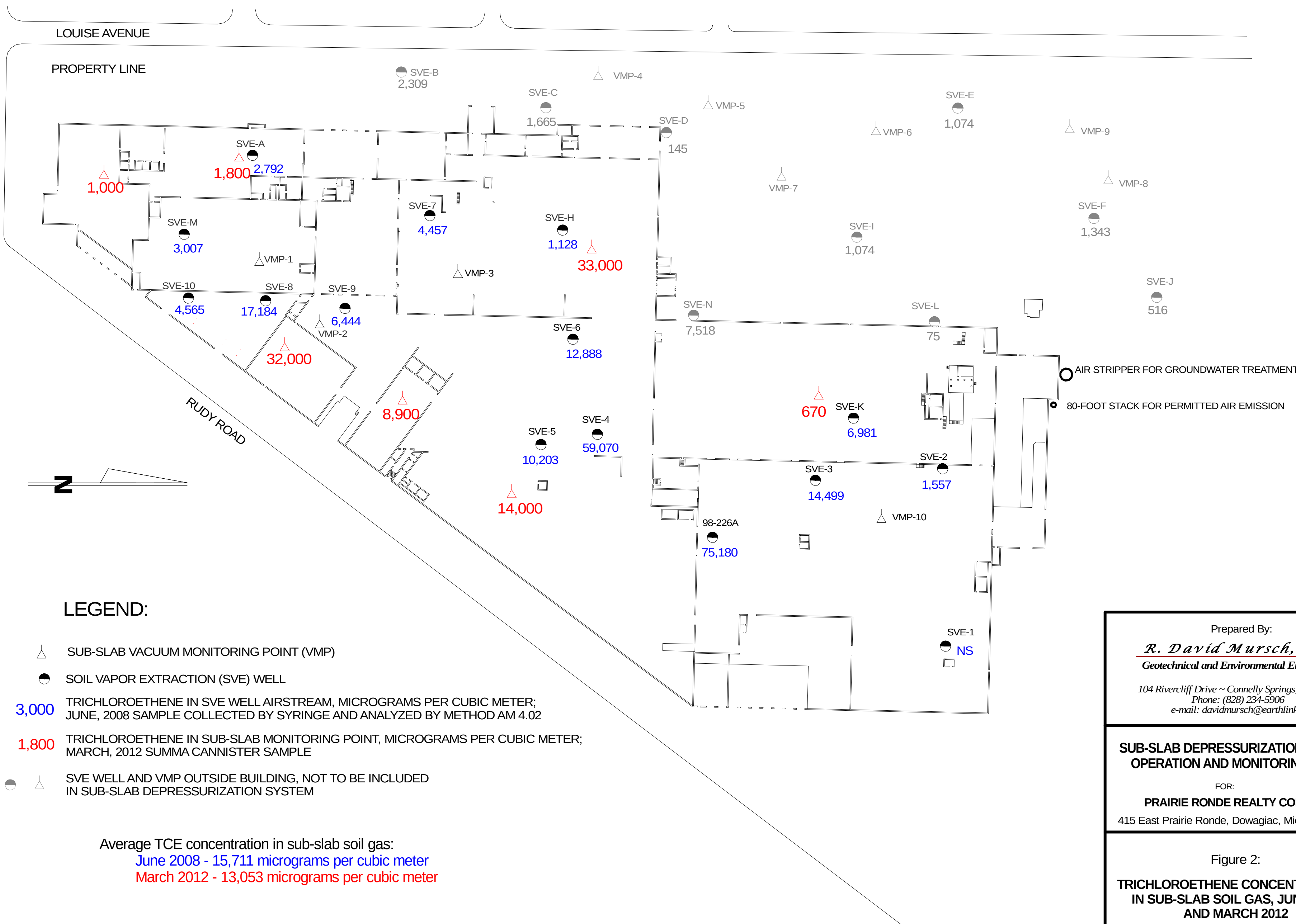
SUB-SLAB DEPRESSURIZATION SYSTEM OPERATION AND MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 1:

INDOOR AIR AND SUB-SLAB SAMPLE LOCATIONS



LEGEND:

SUB-SLAB VACUUM MONITORING POINT (VMP)

SOIL VAPOR EXTRACTION (SVE) WELL

3,000 TRICHLOROETHENE IN SVE WELL AIRSTREAM, MICROGRAMS PER CUBIC METER; JUNE, 2008 SAMPLE COLLECTED BY SYRINGE AND ANALYZED BY METHOD AM 4.02

1,800 TRICHLOROETHENE IN SUB-SLAB MONITORING POINT, MICROGRAMS PER CUBIC METER; MARCH, 2012 SUMMA CANNISTER SAMPLE

SVE WELL AND VMP OUTSIDE BUILDING, NOT TO BE INCLUDED IN SUB-SLAB DEPRESSURIZATION SYSTEM

Average TCE concentration in sub-slab soil gas:
June 2008 - 15,711 micrograms per cubic meter
March 2012 - 13,053 micrograms per cubic meter

Prepared By:
R. David Mursch, P.E.
Geotechnical and Environmental Engineer
104 Rivercliff Drive ~ Connelly Springs, NC 28612
Phone: (828) 234-5906
e-mail: davidmursch@earthlink.net

SUB-SLAB DEPRESSURIZATION SYSTEM OPERATION AND MONITORING PLAN

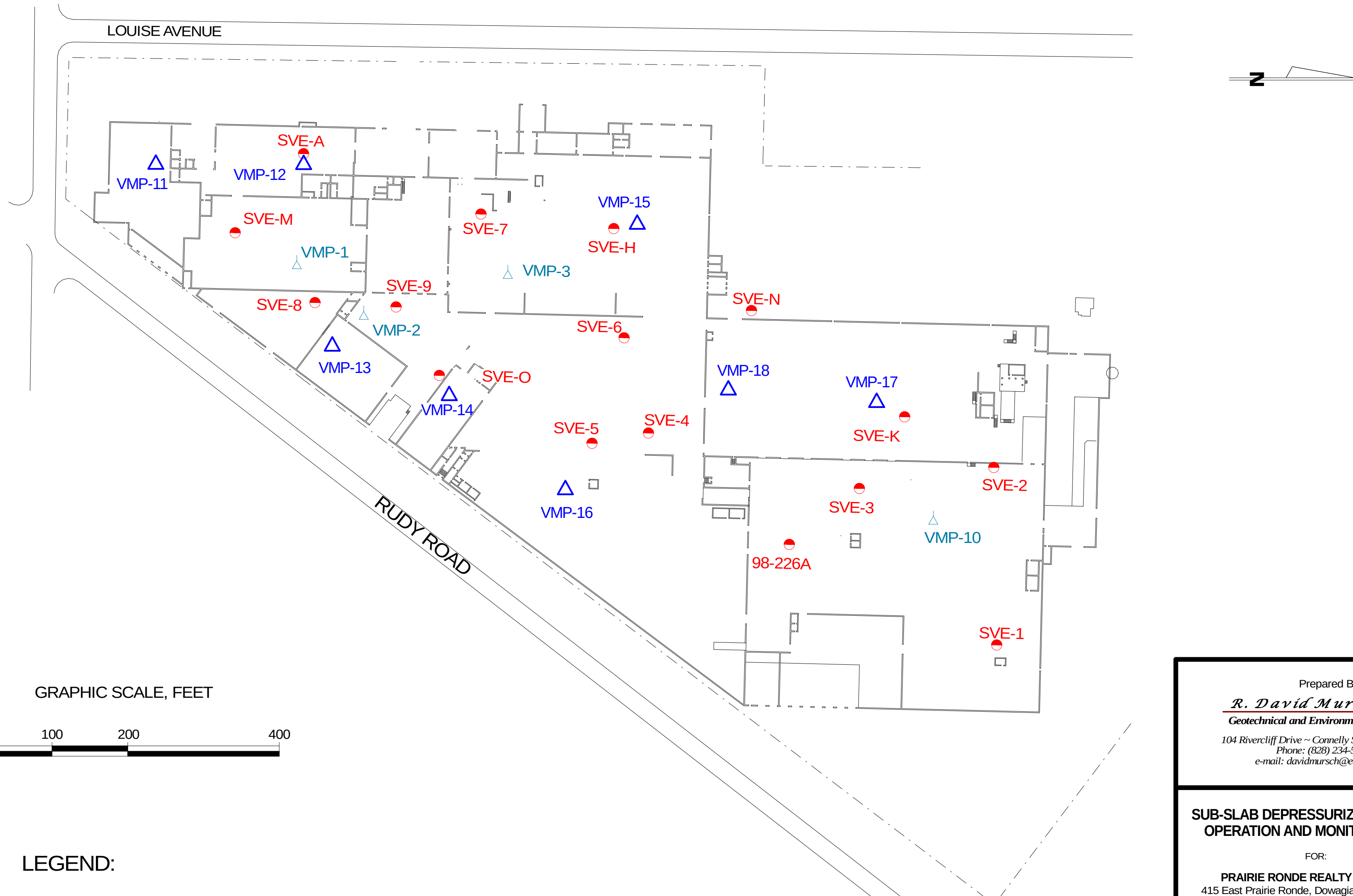
FOR:

PRAIRIE RONDE REALTY COMPANY

415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 2:

TRICHLOROETHENE CONCENTRATIONS IN SUB-SLAB SOIL GAS, JUNE 2008 AND MARCH 2012



GRAPHIC SCALE, FEET

0 100 200 400

LEGEND:

- PRAIRIE RONDE REALTY PROPERTY LINE
- SSDPS EXTRACTION POINTS (FORMER SOIL VAPOR EXTRACTION WELLS)
- VACUUM MONITORING POINT (FOR THE FORMER SVE SYSTEM)
- NEW SSDPS SAMPLING PORT AND VACUUM MONITORING POINT (VMP)

Prepared By:

R. David Mursch, P.E.

Geotechnical and Environmental Engineer

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e-mail: davidmursch@earthlink.net

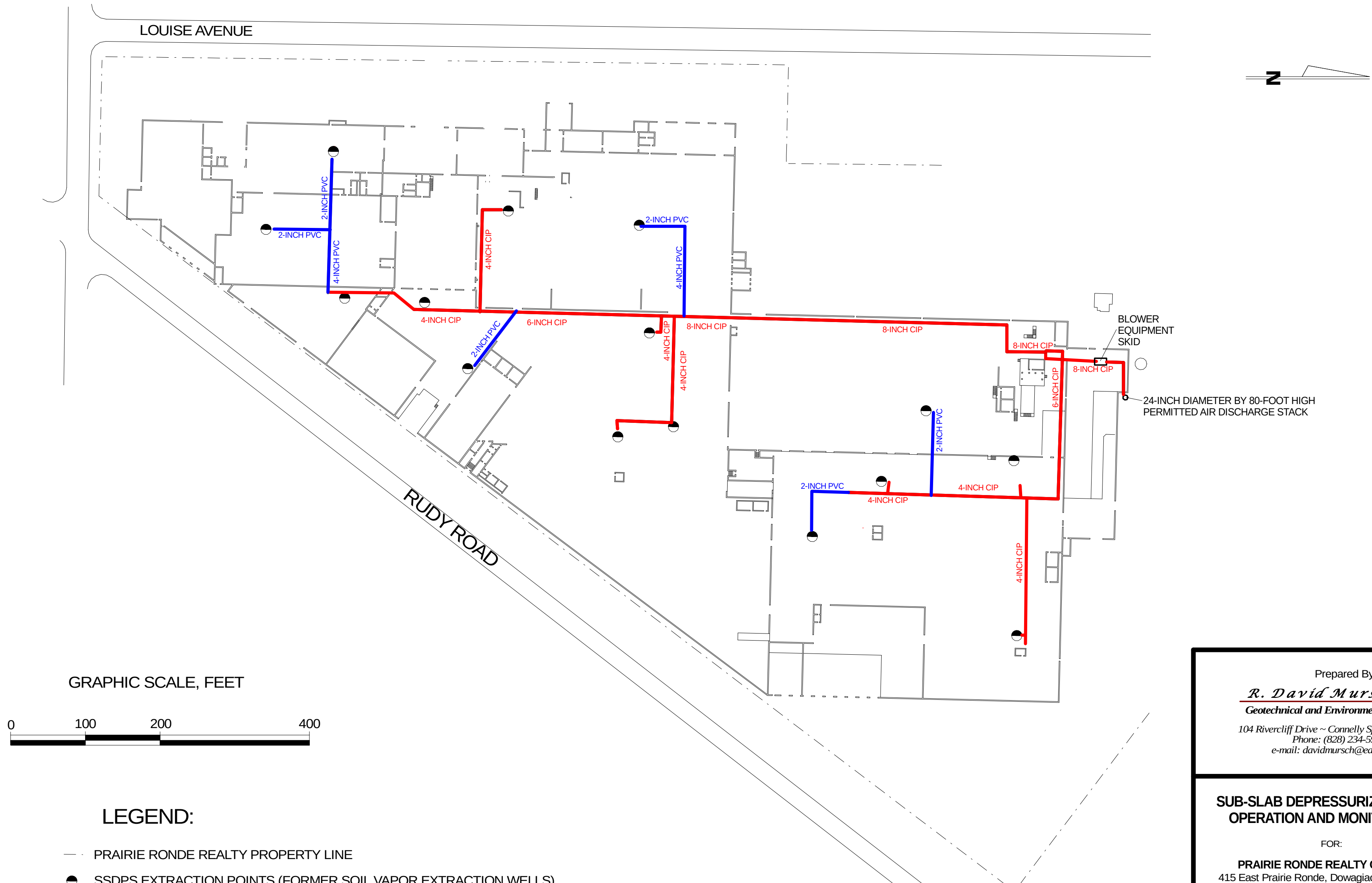
SUB-SLAB DEPRESSURIZATION SYSTEM OPERATION AND MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 3:

SUB-SLAB DEPRESSURIZATION VAPOR EXTRACTION AND VACUUM MONITORING POINTS



LEGEND:

PRAIRIE RONDE REALTY PROPERTY LINE

SSDPS EXTRACTION POINTS (FORMER SOIL VAPOR EXTRACTION WELLS)

SCHEDULE 80 PVC PIPE OVERHEAD TRANSMISSION LINE FOR VAPOR EXTRACTION WELLS

CAST IRON PIPE (CIP) OVERHEAD TRANSMISSION LINE FOR VAPOR EXTRACTION WELLS

Prepared By:

R. David Mursch, P.E.

Geotechnical and Environmental Engineer

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Phone: (828) 234-5906
e-mail: davidmursch@earthlink.net

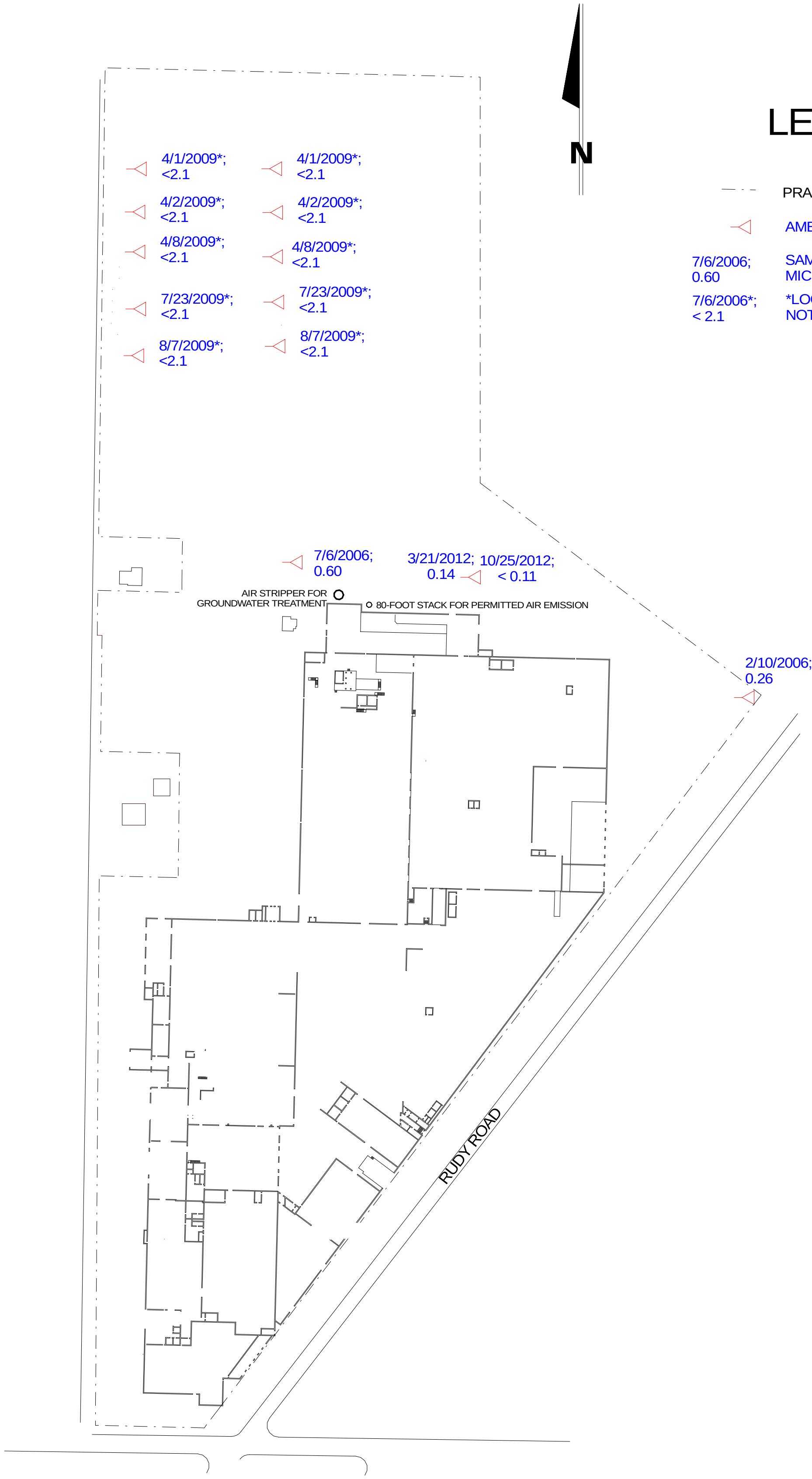
SUB-SLAB DEPRESSURIZATION SYSTEM OPERATION AND MONITORING PLAN

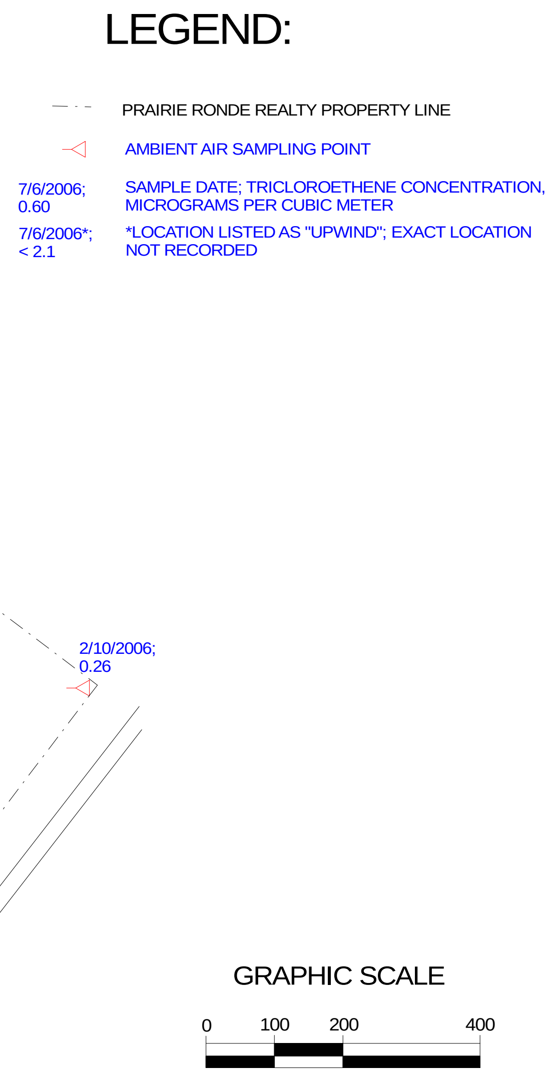
FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

Figure 4:

TRANSMISSION PIPING SYSTEM FOR SUB-SLAB DEPRESSURIZATION VAPOR EXTRACTION NETWORK





Prepared By:

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SUB-SLAB DEPRESSURIZATION SYSTEM OPERATION AND MONITORING PLAN

FOR:

PRAIRIE RONDE REALTY COMPANY
415 East Prairie Ronde, Dowagiac, Michigan 49047

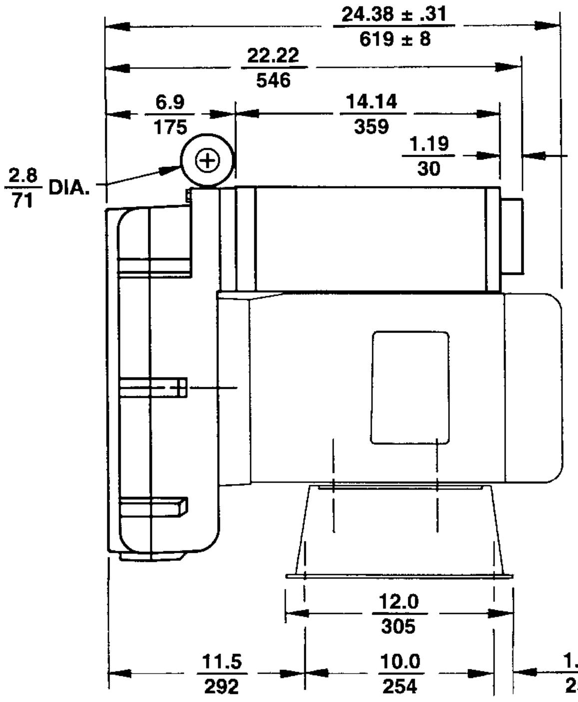
Figure 5:

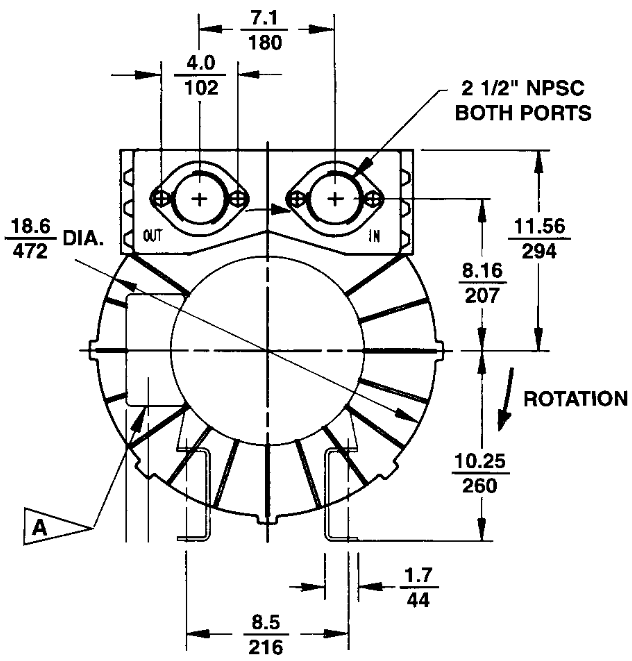
HISTORICAL AMBIENT AIR SAMPLES

BLOWER DATA

EN 858 & CP 858
Sealed Regenerative Blower w/Explosion-Proof Motor

Scale CAD drawing available upon request.





DIMENSIONS: IN / MM
TOLERANCES: .XX ± .1 / 2.5
(UNLESS OTHERWISE NOTED)

A ▷ 0.75" NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

SPECIFICATIONS

MODEL	EN858BD72WL		EN858BD86WL	EN858BA72WL		CP858FZ72WLR
Part No.	038744		038745	080070		038980
Motor Enclosure – Shaft Material	Explosion-proof – **CS**		Explosion-proof – **CS**	Explosion-proof – **CS**		Chem XP – **SS**
Horsepower	10.0		10.0	7.5		Same as EN858BD72WL – 038744 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency [1]	Three - 60 Hz		Three - 60 Hz	Three - 60 Hz		
Voltage [1]	230	460	575	230	460	
Motor Nameplate Amps	24	12	9.6	17	8.5	
Max. Blower Amps [3]	24	12	11.6	26	13	
Inrush Amps	162	81	93	126	63	
Starter Size	2	1	1	1	1	
Service Factor	1.0		1.0	1.0		
Thermal Protection [2]	Class B - Pilot Duty		Class B - Pilot Duty	Class B - Pilot Duty		
XP Motor Class – Group	I-D, II-F&G		I-D, II-F&G	I-D, II-F&G		
Shipping Weight	332 lb (151 kg)		332 lb (151 kg)	320 lb (145 kg)		

1 Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

2 Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

3 Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

Specifications subject to change without notice. Please consult your Local Field Sales Engineer for specification updates.

Rev. 2/04

EN 858 & CP 858
Sealed Regenerative Blower w/Explosion-Proof Motor

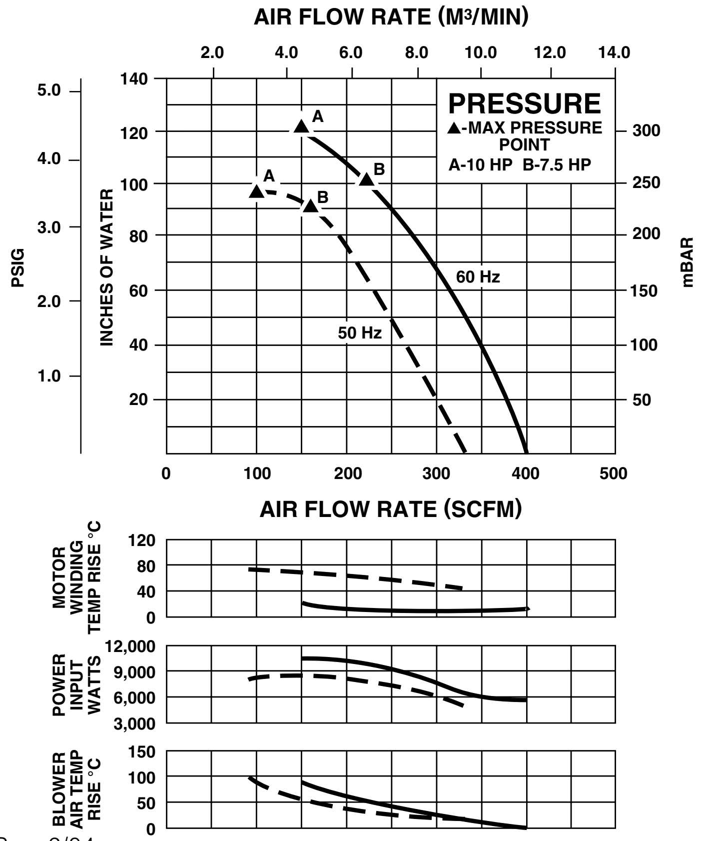
FEATURES
- Manufactured in the USA – ISO 9001 compliant
- Maximum flow: 400 SCFM
- Maximum pressure: 120 IWG
- Maximum vacuum: 98 IWG
- Standard motor: 10 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

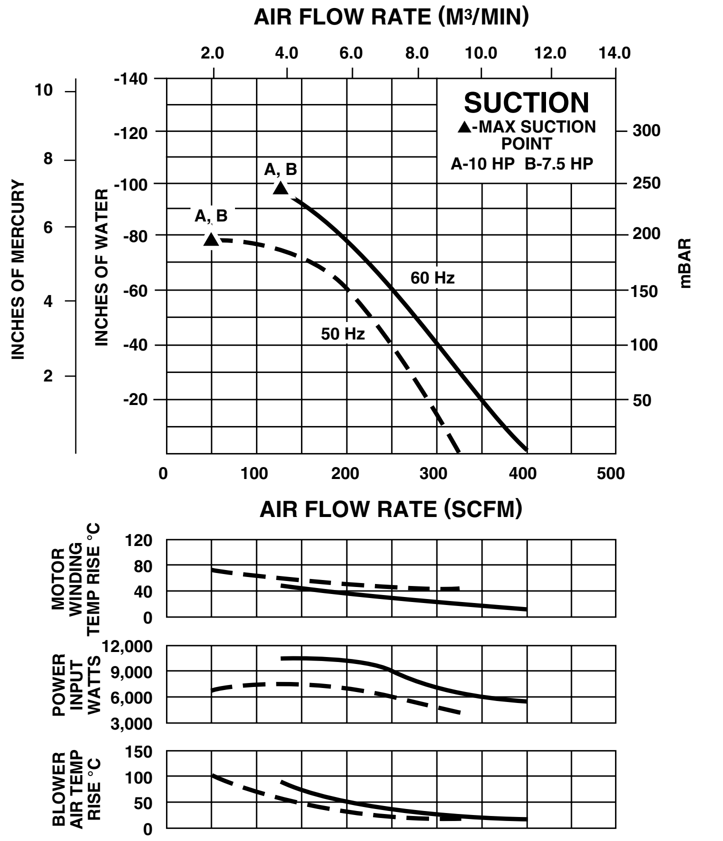
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

BLOWER PERFORMANCE AT STANDARD CONDITIONS





Rev. 2/04

AIR PERMIT

STATE OF MICHIGAN

DEPARTMENT OF ENVIRONMENTAL QUALITY

LANSING

RICK SNYDER
GOVERNOR

DAN WYANT
DIRECTOR

June 26, 2012

Mr. Brian DeLong, Manager
Prairie Ronde Realty Company
415 East Prairie Ronde Street
Dowagiac, Michigan 49047

Dear Mr. DeLong:

This letter is in reference to your Permit to Install application for a vapor depressurization system (State Registration Number B1557) located at 415 East Prairie Ronde Street, Dowagiac, Michigan. This application, identified as No. 742-83F, has been evaluated and approved by the Air Quality Division (AQD), pursuant to the delegation of authority from the Michigan Department of Environmental Quality (DEQ).

This approval is based upon and subject to compliance with all administrative rules promulgated pursuant to Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), and conditions stipulated in the attached supplement. Please review these conditions thoroughly so that you may take the actions necessary to ensure compliance with all of these conditions.

Also, Permit to Install No. 742-83E has been voided because the equipment is now covered by Permit to Install No. 742-83F.

To help us improve the service we provide our customers, we encourage you to complete a *Permit to Install Customer Service Survey* on the following Web page:

http://www.michigan.gov/documents/deq/DEQEval_29-pti-customerservice_287285_7.html

Please contact me if you have any questions regarding this permit.

Sincerely,

Nicholas Zabrodsky

Nicholas Zabrodsky, Sr. Environmental Engineer
Chemical Process Unit
Permit Section, Air Quality Division
517-373-4921
zabrodskyn@michigan.gov

Attachment
cc/att: Ms. Mary Douglas, DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

June 21, 2012

PERMIT TO INSTALL
742-83F

ISSUED TO
Prairie Ronde Realty Company

LOCATED AT
415 East Prairie Ronde Street
Dowagiac, Michigan

IN THE COUNTY OF
Cass

STATE REGISTRATION NUMBER
B1557

The Air Quality Division has approved this Permit to Install, pursuant to the delegation of authority from the Michigan Department of Environmental Quality. This permit is hereby issued in accordance with and subject to Section 5505(1) of Article II, Chapter I, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Pursuant to Air Pollution Control Rule 336.1201(1), this permit constitutes the permittee's authority to install the identified emission unit(s) in accordance with all administrative rules of the Department and the attached conditions. Operation of the emission unit(s) identified in this Permit to Install is allowed pursuant to Rule 336.1201(6).

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: **May 8, 2012**	
DATE PERMIT TO INSTALL APPROVED: **June 21, 2012**	SIGNATURE: MaryAnn Dolehanty
DATE PERMIT VOIDED:	SIGNATURE:
DATE PERMIT REVOKED:	SIGNATURE:

PERMIT TO INSTALL
Common Abbreviations / Acronyms

Common Acronyms		Pollutant / Measurement Abbreviations	
AQD	Air Quality Division	BTU	British Thermal Unit
BACT	Best Available Control Technology	°C	Degrees Celsius
CAA	Clean Air Act	CO	Carbon Monoxide
CEM	Continuous Emission Monitoring	dscf	Dry standard cubic foot
CFR	Code of Federal Regulations	dscm	Dry standard cubic meter
CO_2e	Carbon Dioxide Equivalent	°F	Degrees Fahrenheit
COM	Continuous Opacity Monitoring	gr	Grains
EPA	Environmental Protection Agency	Hg	Mercury
EU	Emission Unit	hr	Hour
FG	Flexible Group	H_2S	Hydrogen Sulfide
GACS	Gallon of Applied Coating Solids	hp	Horsepower
GC	General Condition	lb	Pound
GHGs	Greenhouse Gases	kW	Kilowatt
HAP	Hazardous Air Pollutant	m	Meter
HVLP	High Volume Low Pressure *	mg	Milligram
ID	Identification	mm	Millimeter
LAER	Lowest Achievable Emission Rate	MM	Million
MACT	Maximum Achievable Control Technology	MW	Megawatts
MAERS	Michigan Air Emissions Reporting System	ng	Nanogram
MAP	Malfunction Abatement Plan	NO_x	Oxides of Nitrogen
MDEQ	Michigan Department of Environmental Quality (Department)	PM	Particulate Matter
MSDS	Material Safety Data Sheet	PM10	PM less than 10 microns diameter
NESHAP	National Emission Standard for Hazardous Air Pollutants	PM2.5	PM less than 2.5 microns diameter
NSPS	New Source Performance Standards	pph	Pounds per hour
NSR	New Source Review	ppm	Parts per million
PS	Performance Specification	ppmv	Parts per million by volume
PSD	Prevention of Significant Deterioration	ppmw	Parts per million by weight
PTE	Permanent Total Enclosure	psia	Pounds per square inch absolute
PTI	Permit to Install	psig	Pounds per square inch gauge
RACT	Reasonably Available Control Technology	scf	Standard cubic feet
ROP	Renewable Operating Permit	sec	Seconds
SC	Special Condition	SO_2	Sulfur Dioxide
SCR	Selective Catalytic Reduction	THC	Total Hydrocarbons
SRN	State Registration Number	tpy	Tons per year
TAC	Toxic Air Contaminant	µg	Microgram
TEQ	Toxicity Equivalence Quotient	VOC	Volatile Organic Compound
VE	Visible Emissions	yr	Year

* For High Volume Low Pressure (HVLP) applicators, the pressure measured at the HVLP gun air cap shall not exceed ten (10) pounds per square inch gauge (psig).

GENERAL CONDITIONS

1. The process or process equipment covered by this permit shall not be reconstructed, relocated, or modified, unless a Permit to Install authorizing such action is issued by the Department, except to the extent such action is exempt from the Permit to Install requirements by any applicable rule. **(R 336.1201(1))**

2. If the installation, construction, reconstruction, relocation, or modification of the equipment for which this permit has been approved has not commenced within 18 months, or has been interrupted for 18 months, this permit shall become void unless otherwise authorized by the Department. Furthermore, the permittee or the designated authorized agent shall notify the Department via the Supervisor, Permit Section, Air Quality Division, Michigan Department of Environmental Quality, P.O. Box 30260, Lansing, Michigan 48909-7760, if it is decided not to pursue the installation, construction, reconstruction, relocation, or modification of the equipment allowed by this Permit to Install. **(R 336.1201(4))**

3. If this Permit to Install is issued for a process or process equipment located at a stationary source that is not subject to the Renewable Operating Permit program requirements pursuant to R 336.1210, operation of the process or process equipment is allowed by this permit if the equipment performs in accordance with the terms and conditions of this Permit to Install. **(R 336.1201(6)(b))**

4. The Department may, after notice and opportunity for a hearing, revoke this Permit to Install if evidence indicates the process or process equipment is not performing in accordance with the terms and conditions of this permit or is violating the Department's rules or the Clean Air Act. **(R 336.1201(8), Section 5510 of Act 451, PA 1994)**

5. The terms and conditions of this Permit to Install shall apply to any person or legal entity that now or hereafter owns or operates the process or process equipment at the location authorized by this Permit to Install. If the new owner or operator submits a written request to the Department pursuant to R 336.1219 and the Department approves the request, this permit will be amended to reflect the change of ownership or operational control. The request must include all of the information required by subrules (1)(a), (b), and (c) of R 336.1219 and shall be sent to the District Supervisor, Air Quality Division, Michigan Department of Environmental Quality. **(R 336.1219)**

6. Operation of this equipment shall not result in the emission of an air contaminant which causes injurious effects to human health or safety, animal life, plant life of significant economic value, or property, or which causes unreasonable interference with the comfortable enjoyment of life and property. **(R 336.1901)**

7. The permittee shall provide notice of an abnormal condition, start-up, shutdown, or malfunction that results in emissions of a hazardous or toxic air pollutant which continue for more than one hour in excess of any applicable standard or limitation, or emissions of any air contaminant continuing for more than two hours in excess of an applicable standard or limitation, as required in Rule 912, to the Department. The notice shall be provided not later than two business days after start-up, shutdown, or discovery of the abnormal condition or malfunction. Written reports, if required, must be filed with the Department within 10 days after the start-up or shutdown occurred, within 10 days after the abnormal conditions or malfunction has been corrected, or within 30 days of discovery of the abnormal condition or malfunction, whichever is first. The written reports shall include all of the information required in Rule 912(5). **(R 336.1912)**

8. Approval of this permit does not exempt the permittee from complying with any future applicable requirements which may be promulgated under Part 55 of 1994 PA 451, as amended or the Federal Clean Air Act.

9. Approval of this permit does not obviate the necessity of obtaining such permits or approvals from other units of government as required by law.

10. Operation of this equipment may be subject to other requirements of Part 55 of 1994 PA 451, as amended and the rules promulgated thereunder.

11. Except as provided in subrules (2) and (3) or unless the special conditions of the Permit to Install include an alternate opacity limit established pursuant to subrule (4) of R 336.1301, the permittee shall not cause or permit to be discharged into the outer air from a process or process equipment a visible emission of density greater than the most stringent of the following. The grading of visible emissions shall be determined in accordance with R 336.1303. **(R 336.1301)**
    a) A six-minute average of 20 percent opacity, except for one six-minute average per hour of not more than 27 percent opacity.
    b) A visible emission limit specified by an applicable federal new source performance standard.
    c) A visible emission limit specified as a condition of this Permit to Install.

12. Collected air contaminants shall be removed as necessary to maintain the equipment at the required operating efficiency. The collection and disposal of air contaminants shall be performed in a manner so as to minimize the introduction of contaminants to the outer air. Transport of collected air contaminants in Priority I and II areas requires the use of material handling methods specified in R 336.1370(2). **(R 336.1370)**

13. The Department may require the permittee to conduct acceptable performance tests, at the permittee's expense, in accordance with R 336.2001 and R 336.2003, under any of the conditions listed in R 336.2001. **(R 336.2001)**

SPECIAL CONDITIONS

EMISSION UNIT SUMMARY TABLE

The descriptions provided below are for informational purposes and do not constitute enforceable conditions.

Emission Unit ID	Emission Unit Description (Process Equipment & Control Devices)	Flexible Group ID
EU-SUBSLABSVE	Sub-slab vapor mitigation/depressurization system.	FG-SYSTEM
EU-AIRSTRIP	Groundwater treatment unit.	FG-SYSTEM
Changes to the equipment described in this table are subject to the requirements of R 336.1201, except as allowed by R 336.1278 to R 336.1290.		

FLEXIBLE GROUP SUMMARY TABLE

The descriptions provided below are for informational purposes and do not constitute enforceable conditions.

Flexible Group ID	Flexible Group Description	Associated Emission Unit IDs
FG-SYSTEM	EU-SUBSLAB-SVE and EU-AIRSTRIP	EU-SUBSLAB-SVE, EUAIRSTRIP

The following conditions apply to: FG-SYSTEM

DESCRIPTION: 1) Sub-slab vapor mitigation/depressurization system and 2) Groundwater treatment unit.

Emission Units: EU-SVE and EU-AIRSTRIP

POLLUTION CONTROL EQUIPMENT: None.

I. EMISSION LIMITS

Pollutant	Limit	Time Period/ Operating Scenario	Equipment	Testing / Monitoring Method	Underlying Applicable Requirements
1. VOC	2.28 pph	Test method	FG-SYSTEM	SC VI.1, SC VI.2	R 336.1225, R 336.1702(a)

II. MATERIAL LIMITS

1. The groundwater pumping rate through EU-AIRSTRIP shall not exceed 1,500 gallons per minute without prior written approval from the AQD District Supervisor. **(R 336.1225, R 336.1702(a))**

2. The vapor pumping rate through sub-slab vapor mitigation/depressurization system shall not exceed 1000 ACFM without prior written approval from the AQD District Supervisor. **(R 336.1225, R 336.1702(a))**

III. PROCESS/OPERATIONAL RESTRICTIONS

N/A

IV. DESIGN/EQUIPMENT PARAMETERS

N/A

V. TESTING/SAMPLING

Records shall be maintained on file for a period of five years. **(R 336.1201(3))**

N/A

VI. MONITORING/RECORDKEEPING

Records shall be maintained on file for a period of five years. **(R 336.1201(3))**

1. The permittee shall monitor and record, in a satisfactory manner, the vapor flow rate and the total VOC concentration of the influent vapor stream(s) to FG-SYSTEM and shall use this data to calculate VOC emission rates. This shall be done on a monthly basis until four valid samples, which pass all quality assurance and quality control requirements, have been obtained. Thereafter, the permittee shall monitor the influent vapor stream(s) to FG-SYSTEM for these parameters on a quarterly basis. The permittee shall submit any request for a change in the sampling frequency to the AQD District Supervisor for review and approval. **(R 336.1225, R 336.1702(a))**

2. The permittee shall monitor and record, in a satisfactory manner, the flow rate and the total VOC concentration of the air stripper influent water streams, and shall use this data to calculate VOC emission rates. This shall be done on a quarterly basis. The permittee shall determine the total VOC concentration using the standard MDEQ groundwater analytical scans for VOCs. The permittee shall submit any request for a change in the sampling frequency to the AQD District Supervisor for review and approval. **(R 336.1225, R 336.1702(a))**
3. The permittee shall complete all required calculations in a format acceptable to the AQD District Supervisor by the last day of the calendar month, for the previous calendar month, unless otherwise specified in any monitoring/recordkeeping special condition. **(R 336.1225, R 336.1702(a))**

VII. REPORTING

N/A

VIII. STACK/VENT RESTRICTIONS

The exhaust gases from the stacks listed in the table below shall be discharged unobstructed vertically upwards to the ambient air unless otherwise noted:

Stack & Vent ID	Maximum Exhaust Diameter/Dimensions (inches)	Minimum Height Above Ground (feet)	Underlying Applicable Requirements
1. SV-SYSTEM	24	80	R 336.1225

IX. OTHER REQUIREMENTS

N/A

Footnotes:
[1]This condition is state only enforceable and was established pursuant to Rule 201(1)(b).

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - AIR QUALITY DIVISION

PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE ONLY
APPLICATION NUMBER
742-83F

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at http://www.deq.state.mi.us/aps. Please call the AQD at 517-373-7023 if you have not been contacted within 15 days of your application submittal.

RECEIVED
MAY 0 8 2012
AIR QUALITY DIV.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)
SRN B 1 5 5 7 NAICS 3 3 1 4 2 1

2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency)
Prairie Ronde Realty Company

3. APPLICANT ADDRESS: (Number and Street)
415 East Prairie Ronde Street
MAIL CODE:

CITY: (City, Village or Township) Dowagiac
STATE: MI
ZIP CODE: 49047
COUNTY: Cass

4. EQUIPMENT OR PROCESS LOCATION: (Number and Street – if different than Item 3)

CITY: (City, Village or Township)
ZIP CODE:
COUNTY:

5. GENERAL NATURE OF BUSINESS:
Rental property for warehousing, machining, and offices

6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.)
This application is for re-starting an SVE system that was closed in 2008. The SVE system was formerly included as part of the facility's air permit but the SVE part of the system was removed by modification to the permit in 2009. The existing permit covers operation of a groundwater treatment system and air stripper, with emissions of VOCs (primarily TCE) on the order of 0.13 pph compared to the permit limit of 2.28 pph. The re-started SVE system should generate additional VOC emissions on the order of 0.0098 pph. See attached letter for description of the system and emissions estimates.

7. REASON FOR APPLICATION: (Check all that apply.)
☐ INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS
☒ RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS – **DATE INSTALLED:** 5/5/1994
☐ OTHER – DESCRIBE

8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S): 742-83E

9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? ☒ NOT APPLICABLE ☐ PENDING APPLICATION ☐ YES
PENDING APPLICATION OR ROP NUMBER:

10. AUTHORIZED EMPLOYEE: Brian DeLong
TITLE: Manager
PHONE NUMBER: (Include Area Code) 269-782-2141
SIGNATURE:
DATE: 5-7-12
E-MAIL ADDRESS: bdelong.PRR@comcast.co

11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application)
R. David Mursch
PHONE NUMBER: (Include Area Code) 828-234-5906

CONTACT AFFILIATION: Consultant
E-MAIL ADDRESS: davidmursch@earthlink.net

12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? ☒ YES ☐ NO

FOR DEQ USE ONLY - DO NOT WRITE BELOW

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: 5/8/12

DATE PERMIT TO INSTALL APPROVED: 6/21/12
SIGNATURE: MaryAnn Dolehanty

DATE APPLICATION / PTI VOIDED:
SIGNATURE:

DATE APPLICATION DENIED:
SIGNATURE:

A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - AIR QUALITY DIVISION

PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE ONLY
APPLICATION NUMBER
742-93E

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at http://www.deq.state.mi.us/aps. Please call the AQD at 517-373-7023 if you have not been contacted within 15 days of your application submittal.

RECEIVED
SEP 28 2009
AIR QUALITY DIV.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)
SRN: B I 5 5 7   NAICS: 5 6 2 9 1 0

2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency)
Prairie Ronde Realty Company

3. APPLICANT ADDRESS: (Number and Street)
415 East Prairie Ronde Street
MAIL CODE:

CITY: (City, Village or Township)	STATE:	ZIP CODE:	COUNTY:
Dowagiac	MI	49047	Cass

4. EQUIPMENT OR PROCESS LOCATION: (Number and Street – if different than Item 3)

CITY: (City, Village or Township)	ZIP CODE:	COUNTY:

5. GENERAL NATURE OF BUSINESS:
Warehousing

6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.)
The permit is for a groundwater remediation system consisting of a groundwater treatment unit (air stripper). The off-gas from the air stripper is treated in a three-bed VIC carbon absorption system before discharge through a stack to the atmosphere. The proposed modification is to eliminate the three-bed VIC carbon adsorption unit, because operating this unit is a burden to the facility and the monitoring data show that the treatment is not necessary in order to meet the permitted emission limits.

7. REASON FOR APPLICATION: (Check all that apply.)
- ☐ INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS
- ☒ RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS – **DATE INSTALLED:**
- ☐ OTHER – DESCRIBE

8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S): 742-83D

9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? ☐ NOT APPLICABLE ☐ PENDING APPLICATION ☒ YES
PENDING APPLICATION OR ROP NUMBER: 742-83D

10. AUTHORIZED EMPLOYEE:	TITLE:	PHONE NUMBER: (Include Area Code)
Brian DeLong	Facility Manager	269-782-2141
SIGNATURE: [signature]	DATE: 9-22-09	E-MAIL ADDRESS: bdelong.prr@comcast.ne
11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application) R. David Mursch		PHONE NUMBER: (Include Area Code) 828-234-5906
CONTACT AFFILIATION: Consultant		E-MAIL ADDRESS: davidmursch@earthlink.

12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? ☐ YES ☐ NO

FOR DEQ USE ONLY - DO NOT WRITE BELOW

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: 9-30-09	
DATE PERMIT TO INSTALL APPROVED: 10-20-09	SIGNATURE: [signature]
DATE APPLICATION / PTI VOIDED: 6/21/12	SIGNATURE: [signature]
DATE APPLICATION DENIED:	SIGNATURE:

A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL

EQP 5615E (Rev. 09/2006)

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

October 20, 2009

PERMIT TO INSTALL
No. 742-83E

ISSUED TO
Prairie Ronde Realty Company

LOCATED AT
415 East Prairie Ronde Street
Dowagiac, Michigan 49047

IN THE COUNTY OF
Cass

STATE REGISTRATION NUMBER
B1557

The Air Quality Division has approved this Permit to Install, pursuant to the delegation of authority from the Michigan Department of Environmental Quality. This permit is hereby issued in accordance with and subject to Section 5505(1) of Article II, Chapter I, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Pursuant to Air Pollution Control Rule 336.1201(1), this permit constitutes the permittee's authority to install the identified emission unit(s) in accordance with all administrative rules of the Department and the attached conditions. Operation of the emission unit(s) identified in this Permit to Install is allowed pursuant to Rule 336.1201(6).

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: **9/30/2009**	
DATE PERMIT TO INSTALL APPROVED: **10/20/2009**	SIGNATURE: William A. Presson
DATE PERMIT VOIDED: 6/21/12	SIGNATURE: MaryAnn Dolehanty
DATE PERMIT REVOKED:	SIGNATURE:

Appendix K

Annotated List of Site Assessment Reports

Appendix K – Annotated List of Site Assessment Reports

1. *Documentation of Hydrogeological and Source Area Investigations; Appendix A to the Remedial Action Plan,* by EDI Engineering & Science dated January 1984. This report was a Site-wide hydrogeological investigation that included complete horizontal and vertical delineation of hazardous substances in soils/source areas and investigation of groundwater and surface water. The report included analysis of soil, groundwater and surface water samples for VOCs, metals and other COPCs.

2. *Environmental Assessment – Phase I and II*, by DELTA Environmental Consultants, Inc. (DELTA) dated December 6, 1990. This report included soil data obtained during a Site-wide assessment conducted for a possible real estate transaction and included soil borings and soil analysis for VOCs, semi-volatile organic compounds (SVOCs) and metals.

3. *Baseline Environmental Assessment* (BEA) by Benchmark Engineering Inc. dated October, 1995. The BEA was a comprehensive Site-wide investigation intended to meet the 1995 requirements of Michigan Act 451 (NREPA) for a baseline environmental assessment. The study included a Site-wide review of current and historical operations for potential source areas where hazardous substances could have been released to the environment, identification of COPCs for each identified source area, and investigation of each area with soil and groundwater sampling.

4. *Report of Furnace Brick Removal*, by R. David Mursch, P.E. dated August 31, 1997. PRR remediated an area of historical (pre-1984) disposal of furnace bricks at the northwest corner of the property, in accordance with a work plan approved by the MDEQ. The remediation included analysis of twenty-three soil samples for copper in accordance with the MDEQ requirements for Verification of Soil Remediation (VSR) sampling.

5. *Field Logs and Tables* provided by the MDEQ in 2001 (Tables 8, 9 and 10). In 2000 and 2001 the MDEQ performed an assessment of surface water and groundwater potentially associated with the PRR property. The assessment included analysis of surface water samples from Pine Lake, Pine Lake Drain, and the unnamed drain west of Louise Avenue; surface water samples from seeps along the drains and Pine Lake; groundwater samples from direct push technology (DPT) borings; and soil samples from DPT borings and shallow grab samples.

6. *Phase I Current Conditions Report*, by SECOR International, Inc. dated March, 2002. In 2002, SECOR International Inc. performed a comprehensive re-assessment in two phases. The Phase I assessment included analysis of surface water samples from Pine Lake, Pine Lake Drain, the unnamed drain, and several of the seeps identified in the previous MDEQ investigation; sediment samples from Pine Lake and the seeps and drains; and groundwater samples obtained from beneath Pine Lake.

7. *Report of Subsurface Exploration – Phase I Plant Modernization*, by R. David Mursch, P. E. dated October 30, 2002 (Table 16). In 2002, a geotechnical investigation was performed inside the plant building for a possible plant modernization. As part of this investigation, soil samples from an area of planned foundation excavations were analyzed for VOCs and metals.

8. *Phase II Remedial Investigation Report*, by SECOR International, Inc. dated December 2002. Phase II of the SECOR investigation included sampling of soil and groundwater for VOC and metals analyses.

9. *Integrated Geophysical Investigation Summary Report*, by Weston Solutions of Michigan, Inc. dated August 2004. During 2002, MDEQ performed a Site-wide geophysical survey including soil and groundwater samples from several borings.

10. *Soil Gas Data Evaluation,* by Earth Tech dated June 2005. At the request of the USEPA, PRR collected soil gas samples for VOC analysis to screen for COPCs in the vadose zone.

11. *Current Conditions Report,* by R. David Mursch, P.E. dated July 31, 2005C. This report included a supplemental Site-wide assessment of the soil and groundwater that was intended to serve as an update to the SECOR Phase I and Phase II investigations listed above. The work included additional explorations to more closely define the outer limits of the VOC-impacted groundwater, additional vertical profile borings to provide supplemental data on the vertical extent of groundwater impact, and detailed assessment of source areas and two 'hot spot' areas of relatively higher VOC impact that SECOR had identified within the general area of impacted groundwater.

12. *Third Quarter 2005 Monitoring Report*, by R. David Mursch P.E. dated October 14, 2005A. During 2005, several monitoring wells were sampled for total metals analysis using low-flow methods to further assess for potential metals impact to Site groundwater.

13. *Air Sampling Results,* by Earth Tech dated May 2006. Indoor, sub-slab and ambient air samples were analyzed at five residences across from the plant.

14. *Third Quarter 2006 Monitoring Report,* by R. David Mursch, PE, dated December 31, 2006. This report included results of sampling residential wells to the west and northwest of PRR, additional assessment of the deep aquifer, supplemental groundwater sampling for definition to the northwest, and assessment at hot spots identified in previous assessments.

15. *Results of Ecological Studies,* by Earth Tech dated February 23, 2007A. This report includes results of soil sampling and analysis for the wetlands area north of the property.

16. *Ecological Studies – Surface Water Monitoring* by Earth Tech dated May 10, 2007b. This report presented results of surface water sampling and analysis for the seeps to the unnamed drain west of Louise Avenue.

17. *Second Quarter 2007 Monitoring Report,* by R. David Mursch, P.E. dated August 13, 2007. This report includes data from Direct Push Technology (DPT) borings north of the Old Borrow Pit (OBP) source area to further define VOC impacts in groundwater at this area.

18. *Groundwater Assessment for Supplemental Indoor Air Sampling*, by R. David Mursch, P.E. dated November 14, 2008. The report includes sampling of shallow groundwater west of the PRR property to assist in selecting residences for possible supplemental indoor air sampling.

19. *Report of Supplemental Soil Sampling,* by R. David Mursch, P.E. dated November 28, 2008. This report included sampling of soil for VOC analysis in areas of the plant that had been remediated, and demonstrated that the VOC concentrations in the soil have been remediated to levels below relevant MDEQ Part 201 criteria.

20. *Deep Aquifer Evaluation,* by R. David Mursch P.E. dated March 25, 2009A. This report evaluated groundwater data obtained from the deep aquifer downgradient of the OSSR source area.

21. *ABC®+ Pilot Test Status Report,* by R. David Mursch P.E. dated March 30, 2009C. This report presented data related to a pilot test for a chemical injection remediation technology at the OSSR.

22. *2009 Spring Vapor Intrusion Results*, by AECOM dated June 26, 2009. This report presented results of a comprehensive program of sampling indoor air at residences downgradient from the PRR property.

23. *Final Report of Deep Aquifer Evaluation*. R. David Mursch, September 2009B.

24. *2009 Indoor Air and Sub-Slab Sampling Summary Report for March through September 2009,* by AECOM dated September 2009.

Appendix K – Annotated List of Site Assessment Reports

25. *Human Health Risk Assessment and Screening Level Ecological Risk Assessment.* AECOM 2009*. Evaluates human health risks, except for indoor air. The Screening Level Ecological Risk Assessment portion of this report was revised, see AECOM 2011.*

26. *Indoor Air and Sub-Slab Sampling Summary Report for 401 Louise Street,* by AECOM dated February 2010.

27. *Ecological Risk Assessment. Step 1 and Step 2 Screening and Step 3A Refined Screening Assessment.* AECOM, 2011. Evaluates ecological risks, including risks to protected species in a nearby wetland.

28. *Report of ABC®+ Pilot Test*, by R. David Mursch, September 2011B*.*

29. Indoor Air and Sub-Slab Soil Gas Sam[pling Report for PRR Building. By AECOM, dated April 2012.

Appendix L

Most-Recent Analytical Data for Soil, Groundwater, Indoor Air and Sub-Slab Soil

Appendix L, Table 1
October 2012 Groundwater Data, Volatile Organic Compounds
Prairie Ronde Realty, Dowagiac, MI

WELL	Units	TRICHLOROETHENE	1,1,1-TRICHLOROETHANE	CIS-1,2 DICHLOROETHENE	TRANS-1,2-DICHLOROETHENE	VINYL CHLORIDE	OTHER (2)
Part 201 Criterion (1)		**5**	**89**	**70**	**100**	**2**	
MONITORING WELLS SCREENED ABOVE THE AQUITARD ZONE:							
83-17A	ug/L	< 1	< 1	< 1	< 1	< 1	
83-17B	ug/L	47	< 1	53	3.6	1.2	
83-19A	ug/L	14	< 1	2.5	< 1	< 1	
83-19B	ug/L	170	< 1	47	2.5	8.6	
83-21A	ug/L	< 1	< 1	< 1	< 1	< 1	
83-21B	ug/L	70	< 1	12	2.0	1.7	
83-23A	ug/L	1.5	< 1	< 1	< 1	< 1	
83-23B	ug/L	**340**	9.9	27	< 2	< 2	11DCA=7.5
83-24A	ug/L	32	< 1	3.1	< 1	< 1	
83-24B	ug/L	4.4	< 1	21	< 1	< 1	
83-28A	ug/L	< 1	< 1	32	< 1	< 1	
83-28B	ug/L	6.6	< 1	19	< 1	4.0	
96-201B (ABC+)	ug/L	120	5.8	< 1	< 1	< 1	
96-202B	ug/L	22	< 1	130	3.0	1.7	11DCE=1.8
96-203A	ug/L	**420**	< 5	12	< 5	< 5	
97-212B	ug/L	99	< 1	93	4.0	2.2	11DCE=2.0
97-213B	ug/L	24	< 5	510	72	< 5	
97-214B (ABC+)	ug/L	< 2	7.2	280	< 2	**250**	11DCA=81
98-215A (ABC+)	ug/L	18	1.2	3.0	< 1	< 1	
00-216A	ug/L	35	< 1	6.0	1.3	< 1	
98-218B	ug/L	46	< 1	31	5.6	< 1	
98-220A	ug/L	**820**	7.2	< 5	< 5	< 5	
98-223A	ug/L	59	< 1	70	< 1	< 1	
98-223A (Dup)	ug/L	56	< 1	70	< 1	< 1	
98-223B	ug/L	**210**	< 2.0	27	< 2.0	< 2.0	
98-224B	ug/L	95	< 1	20	3.7	< 1	
98-225B	ug/L	**2,700**	< 25	220	< 25	< 25	
98-226A	ug/L	**600**	< 5	< 5	< 5	< 5	
98-244A	ug/L	< 2.5	< 2.5	270	18	< 2.5	
98-245A	ug/L	**250**	< 2.5	42	3.2	< 2.5	
02-02	ug/L	170	4.4	< 2	< 2	< 2	CHLOR = 0.56
02-03	ug/L	2.7	< 1	< 1	< 1	< 1	
02-04	ug/L	130	< 1	19	5.3	< 1	
05-14	ug/L	66	< 1	1.2	< 1	< 1	
05-15	ug/L	1.1	< 1	< 1	< 1	< 1	
05-16	ug/L	16	< 1	4.7	1.0	< 1	

Appendix L, Table 1
October 2012 Groundwater Data, Volatile Organic Compounds
Prairie Ronde Realty, Dowagiac, MI

WELL	Units	TRICHLOROETHENE	1,1,1-TRICHLOROETHANE	CIS-1,2 DICHLOROETHENE	TRANS-1,2- DICHLOROETHENE	VINYL CHLORIDE	OTHER (2)	
Part 201 Criterion (1)		**5**	**89**	**70**	**100**	**2**		
CONTINUOUS MULTI-CHANNEL	ug/L							
06-17 / 1	ug/L	110	2.9	1.6	< 1	< 1		
06-17 / 2	ug/L	61	1.9	1.3	< 1	< 1		
06-18 / 1 (ABC+)	ug/L	46	110	**2,000**	< 10	**540**	11DCA=74	11DCE = 13
06-18 / 2 (ABC+)	ug/L	100	4.8	9.5	< 1	1.0	11DCA = 1.1	
06-19 / 1	ug/L	1.9	< 1	< 1	< 1	< 1		
06-19 / 2	ug/L	140	< 1	14	< 1	< 1		
06-19 / 3	ug/L	120	< 1	60	3.3	2.3		
06-20 / 1	ug/L	< 1	< 1	< 1	< 1	< 1		
06-20 / 2	ug/L	66	1.2	3.2	< 1	< 1		
06-20 / 3	ug/L	120	< 1	36	1.3	< 1	11DCA = 1.2	
06-20 / 4	ug/L	61	< 1	47	1.4	< 1		
06-21 / 1	ug/L	< 1	< 1	< 1	< 1	< 1		
06-21 / 2	ug/L	1.5	< 1	< 1	< 1	< 1	CHLOR = 0.31	
06-21 / 3	ug/L	7.2	< 1	15	< 1	< 1		
06-21 / 3 (Dup)	ug/L	7.1	< 1	15	< 1	< 1		
06-21 / 4	ug/L	< 1	< 1	140	2.9	2.0		
MONITORING WELLS SCREENED BELOW THE AQUITARD ZONE:								
98-201C	ug/L	< 1	< 1	< 1	< 1	< 1		
98-215C	ug/L	1.6	< 1	< 1	< 1	< 1		
98-217C	ug/L	3.9	< 1	2.4	< 1	< 1		
02-01	ug/L	< 1	< 1	< 1	< 1	< 1		
CONTINUOUS MULTI-CHANNEL TUBING WELLS - PORTS BELOW THE AQUITARD ZONE:								
06-17 / 3	ug/L	33	< 1	3.8	< 1	< 1		
06-17 / 4	ug/L	61	< 1	17	< 1	< 1	CHLOR = 0.25	
06-17 / 7	ug/L	4.5	< 1	8.6	< 1	< 1		
06-18 / 3	ug/L	71	1.3	20	< 1	1.5		
06-18 / 4	ug/L	69	1.0	19	< 1	1.8		
06-18 / 7	ug/L	120	3.4	120	< 1	4.4	11DCA = 2.2	
06-19 / 7	ug/L	95	< 1	21	< 1	< 1		
06-20 / 5	ug/L	< 1	< 1	< 1	< 1	< 1	Artesian, flowing	
06-20 / 6	ug/L	< 1	< 1	9.3	< 1	< 1		
PURGE WELLS:								
PW-1	ug/L	82	< 1	20	1.1	< 1		
PW-5	ug/L	200	< 2.5	67	4.5	< 2.5		
PW-8	ug/L	170	1.5	18	2.2	< 1		
PW-10	ug/L	180	< 2	12	2.0	< 2		

Appendix L, Table 1
October 2012 Groundwater Data, Volatile Organic Compounds
Prairie Ronde Realty, Dowagiac, MI

WELL	Units	TRICHLOROETHENE	1,1,1-TRICHLOROETHANE	CIS-1,2 DICHLOROETHENE	TRANS-1,2-DICHLOROETHENE	VINYL CHLORIDE	OTHER (2)
Part 201 Criterion (1)		**5**	**89**	**70**	**100**	**2**	
PW-12	ug/L	110	< 1	36	3.3	< 1	
PW-14	ug/L	61	< 1	15	< 1	< 1	
PW-15	ug/L	**380**	26	57	< 5	12	CHLOR = 1.2
PW-16	ug/L	190	< 2	85	< 2	< 2	
SPARGE INJECTION WELLS:							
IW-1 (ABC+)	ug/L	**4,100**	< 1,000	**110,000**	< 1000	**1800**	11DCA=**1,800**
IW-11	ug/L	200	< 1	44	8.3	< 1	
IW-14	ug/L	19	1.7	54	< 1	< 1	
IW-18	ug/L	1.2	< 1	140	11	3.5	
IW-21	ug/L	120	< 10	570	38	< 10	
IW-24	ug/L	**640**	< 10	210	< 10	< 10	
IW-25R	ug/L	**280**	< 2.5	420	36	< 2.5	
ABC+ PILOT TEST TEMPORARY 1-INCH WELLS:							
TW-1 (ABC+)	ug/L	**1,200**	**1,300**	**24,000**	< 20	**110**	11DCA=290 11DCE=**210**
TW-2 (ABC+)	ug/L	< 20	**130**	**1,700**	< 20	**32**	11DCA=54
TW-3 (ABC+)	ug/L	< 200	**400**	**21,000**	< 200	**1,800**	11DCA=340
TW-4 (ABC+)	ug/L	< 1	< 1	< 1	< 1	7.0	

NOTES: EPA Method 8260 for all analyses

< = Less than
Bold = Exceeds Part 201 Criterion
(Dup) = Duplicate Sample

11DCA = 1,1-Dichloroethane
11DCE = 1,1-Dichloroethene
CHLOR = Chloroform

(1) Lower of Part 201 GSI and Drinking Water Protection Criteria (MDEQ, 2004 (September 28, 2012 Update).
(2) Criteria for other chemicals: 1,1-DCA=740 ug/L; 1,1-CE=7; CHLORO=80.

Appendix L, Table 2
September 2006 Groundwater Data - Metals
Prairie Ronde Realty
Dowagiac, Michigan

WELL	DEPTH, FEET	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	LEAD	NICKEL	ZINC
Part 201 GSI Criteria (1)	-	10	1300 (2)	4.7 (2)	170 (2)	21 (2)	46 (2)	120 (2)	280 (2)
Part 201 Drinking Water Criteria (1)	-	10	2,000	5	100	1,000	4	100	2,400
96-203A	26	< 1.0	76	< 0.20	< 1.0	< 1.0	< 1.0	1.2e	12e
98-219A	30	< 1.0	82	< 0.20e	< 1.0	6.8	< 1.0	6.2e	11e
98-219A (Dup)	30	< 1.0	84	< 0.20	1.0	7.4	< 1.0	6.7e	12e
98-221A	30	< 1.0	7.9	< 0.20	2.0	1.7	< 1.0	1.5e	11e
98-222A	37	< 1.0	55	< 0.20	< 1.0	1.8	< 1.0	1.3e	14e
98-223A	23	< 1.0	21	< 0.20	< 1.0	< 1.0	< 1.0	< 1.0e	30e
98-223A (Dup)	23	< 1.0	21	< 0.20	< 1.0	< 1.0	< 1.0	< 1.0e	10e
98-224B	42	< 1.0	63	< 0.20	< 1.0	1.9	< 1.0	< 1.0e	12e
98-226A	30	1.3	37	< 0.20	2.6	3.7	< 1.0	< 1.0e	17e
06-19 / 1	25	1.9	11	< 0.20	1.1	< 1.0	< 1.0	1.4e	5.5e
06-23	33	3.4	44	< 0.20	< 1.0	1.2	< 1.0	< 1.0e	8.5e
06-24	23	< 1	46	< 0.20	< 1.0	1.1	< 1.0	< 1.0e	8.0e
06-24 (Dup)	23	< 1	46	< 0.20	< 1.0	1.2	< 1.0	< 1.0e	4.5e
06-25	22	< 1	26	< 0.20	6.3	2.2	< 1.0	< 1.0e	11e
RL-2	40	1.2	74	0.28	< 1.0	< 1.0	4.4	< 1.0e	290

NOTES:

All samples were analyzed by EPA Method 6020A; results are in micrograms per liter.
All samples were obtained using low flow procedures.
< = Less than.
(Dup) = Duplicate sample
e = Data qualified by laboratory; see Mursch, 2006
Shaded concentration exceeds GSI criterion (this is an upgradient background well)
(1) MDEQ, 2004 (September 28, 2012 Update)
(2) Calculated based on site-spcific hardness of 275 mg/L as CaCO3 (Mursch, 2002)

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		State Default Background Levels	Part 201 Residential Critera for Protection of Drinking Water (2)	Part 201 Residential Criteria for Direct Contact/Soil Ingestion (2)	Ecological Screening Levels (3) ug/Kg	Detection Frequency	Maximum Detected Concentration (ug/Kg)	Ratio of Maximum Detected Concentration to Ecological Screening Level	SB-11	SB-15	SB-16	SB-19	SB-19	08-G5	08-G5	08-G6	G-14	G-17	G-19
Depth (ft bgs)									8-12	0-2	2-4	4-8	12-16 Straddles Water Table	7	12	15	15-19	15-19	19-21
Sample Date									07/17/02	06/06/02	06/06/02	07/19/02	07/19/02	10/22/08	10/22/08	10/22/08	08/02/95	08/03/95	08/02/95
Sample Location									CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL
Sampled By									SECOR	SECOR	SECOR	SECOR	SECOR	D. Mursch	D. Mursch	D. Mursch	Benchmark	Benchmark	Benchmark
Analyzed By									Merit	Merit	Merit	Merit	Merit	TriMatrix	TriMatrix	TriMatrix	Deep South	Deep South	Deep South
References									A	A	A	A	A	B	B	B	B	B	B
VOLATILE ORGANICS																			
Trichloroethene	(µg/kg)	NA	100	500,000	12,400	9 / 32	720	0.1	< 50	< 50	< 50	190	< 50	< 56	420	< 65	--	--	--
1,1,1-Trichloroethane	(µg/kg)	NA	4,000	460,000	29,800	0 / 20	-	-	< 50	< 50	< 50	< 50	< 50	< 56	< 57	< 65	--	--	--
cis-1,2-Dichloroethene	(µg/kg)	NA	1,400	640,000	NA	1 / 26	90	-	< 50	< 50	< 50	< 50	< 50	< 56	< 57	< 65	--	--	--
trans-1,2-Dichloroethene	(µg/kg)	NA	2,000	1,400,000	784	0 / 26	-	-	< 50	< 50	< 50	< 50	< 50	< 56	< 57	< 65	--	--	--
Tetrachloroethene	(µg/kg)	NA	100	88,000	9,920	0 / 20	-	-	< 50	< 50	< 50	< 50	< 50	< 56	< 57	< 65	--	--	--
Methylene chloride	(µg/kg)	NA	100	1,300,000	4,050	0 / 20	0	0.000	< 300	< 300	< 300	< 300	< 300	< 280	< 290	< 320	--	--	--
Vinyl chloride	(µg/kg)	NA	40	3,800	646	0 / 26	-	-	< 50	< 50	< 50	< 50	< 50	< 56	< 57	< 65	--	--	--
n-Butylbenzene	(µg/kg)	NA	1,600	2,500,000	NA	1 / 11	250	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
sec-Butylbenzene	(µg/kg)	NA	1,600	2,500,000	NA	1 / 11	110	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
p-Isopropyltoluene	(µg/kg)	NA	NA	NA	NA	0 / 11	-	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
Naphthalene	(µg/kg)	NA	35,000	16,000,000	99	1 / 11	300	3.02	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
n-Propylbenzene	(µg/kg)	NA	1,600	2,500,000	NA	0 / 11	-	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
1,2,4-Trimethylbenzene	(µg/kg)	NA	2,100	110,000	NA	1 / 11	80	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
1,3,5-Trimethylbenzene	(µg/kg)	NA	1,800	94,000	NA	0 / 11	-	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
o-Xylene	(µg/kg)	NA	NA	NA	NA	0 / 11	-	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
p,m-Xylene	(µg/kg)	NA	NA	NA	NA	0 / 11	-	-	< 50	< 50	< 50	< 50	< 50	--	--	--	--	--	--
Xylene (Total)	(µg/kg)	NA	5,600	150,000	10,000	0 / 9	-	-	--	--	--	--	--	< 170	< 170	< 190	--	--	--
INORGANIC CHEMICALS																			
Arsenic	(µg/kg)	5,800	4,600	7,600	18,000	23 / 23	12,000	0.667	--	680	780	1,600	--	--	--	--	--	--	--
Barium	(µg/kg)	75,000	1,300,000	37,000,000	330,000	29 / 29	88,000	0.267	--	11,100	15,200	33,000	--	--	--	--	--	--	--
Cadmium	(µg/kg)	1,200	6,000	550,000	360	17 / 30	4,500	12.500	--	< 50	90	210	--	--	--	--	--	--	--
Chromium	(µg/kg)	18,000	30,000	2,500,000	26,000	64 / 64	265,200	10.200	--	21,800	23,300	50,200	--	--	--	--	20,200	2,750	7,250
Copper	(µg/kg)	32,000	5,800,000	20,000,000	28,000	96 / 96	19,000,000	678.571	--	27,600	16,700	87,300	--	--	--	--	6,250	2,750	3,750
Lead	(µg/kg)	21,000	700,000	400,000	11,000	61 / 64	90,000	8.182	--	5,100	4,100	9,900	--	--	--	--	2,100	650	2,300
Nickel	(µg/kg)	20,000	100,000	40,000,000	38,000	14 / 14	34,000	0.895	--	2,090	5,100	1,420	--	--	--	--	--	--	--
Silver	(µg/kg)	1,000	4,500	2,500,000	4,200	3 / 27	8,400	2.000	--	< 200	< 200	< 200	--	--	--	--	--	--	--
Zinc	(µg/kg)	47,000	2,400,000	170,000,000	46,000	30 / 30	475,000	10.326	--	26,400	87,700	21,000	--	--	--	--	--	--	--

Notes
< = Less than
-- = Sample was not analyzed for this constituent
VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water
VALUE = Concentration exceeds Ecological Screening Level
Human health Criteria for chromium are for hexavalent chromium

References
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CWRL Cooling Water Retention Lagoons
FBRA Furnace Brick Remediation Area
FCPL Former Chrome Plating Line
FPDA Former Pit Degreaser Area
NGA North Gate Area (Includes Adjacent Former Storage Tanks)
OBP Old Borrow Pit Area
OSSR Oil and Solvent Storage Rooms
Wetland Northeast of PRR Property

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		G-21	G-21	G-22	G-23	G-23	G-24	G-24	G-29	G-31	VSR-1	VSR-2	VSR-3A	VSR-3B	VSR-4A	VSR-4B	VSR-5	VSR-6	VSR-7
Depth (ft bgs)		5-9	15-19	5-9	5-9	15-19	5-9	15-19	15-17	50-52	Native Soil	Native Soil	Native Soil	Screened Soil	Native Soil	Screened Soil	Native Soil	Native Soil	Native Soil
Sample Date		08/03/95	08/03/95	08/04/95	08/01/95	08/01/95	08/01/95	08/01/95	08/03/95	08/06/95	1997	1997	1997	1997	1997	1997	1997	1997	1997
Sample Location		CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	CWRL	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA
Sampled By		Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch
Analyzed By		Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix
References		B	B	B	B	B	B	B	B	B	D	D	D	D	D	D	D	D	D
VOLATILE ORGANICS																			
Trichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p,m-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INORGANIC CHEMICALS																			
Arsenic	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	(µg/kg)	6,750	4,750	265,200	19,200	2,500	4,750	4,750	--	7,200	--	--	--	--	--	--	--	--	--
Copper	(µg/kg)	7,750	3,750	55,200	5,250	2,750	4,750	4,250	--	7,200	1,740,000	301,000	98,400	12,400,000	8,010,000	19,000,000	109,000	45,500	1,280,000
Lead	(µg/kg)	1,380	1,150	19,000	1,600	<250	7,500	2,310	--	17,500	--	--	--	--	--	--	--	--	--
Nickel	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes

< = Less than

-- = Sample was not analyzed for this constituent

VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water

VALUE = Concentration exceeds Ecological Screening Level

Human health Criteria for chromium are for hexavalent chromium

The Detection Frequency is presented as:
(Number of samples with constituent concentrations above the laboratory detection limit) / (Number of samples analyzed for constituent)

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CWRL	Cooling Water Retention Lagoons	NGA	North Gate Area (Includes Adjacent Former Storage Tanks)
FBRA	Furnace Brick Remediation Area	OBP	Old Borrow Pit Area
FCPL	Former Chrome Plating Line	OSSR	Oil and Solvent Storage Rooms
FPDA	Former Pit Degreaser Area	Wetland	Wetland Northeast of PRR Property

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		VSR-8A	VSR-8B	VSR-9A	VSR-9B	VSR-10A	VSR-10B	VSR-11	VSR-12	VSR-13A	VSR-13B	VSR-14	VSR-15	VSR-16	VSR-17	VSR-18	VSR-19	VSR-20	VSR-21
Depth (ft bgs)		Native Soil	Screened Soil	Native Soil	Screened Soil	Native Soil	Screened Soil	Native Soil	Screened Soil	Screened Soil	Screened Soil	Screened Soil	Native Soil	Native Soil	Native Soil	Native Soil	Screened Soil	Native Soil	Native Soil
Sample Date		1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Sample Location		FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA	FBRA
Sampled By		D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch
Analyzed By		TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix
References		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
VOLATILE ORGANICS																			
Trichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p,m-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INORGANIC CHEMICALS																			
Arsenic	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	(µg/kg)	6,120	2,880,000	826,000	1,160,000	2,860,000	4,400,000	88,900	1,170,000	485,000	309,000	1,530,000	55,300	3,780,000	47,000	15,300	1,090,000	729,000	757,000
Lead	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes

< = Less than

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VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water

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Human health Criteria for chromium are for hexavalent chromium

The Detection Frequency is presented as:
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FBRA Furnace Brick Remediation Area
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NGA North Gate Area (Includes Adjacent Former Storage Tanks)
OBP Old Borrow Pit Area
OSSR Oil and Solvent Storage Rooms
Wetland Wetland Northeast of PRR Property

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		VSR-22	VSR-23	VSR-24	VSR-25	VSR-26	G-13	G-15	G-15	G-16	SB-10	SB-10	02-251	02-252	02-253	02-254	02-255	02-256	02-257
Depth (ft bgs)		Native Soil	Screened Soil	Native Soil	Native Soil	Native Soil	15-19	15-19	42-44	15-19	8-12	24-28 Straddles Water Table	2-3	2-3	2-3	2-3	2-3	2-3	2-3
Sample Date		1997	1997	1997	1997	1997	08/05/95	08/05/95	08/05/95	08/02/95	07/15/02	07/15/02	09/06/05	09/06/05	09/06/05	09/06/05	09/06/05	09/06/05	09/06/05
Sample Location		FBRA	FBRA	FBRA	FBRA	FBRA	FCPL	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA
Sampled By		D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	Benchmark	Benchmark	Benchmark	Benchmark	SECOR	SECOR	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch
Analyzed By		TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	Deep South	Deep South	Deep South	Deep South	Merit	Merit	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix
References		D	D	D	D	D	B	B	B	B	A	A	B	B	B	B	B	B	B
VOLATILE ORGANICS																			
Trichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	170	--	--	--	--	--	--	--
1,1,1-Trichloroethane	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
Tetrachloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
Methylene chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	< 300	< 300	--	--	--	--	--	--	--
Vinyl chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
n-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
sec-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
p-Isopropyltoluene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
Naphthalene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
n-Propylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
o-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
p,m-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	< 50	--	--	--	--	--	--	--
Xylene (Total)	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INORGANIC CHEMICALS																			
Arsenic	(µg/kg)	--	--	--	--	--	--	--	--	--	680	--	1,600	750	1,200	12,000	2,300	3,000	1,400
Barium	(µg/kg)	--	--	--	--	--	--	--	--	--	6,500	--	16,000	15,000	39,000	40,000	32,000	52,000	28,000
Cadmium	(µg/kg)	--	--	--	--	--	--	--	--	--	< 50	--	<52	<52	72	160	89	1,700	90
Chromium	(µg/kg)	--	--	--	--	--	5,750	20,200	7,800	3,250	1,400	--	3,700	2,500	6,900	23,000	5,900	16,000	5,100
Copper	(µg/kg)	10,800,000	295,400	5,540	34,600	1,220,000	4,250	6,250	5,500	4,000	1,000	--	3,200	1,500	4,500	36,000	31,000	484,000	20,000
Lead	(µg/kg)	--	--	--	--	--	1,150	2,100	17,500	3,600	2,000	--	2,900	1,400	3,600	78,000	13,000	68,000	17,000
Nickel	(µg/kg)	--	--	--	--	--	--	--	--	--	900	--	--	--	--	--	--	--	--
Silver	(µg/kg)	--	--	--	--	--	--	--	--	--	< 200	--	<520	<520	<530	<570	<520	1,300	<520
Zinc	(µg/kg)	--	--	--	--	--	--	--	--	--	3,100	--	14,000	8,400	16,000	60,000	41,000	243,000	56,000

Notes

< = Less than

-- = Sample was not analyzed for this constituent

VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water

VALUE = Concentration exceeds Ecological Screening Level

Human health Criteria for chromium are for hexavalent chromium

The Detection Frequency is presented as:
(Number of samples with constituent concentrations above the laboratory detection limit) / (Number of samples analyzed for constituent)

References

A Secor Phase II Report - Appendix C - Merit Analytical Data (Secor, 2002)
B Report of Supplemental Soil Assessment (Mursch, 2000)
C Letter report from Earth Tech to Jill Groboski (US EPA), (Earth Tech, February 23, 2007)
D Summary of Historic Metals Data (Mursch, 2005)

CWRL Cooling Water Retention Lagoons
FBRA Furnace Brick Remediation Area
FCPL Former Chrome Plating Line
FPDA Former Pit Degreaser Area
NGA North Gate Area (Includes Adjacent Former Storage Tanks)
OBP Old Borrow Pit Area
OSSR Oil and Solvent Storage Rooms
Wetland Wetland Northeast of PRR Property

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		02-258	02-259	02-260	02-261	02-262	02-263	08-G3	08-G3	08-G4	08-G4	CB-3	CB-4	CB-4	CB-4	CB-6	CB-6	CB-6	G-1
Depth (ft bgs)		2-3	2-3	2-3	2-3	2-3	2-3	7-8	18	4	19	6-8	3-5	8-10	11-13	1-2	5-6	9-10	15-19
Sample Date		09/06/05	09/06/05	09/06/05	09/06/05	09/06/05	09/06/05	10/22/08	10/22/08	10/22/08	10/22/08	2002	2002	2002	2002	2002	2002	2002	08/01/95
Sample Location		FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FPDA	FUST
Sampled By		D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	D. Mursch	Weston	Weston	Weston	Weston	Weston	Weston	Weston	Benchmark
Analyzed By		TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	MDEQ	MDEQ	MDEQ	MDEQ	MDEQ	MDEQ	MDEQ	Deep South
References		B	B	B	B	B	B	B	B	B	B	D	D	D	D	D	D	D	B
VOLATILE ORGANICS																			
Trichloroethene	(µg/kg)	--	--	--	--	--	--	< 54	< 52	51	98	ND	ND	ND	ND	160	690	--	--
1,1,1-Trichloroethane	(µg/kg)	--	--	--	--	--	--	< 54	< 52	< 47	< 59	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	< 54	< 52	< 47	< 59	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	< 54	< 52	< 47	< 59	--	--	--	--	--	--	--	--
Tetrachloroethene	(µg/kg)	--	--	--	--	--	--	< 54	< 52	< 47	< 59	--	--	--	--	--	--	--	--
Methylene chloride	(µg/kg)	--	--	--	--	--	--	< 270	< 260	< 240	< 290	--	--	--	--	--	--	--	--
Vinyl chloride	(µg/kg)	--	--	--	--	--	--	< 54	< 52	< 47	< 59	--	--	--	--	--	--	--	--
n-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p,m-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	(µg/kg)	--	--	--	--	--	--	< 160	< 160	< 140	< 180	--	--	--	--	--	--	--	--
INORGANIC CHEMICALS																			
Arsenic	(µg/kg)	3,600	1,100	1,100	1,600	2,200	2,300	--	--	--	--	--	--	--	--	--	--	--	--
Barium	(µg/kg)	38,000	31,000	24,000	11,000	5,000	18,000	--	--	--	--	23,000	30,000	17,000	19,000	88,000	51,000	7,200	--
Cadmium	(µg/kg)	4,500	74	290	<52	110	<53	--	--	--	--	110	ND	ND	ND	1,100	150	ND	--
Chromium	(µg/kg)	32,000	3,700	4,800	3,700	8,800	5,200	--	--	--	--	8,500	7,000	8,400	7,100	14,000	4,300	5,000	3,250
Copper	(µg/kg)	438,000	10,000	12,000	2,700	3,900	4,300	--	--	--	--	7,000	5,200	8,300	5,000	740,000	10,000	8,100	4,000
Lead	(µg/kg)	50,000	4,400	4,400	2,300	9,000	5,300	--	--	--	--	5,600	5,200	5,900	3,600	69,000	14,000	6,400	2,400
Nickel	(µg/kg)	--	--	--	--	--	--	--	--	--	--	7,800	6,900	7,000	5,100	34,000	3,200	7,300	--
Silver	(µg/kg)	8,400	<530	<520	<520	<540	<530	--	--	--	--	ND	ND	ND	ND	930	ND	ND	--
Zinc	(µg/kg)	475,000	17,000	29,000	13,000	75,000	21,000	--	--	--	--	360,000	35,000	22,000	23,000	270,000	42,000	22,000	--

Notes

< = Less than

-- = Sample was not analyzed for this constituent

VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water

VALUE = Concentration exceeds Ecological Screening Level

Human health Criteria for chromium are for hexavalent chromium

The Detection Frequency is presented as:
(Number of samples with constituent concentrations above the laboratory detection limit) / (Number of samples analyzed for constituent)

References

A Secor Phase II Report - Appendix C - Merit Analytical Data (Secor, 2002)

B Report of Supplemental Soil Assessment (Mursch, 2000)

C Letter report from Earth Tech to Jill Groboski (US EPA), (Earth Tech, February 23, 2007)

D Summary of Historic Metals Data (Mursch, 2005)

CWRL	Cooling Water Retention Lagoons	NGA	North Gate Area (Includes Adjacent Former Storage Tanks)
FBRA	Furnace Brick Remediation Area	OBP	Old Borrow Pit Area
FCPL	Former Chrome Plating Line	OSSR	Oil and Solvent Storage Rooms
FPDA	Former Pit Degreaser Area	Wetland	Wetland Northeast of PRR Property

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		G-2	G-3	G-4	G-5	G-7	G-8	G-9	G-20	G-30	HA-3	HA-6	HA-7	G-25	G-25	G-27	G-28	SB-4	SB-4
Depth (ft bgs)		15-19	15-19	5-7	15-19	15-19	15-19	15-19	15-19	1-2				5-9	10-14	15-19	13-15	20-24	24-28 Straddles Water Table
Sample Date		08/03/95	08/05/95	08/02/95	08/02/95	08/05/95	08/04/95	08/01/95	08/03/95	08/01/95	1990	1990	1990	1995	1995	1995	1995	07/09/02	07/09/02
Sample Location		FUST	FUST	FUST	FUST	NGA	NGA	NGA	NGA	OBP	OBP	OBP	OBP	OBP	OBP	OBP	OBP	OSSR	OSSR
Sampled By		Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	Delta	Delta	Delta	Benchmark	Benchmark	Benchmark	Benchmark	SECOR	SECOR
Analyzed By		Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	Deep South	NA	NA	NA	Deep South	Deep South	Deep South	Deep South	Merit	Merit
References		B	B	B	B	B	B	B	B	BEA	D	D	D	BEA	BEA	BEA	BEA	A	A
VOLATILE ORGANICS																			
Trichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	720
1,1,1-Trichloroethane	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
cis-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	90
trans-1,2-Dichloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
Tetrachloroethene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
Methylene chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 300	<300
Vinyl chloride	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
n-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
sec-Butylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
p-Isopropyltoluene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
Naphthalene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
n-Propylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
1,2,4-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
1,3,5-Trimethylbenzene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
o-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
p,m-Xylene	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 50	< 50
Xylene (Total)	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INORGANIC CHEMICALS																			
Arsenic	(µg/kg)	--	--	--	--	--	--	--	--	--	1,600	1,200	1,400	--	--	--	--	510	--
Barium	(µg/kg)	--	--	--	--	--	--	--	--	--	4,200	3,700	4,200	--	--	--	--	2,700	--
Cadmium	(µg/kg)	--	--	--	--	--	--	--	--	--	2,400	1,300	1,700	--	--	--	--	< 50	--
Chromium	(µg/kg)	3,250	2,750	5,200	3,250	3,250	14,800	2,250	3,250	12,800	4,800	3,800	3,600	6,250	3,750	2,750	2,750	6,900	--
Copper	(µg/kg)	4,250	2,750	6,500	5,000	4,000	21,800	2,750	4,750	368,500	5,200	5,200	6,000	8,500	8,250	3,000	36,200	2,100	--
Lead	(µg/kg)	1,700	1,250	7,500	900	3,600	90,000	1,200	<250	21,000	5,100	2,800	3,700	2,380	1,350	1,200	500	1,100	--
Nickel	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,730	--
Silver	(µg/kg)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 200	--
Zinc	(µg/kg)	--	--	--	--	--	--	--	--	--	15,000	8,000	10,000	--	--	--	--	14,400	--

Notes

< = Less than

-- = Sample was not analyzed for this constituent

VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water

VALUE = Concentration exceeds Ecological Screening Level

Human health Criteria for chromium are for hexavalent chromium

The Detection Frequency is presented as:
(Number of samples with constituent concentrations above the laboratory detection limit) / (Number of samples analyzed for constituent)

CWRL	Cooling Water Retention Lagoons (includes adjacent API Separator)
FBRA	Furnace Brick Remediation Area
FCPL	Former Chrome Plating Line
FPDA	Former Pit Degreaser Area
NGA	North Gate Area (Includes Adjacent Former Storage Tanks)
OBP	Old Borrow Pit Area (includes adjacent former incinerator)
OSSR	Oil and Solvent Storage Rooms
Wetland	Wetland Northeast of PRR Property

References

A	Secor Phase II Report - Appendix C - Merit Analytical Data (Secor, 2002)
B	Report of Supplemental Soil Assessment (Mursch, 2000)
C	Letter report from Earth Tech to Jill Groboski (US EPA), (Earth Tech, February 23, 2007)
D	Summary of Historic Metals Data (Mursch, 2005)

Appendix L, Table 3A
Summary of Soil Data
Prairie Ronde Realty
Dowagiac, Michigan

Sample Location ID		SB-6	SB-6	08-G1	08-G2	G-11	G-11	G-12	G-12	G-18	OS-4	WS-03	WS-08	WS-09	WS-14	WS-20	WS-22
Depth (ft bgs)		20-24	24-28 Straddles Water Table	22	15	15-19	20-24	15-19	20-24	15-19	0-16	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date		07/11/02	07/11/02	10/22/08	10/22/08	08/04/95	08/04/95	08/04/95	08/04/95	08/04/95	10/12/83	12/05/06	12/05/06	12/05/06	12/05/06	12/05/06	12/05/06
Sample Location		OSSR	OSSR	OSSR	OSSR	OSSR	OSSR	OSSR	OSSR	OSSR	OSSR	Wetland	Wetland	Wetland	Wetland	Wetland	Wetland
Sampled By		SECOR	SECOR	D. Mursch	D. Mursch	Benchmark	Benchmark	Benchmark	Benchmark	Benchmark	W&W	ET	ET	ET	ET	ET	ET
Analyzed By		Merit	Merit	TriMatrix	TriMatrix	Deep South	Deep South	Deep South	Deep South	Deep South	W&W	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix	TriMatrix
References		A	A	B	B	B	B	B	B	B	B	C	C	C	C	C	C
VOLATILE ORGANICS																	
Trichloroethene	(µg/kg)	< 50	< 50	110	< 56	--	--	--	--	--	--	< 340	< 74	< 210	< 350	< 220	< 330
1,1,1-Trichloroethane	(µg/kg)	< 50	< 50	< 59	< 56	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	(µg/kg)	< 50	< 50	< 59	< 56	--	--	--	--	--	--	< 340	< 74	< 210	< 350	< 220	< 330
trans-1,2-Dichloroethene	(µg/kg)	< 50	< 50	< 59	< 56	--	--	--	--	--	--	< 340	< 74	< 210	< 350	< 220	< 330
Tetrachloroethene	(µg/kg)	< 50	< 50	< 59	< 56	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	(µg/kg)	< 300	< 300	< 300	< 280	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	(µg/kg)	< 50	< 50	< 59	< 56	--	--	--	--	--	--	< 340	< 74	< 210	< 350	< 220	< 330
n-Butylbenzene	(µg/kg)	< 50	250	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	(µg/kg)	< 50	110	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	(µg/kg)	< 50	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	(µg/kg)	< 50	300	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	(µg/kg)	< 50	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	(µg/kg)	< 50	80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	(µg/kg)	< 50	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	(µg/kg)	< 50	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p,m-Xylene	(µg/kg)	< 50	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (Total)	(µg/kg)	--	--	< 180	< 170	--	--	--	--	--	--	--	--	--	--	--	--
INORGANIC CHEMICALS																	
Arsenic	(µg/kg)	620	--	--	--	--	--	--	--	--	2,000	--	--	--	--	--	--
Barium	(µg/kg)	2,200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	(µg/kg)	< 50	--	--	--	--	--	--	--	--	<400	--	--	--	--	--	--
Chromium	(µg/kg)	1,000	--	--	--	1,750	2,250	3,000	3,750	3,750	3,600	--	--	--	--	--	--
Copper	(µg/kg)	1,400	--	--	--	2,250	2,500	4,500	5,000	4,250	34,000	--	--	--	--	--	--
Lead	(µg/kg)	< 1,000	--	--	--	2,100	1,800	1,100	1,100	1,300	8,000	--	--	--	--	--	--
Nickel	(µg/kg)	1,350	--	--	--	--	--	--	--	--	4,000	--	--	--	--	--	--
Silver	(µg/kg)	< 200	--	--	--	--	--	--	--	--	<800	--	--	--	--	--	--
Zinc	(µg/kg)	4,800	--	--	--	--	--	--	--	--	18,000	--	--	--	--	--	--

Notes

< = Less than

-- = Sample was not analyzed for this constituent

VALUE = Concentration exceeds Part 201 Criteria for Protection of Drinking Water

VALUE = Concentration exceeds Ecological Screening Level

Human health Criteria for chromium are for hexavalent chromium

The Detection Frequency is presented as:
(Number of samples with constituent concentrations above the laboratory detection limit) / (Number of samples analyzed for constituent)

References

A Secor Phase II Report - Appendix C - Merit Analytical Data (Secor, 200
B Report of Supplemental Soil Assessment (Mursch, 2000)
C Letter report from Earth Tech to Jill Groboski (US EPA), (Earth Tech, F
D Summary of Historic Metals Data (Mursch, 2005)

CWRL	Cooling Water Retention Lagoons
FBRA	Furnace Brick Remediation Area
FCPL	Former Chrome Plating Line
FPDA	Former Pit Degreaser Area
NGA	North Gate Area (Includes Adjacent Former Storage Tanks)
OBP	Old Borrow Pit Area
OSSR	Oil and Solvent Storage Rooms
Wetland	Wetland Northeast of PRR Property

Appendix L, Table 3B
Summary of Soil Data
Part 201 Criteria Exceeded in Areas of Concern
Prairie Ronde Realty, Dowagiac, Michigan

Area	Part 201 Residential Drinking Water Protection Criteria (3)	Part 201 Direct Contact Criteria (4)	Ecological Screening Levels
CWRL (and API Separator)	TCE, chromium (1)	None	Chromium (1), copper, lead (2), zinc
FRBA	Copper	None	Copper
FCPL	None	None	None
FPDA	TCE, arsenic, chromium, silver	Arsenic	Cadmium, chromium (1), copper, lead, silver, zinc
FUST	None	None	None
NGA (and adjacent storage tanks)	None	None	Lead
OBP (and former incinerator)	None	None	Cadmium, lead (2), Copper
OSSR	TCE, methylene chloride	None	Naphthalene, copper
Wetland	None	None	None

(1) Based on criteria for hexavalent chromium
(2) Lead concentration less than state default background level
(3) Source of criteria: MDEQ, 2004 (September 28, 2012 Update)
(4) Source of Ecological Screening Levels: USEPA, 2003

CWRL = Cooling Water Retention Lagoons
FRBA = Furnace Brick Remediation Area
FCPL = Former Chrome Plating Line
FCPA = Former Pit Degreaser Area
FUST = Former Underground Storage Tank Area
NGA = North Gate Area
OBP = Old Burn Pit
OSSR = Oil and Solvent Storage Room

Appendix L, Table 4
Residential Indoor Air and Soil Gas Sampling Results
Prairie Ronde Realty, Dowagiac, Michigan

Property Address	Date Sampled	TCE in Indoor Air (ug/m3)	Reporting Limit: TCE Indoor Air (ug/m3)	TCE in Soil Gas (ug/m3)	Reporting Limit: TCE Soil Gas (ug/m3)	Comments/Sample IDs
Trip Blank	4/8/2009	ND	0.027	---	---	TB-040809
Trip Blank	8/7/2009	ND	0.027	---	---	TB-080709
305 Louise	4/1/2009	ND	0.027	ND	2.1	305Louise-IA-040109, 305Louise-SG-040109
	8/5/2009	**0.27**	0.027	ND	2.1	305Louise-IA-080509, 305Louise-SG-080509
307 Louise	4/8/2009	**0.057**	0.027	ND	2.1	307Louise-IA-040809, 307Louise-SG-040809
	8/5/2009	**0.26**	0.027	ND	2.1	307Louise-IA-080509, 307Louise-SG-080509
309 Louise	4/1/2009	ND	0.027	ND	2.1	309Louise-IA-040109, 309Louise-SG-040109
	7/23/2009	**0.14**	0.027	ND	2.1	309Louise-IA-072309, 309Louise-SG-072309
312 Louise	4/8/2009	**0.47**	0.027	**330**	8.2	312Louise-IA-040809, 312Louise-SG-040809
	8/7/2009	**0.8**	0.027	**260**	4	312Louise-IA-080709, 312Louise-SG-080709
313 Louise	4/1/2009	**0.029**	0.027	ND	2.1	313Louise-IA-040109, 313Louise-SG-040109
	8/5/2009	**0.2**	0.027	ND	2.1	313Louise-IA-080509, 313Louise-SG-080509
317 Louise	4/1/2009	**0.35**	0.027	**410**	20	317Louise-IA-040109, 317Louise-SG-040109
	7/22/2009	**0.62**	0.027	**270**	2.1	317Louise-IA-072209, 317Louise-SG-072209
401 Louise	4/1/2009	**2.3**	0.027	**1600**	21	401Louise-IA-040109, 401Louise-SG-040109
	4/1/2009	2.3	0.027	1600	2.1	401Louise-IA-040109, 401Louise-SG-040109
	9/24/2009	6.7	0.027	---	---	401Louise-IA-092409 (no sub-slab sample)
	10/28/2009	0.27	0.027	20	2.2	401Louise-IA-102809, 401Louise-SG-102809
	12/3/2009	0.099	0.038	7.3	2.1	401Louise-IA-120309, 401Louise-SG-120309
403 Louise	4/14/2009	**0.68**	0.027	**200**	9.3	403Louise-IA-041409, 403Louise-SG-041409
405 Louise	4/14/2009	**0.27**	0.027	**81**	2.1	405Louise-IA-041409, 405Louise-SG-041409
	8/5/2009	**0.32**	0.027	**27**	2.1	405Louise-IA-080509, 405Louise-SG-080509
407 Louise	4/1/2009	**0.10**	0.027	**26**	2.1	407Louise-IA-040109, 407Louise-SG-040109
	8/7/2009	**0.21**	0.027	**7**	2.1	407Louise-IA-080709, 407Louise-SG-080709
409 Louise	4/8/2009	**0.23**	0.027	**80**	2.1	409Louise-IA-040809, 409Louise-SG-040809
	8/5/2009	**0.18**	0.027	**24**	2.1	409Louise-IA-080509, 409Louise-SG-080509
413 Louise	4/8/2009	**0.79**	0.027	**2.6**	2.1	413Louise-IA-040809, 413Louise-SG-040809
	7/22/2009	**0.99**	0.027	ND	2.1	413Louise-IA-072209, 413Louise-SG-072209
415 Louise	4/1/2009	**0.25**	0.027	ND	2.1	415Louise-IA-040109, 415Louise-SG-040109
	7/22/2009	**0.33**	0.027	ND	2.1	415Louise-IA-072209, 415Louise-SG-072209
504 Louise	4/1/2009	**0.038**	0.027	ND	2.1	504Louise-IA-040109, 504Louise-SG-040109
	8/5/2009	**0.19**	0.027	ND	2.1	504Louise-IA-080509, 504Louise-SG-080509

Appendix L, Table 4
Residential Indoor Air and Soil Gas Sampling Results
Prairie Ronde Realty, Dowagiac, Michigan

Property Address	Date Sampled	TCE in Indoor Air (ug/m3)	Reporting Limit: TCE Indoor Air (ug/m3)	TCE in Soil Gas (ug/m3)	Reporting Limit: TCE Soil Gas (ug/m3)	Comments/Sample IDs
601 Louise	4/8/2009	**0.36**	0.027	ND	2.1	601Louise-IA-040809, 601Louise-SG-040809
	7/22/2009	**0.56**	0.027	ND	2.1	601Louise-IA-072209, 601Louise-SG-072209
700 Louise	4/2/2009	**0.042**	0.027	ND	2.1	700Louise-IA-040209, 700Louise-SG-040209
	8/6/2009	**0.2**	0.027	ND	2.1	700Louise-IA-080609, 700Louise-SG-080609
306 Florence	4/1/2009	**0.11**	0.027	ND	2.1	306Florence-IA-040109, 306Florence-SG-040109
	7/22/2009	**0.43**	0.027	ND	2.1	306Florence-IA-072209, 306Florence-SG-072209
308 Florence	4/2/2009	**0.042**	0.027	ND	2.1	308Florence-IA-040209, 308Florence-SG-040209
	7/23/2009	**0.32**	0.027	**2.2**	2.1	308Florence-IA-072309, 308Florence-SG-072309
313 Florence	4/9/2009	**0.26**	0.027	**24**	2.1	313Florence-IA-040909, 313Florence-SG-040909
	7/22/2009	**0.87**	0.25	**24**	2.1	313Florence-IA-072209, 313Florence-SG-072209
315 Florence	4/2/2009	**0.61**	0.027	ND	2.1	315Florence-IA-040209, 315Florence-SG-040209
	8/7/2009	**0.82**	0.027	ND	4	315Florence-IA-080709, 315Florence-SG-080709

Ambient Air Samples		TCE in Outdoor Air (ug/m3)	Reporting Limit: TCE in Outdoor Air (ug/m3)
UP-AA-040109	4/1/2009	ND	2.1
DOWN-AA-040109	4/1/2009	ND	2.1
UP-AA-040209	4/2/2009	ND	2.1
DOWN-AA-040209	4/2/2009	ND	2.1
UP-AA-040809	4/8/2009	ND	2.1
DOWN-AA-040809	4/8/2009	ND	2.1
UP-072309	7/23/2009	ND	2.1
DOWN-072309	7/23/2009	ND	2.1
UP-AA-080509	8/5/2009	ND	2.1
DOWN-AA-080509	8/5/2009	ND	2.1
UP-AA-080709	8/7/2009	ND	2.1
DOWN-AA-080709	8/7/2009	ND	2.1

KEY:

	Above 2.1 ug/m3 (shaded)
0.35	Detection of compound above reporting limit (**bold**)
---	Results not available
ND	Not detected at stated Reporting Limit

Appendix L, Table 5
PRR Building Indoor Air Data Summary
Prairie Ronde Realty, Dowagiac, MI

Compound	Indoor Air Screening Level(a)	PRR Office							JMT						
		23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	1-Jan-13	15-Feb-13	Mar-13	23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation
Chloroethane	44,000	<0.12	--	<0.12	**0.37**	<4.0	--	<1.1	<0.12	--	<0.12	<0.12	<0.12	--	<0.72
1,1-Dichloroethane	77	**0.028**	--	<0.081	<0.081	<1.2	<0.064	<1.6	**0.081**	--	<0.081	<0.081	<0.081	<0.059	<1.1
cis-1,2-Dichloroethene	260(b)	**8.0**	--	<0.079	<0.079	<1.6	**0.14**	<1.6	**13**	--	0.10	<0.079	**0.11**	**0.38**	<1.1
trans-1,2-Dichloroethene	260	<0.056	--	<0.079	<0.079	<1.6	<0.062	<1.6	<0.056	--	<0.079	<0.079	<0.079	<0.058	<1.1
Tetrachloroethene	180	**0.41**	--	**0.28**	**0.18**	<2.7	**0.87**	<1.4	**0.67**	--	**0.16**	**0.79**	**0.73**	**1.0**	<0.92
1,1,1-Trichloroethane	22,000	**0.74**	--	**0.2**	<0.11	<1.6	<0.086	<2.2	**2.1**	--	<0.11	<0.11	<0.11	**0.082**	<1.5
Trichloroethene	8.8	**17**	**3.4**	**1.3**	**0.52**	<2.1	**0.97**	<1.1	**39**	**10**	**1.5**	**0.41**	**0.72**	**3.2**	<0.74
Vinyl Chloride	28	**0.023**	--	<0.051	<0.051	<1.0	<0.040	<0.52	<0.013	--	<0.051	<0.051	<0.051	<0.037	<0.35

Compound	Indoor Air Screening Level(a)	South Rec. Park							Quality Trucking						
		23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	13-Jan-13	1-Feb-13	Mar-13	23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation
Chloroethane	44,000	<0.12	--	<0.22	<0.12	<0.58	--	<0.68	<0.22	--	<0.012	<0.12	<0.012	--	<0.75
1,1-Dichloroethane	77	**0.12**	--	<0.15	<0.081	<0.40	<0.059	<1.0	**1.9**	--	<0.081	<0.081	<0.081	<0.059	<1.1
cis-1,2-Dichloroethene	260(b)	**3.6**	--	**3.7**	**0.46**	**0.77**	**3.5**	**2.4**	**3.3**	--	**0.56**	**0.41**	**0.75**	<0.058	**2.6**
trans-1,2-Dichloroethene	260	<0.056	--	<0.15	<0.079	<0.39	<0.058	<1.0	<0.10	--	<0.079	<0.079	<0.079	<0.058	<1.1
Tetrachloroethene	180	**0.49**	--	**0.50**	**0.55**	**92**	**40.6**	<0.87	**0.92**	--	**0.64**	**0.95**	**49**	**32.8**	**1.3**
1,1,1-Trichloroethane	22,000	**1.1**	--	**0.88**	**0.17**	<0.53	**0.44**	<1.4	**4.1**	--	**0.21**	**0.17**	**0.17**	**0.52**	<1.5
Trichloroethene	8.8	**20**	--	**22**	**7.1**	**4.6**	**13.3**	**12.5**	**30**	**8.1**	**7.6**	**6.1**	**5.5**	**16.8**	**15.0**
Vinyl Chloride	28	**0.089**	--	**0.18**	<0.051	<0.25	<0.037	<0.33	**0.091**	--	<0.051	<0.051	<0.051	**0.10**	<0.36

Notes:
All data presented in micrograms per cubic meter
Compounds analyzed by USEPA Method TO-15 Selective Ion Monitoring (SIM).
Bold indicates a detection above reporting limit; yellow highlighted results exceed the industrial indoor air screening levels.
< - Not detected at or above the reported detection limit.
* = Data considered invalid due to loss of vacuum in canister during transit from PRR to laboratory
-- = Not sampled or not analyzed
USEPA - United States Environmental Protection Agency.
(a) USEPA Regional Screening Level for Industrial Air (USEPA, November 2012), adjusted for target risk of 1x10-5 and target hazard quotient of 1.
(b) Screening level not available. Screening level for trans-1,2-dichloroethene was used due to chemical structural similarities.

Appendix L, Table 5
PRR Building Indoor Air Data Summary
Prairie Ronde Realty, Dowagiac, MI

Compound	Indoor Air Screening Level[(a)]	Velthouse Antiques							Michigan Precision						
		23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13	23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation
Chloroethane	44,000	<0.12	--	<0.12	<0.12	<0.12	--	<0.78	<0.12	--	<0.12	*	<0.12	--	<0.80
1,1-Dichloroethane	77	**0.025**	--	<0.081	<0.081	<0.081	<0.059	<1.2	<0.020	--	<0081	*	<0081	<0.059	<1.2
cis-1,2-Dichloroethene	260[(b)]	**0.82**	--	**0.72**	<0.079	<0.079	**0.12**	<1.2	**0.36**	--	**1.9**	*	**0.62**	**3.1**	**3.2**
trans-1,2-Dichloroethene	260	<0.056	--	<0.079	<0.079	<0.079	<0.058	<1.2	<0.056	--	<0.079	*	<0.079	<0.058	<1.2
Tetrachloroethene	180	**0.41**	--	**0.16**	**0.76**	**0.22**	**0.27**	<0.99	**0.23**	--	**0.45**	*	**44**	**29.9**	**132**
1,1,1-Trichloroethane	22,000	**1.6**	--	**0.31**	**0.34**	**0.19**	**0.21**	<1.6	**0.14**	--	**0.43**	*	**0.15**	**0.38**	<1.7
Trichloroethene	8.8	**26**	**3.9**	**6.7**	**3.3**	**1.7**	**2.9**	**1.8**	**6.0**	--	**16**	*	**8.6**	**14.4**	**67.7**
Vinyl Chloride	28	**0.016**	--	<0.051	<0.051	<0.051	<0.037	<0.37	<0.013	--	**0.093**	*	<0.051	**0.090**	<0.39

Compound	Indoor Air Screening Level[(a)]	North Rec. Park 1							North Rec. Park 2		
		23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation
Chloroethane	44,000	<0.12	--	<0.12	<0.12	<0.47	--	<0.72	--	--	<0.68
1,1-Dichloroethane	77	**0.091**	--	**0.13**	<0.081	<0.32	**0.11**	<1.1	--	--	<1.0
cis-1,2-Dichloroethene	260[(b)]	**2.5**	--	**5.1**	**0.72**	**1.9**	**10.5**	**2.9**	--	--	**3.7**
trans-1,2-Dichloroethene	260	<0.056	--	**0.12**	<0.079	<0.32	**0.12**	<1.1	--	--	<1.0
Tetrachloroethene	180	**0.30**	--	**0.58**	**1.3**	**56**	**31.6**	<0.92	--	--	<0.87
1,1,1-Trichloroethane	22,000	**0.75**	--	**1.0**	**0.34**	<0.44	**1.0**	<1.5	--	--	<1.4
Trichloroethene	8.8	**20**	--	**24**	**7.0**	**9.8**	**37.6**	**15.4**	--	--	**19.0**
Vinyl Chloride	28	**0.065**	--	**0.25**	<0.051	<0.20	**0.34**	<0.35	--	--	<0.33

Notes:
All data presented in micrograms per cubic meter
Compounds analyzed by USEPA Method TO-15 Selective Ion Monitoring (SIM).
Bold indicates a detection above reporting limit; yellow highlighted results exceed the industrial indoor air screening levels.
< - Not detected at or above the reported detection limit.
* = Data considered invalid due to loss of vacuum in canister during transit from PRR to laboratory
-- = Not sampled or not analyzed
USEPA - United States Environmental Protection Agency.
(a) USEPA Regional Screening Level for Industrial Air (USEPA, November 2012), adjusted for target risk of 1x10-5 and target hazard quotient of 1.
(b) Screening level not available. Screening level for trans-1,2-dichloroethene was used due to chemical structural similarities.

Appendix L, Table 5
PRR Building Indoor Air Data Summary
Prairie Ronde Realty, Dowagiac, MI

Compound	Indoor Air Screening Level[(a)]	Ambient Air					
		23-Mar-12	25-Apr-12	25-Oct-12	12-Dec-12	25-Oct-12	12-Dec-12
Comments		Pre ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation	Post ventilation
Chloroethane	44,000	<0.12	--	<0.12	--	<0.12	--
1,1-Dichloroethane	77	<0.020	--	<0.081	--	<0.081	--
cis-1,2-Dichloroethene	260[(b)]	<0.056	--	<0.079	--	<0.079	--
trans-1,2-Dichloroethene	260	<0.056	--	<0.079	--	<0.079	--
Tetrachloroethene	180	**0.17**	--	<0.014	--	<0.014	--
1,1,1-Trichloroethane	22,000	<0.11	--	<0.11	--	<0.11	--
Trichloroethene	8.8	**0.14**	**0.19**	<0.11	--	<0.11	--
Vinyl Chloride	28	<0.013	--	<0.051	--	<0.051	--

Notes:
All data presented in micrograms per cubic meter
Compounds analyzed by USEPA Method TO-15 Selective Ion Monitoring (SIM).
Bold indicates a detection above reporting limit; yellow highlighted results exceed the industrial indoor air screening levels.
< - Not detected at or above the reported detection limit.
* = Data considered invalid due to loss of vacuum in canister during transit from PRR to laboratory
-- = Not sampled or not analyzed
USEPA - United States Environmental Protection Agency.
(a) USEPA Regional Screening Level for Industrial Air (USEPA, November 2012), adjusted for target risk of 1x10-5 and target hazard quotient of 1.
(b) Screening level not available. Screening level for trans-1,2-dichloroethene was used due to chemical structural similarities.

Appendix L, Table 6
PRR
Building Sub-Slab Soil Vapor Data Summary
Prairie Ronde Realty, Dowagiac, Michigan

Compound	Sub-Slab Soil Vapor Screening Level(a)	PRR Office / VMP-11						JMT / VMP-12					
		23-Mar-12	07-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13	23-Mar-12	7-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS
Chloroethane	1,466,667	<10	<29	<16	<4.0	<2.4	<4.0	<20	<4.0	<4.0	<4.0	<0.78	<0.80
1,1-Dichloroethane	2,567	<5.8	<9.0	<4.9	<1.2	<3.7	<6.1	<12	<1.2	<1.2	<1.2	<1.2	<1.2
cis-1,2-Dichloroethene	8,667(b)	<7.6	<12	<6.4	<1.6	<3.6	<6.0	**380**	<1.6	<1.6	<1.6	<1.2	<1.2
trans-1,2-Dichloroethene	8,667	<7.6	<12	<6.4	<1.6	<3.6	<6.0	<15	<1.6	<1.6	<1.6	<1.2	<1.2
Tetrachloroethene	6,000(c)	**17**	<20	<11	**5.9**	**14.4**	**7.4**	<26	<2.7	<2.7	<2.7	**1.1**	<1.0
1,1,1-Trichloroethane	733,333	**51**	**34**	**30**	**19**	**28.5**	**21.3**	**160**	<1.6	<1.6	<1.6	<1.6	<1.7
Trichloroethene	293	**1,000**	**910**	**620**	**460**	**671**	**474**	**1,800**	<2.1	<2.1	<2.1	**5.5**	**3.9**
Vinyl Chloride	933	<2.4	<7.6	<4.1	<1.0	<4.1	<1.9	<4.9	<1.0	<1.0	<1.0	<0.37	<0.39

Compound	Sub-Slab Soil Vapor Screening Level(a)	South Rec. Park / VMP-15						Quality Trucking / VMP-16					
		23-Mar-12	7-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13	23-Mar-12	7-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS
Chloroethane	1,466,667	<150	<7.6	<4.0	<4.0	<0.72	<0.80	<370	<270	<20	<43	<0.72	<3.6
1,1-Dichloroethane	2,567	<89	<2.3	<1.2	<1.2	<1.1	<1.2	**520**	<83	<6.3	<13	**1.8**	**14.9**
cis-1,2-Dichloroethene	8,667(b)	<120	**3**	**2.6**	**2.6**	**2.3**	**1.3**	**750**	<110	**11**	**38**	**8.1**	**57.2**
trans-1,2-Dichloroethene	8,667	<120	<3.0	<1.6	<1.6	<1.1	<1.2	<270	<110	<8.2	<17	<1.1	<5.4
Tetrachloroethene	6,000(c)	<200	<5.2	<2.7	**5.7**	**12.8**	**4.1**	<470	<190	**15**	**84**	**33.0**	**79.6**
1,1,1-Trichloroethane	733,333	<120	<3.1	<1.6	<1.6	<1.5	<1.7	**10,000**	**740**	**88**	**270**	**32.9**	**264**
Trichloroethene	293	**14,000**	**220**	**170**	**200**	**139**	**73**	**33,000**	**7,700**	**690**	**2,400**	**261**	**3,160**
Vinyl Chloride	933	<37	<2.0	<1.0	<1.0	<0.35	<0.39	<88	<70	<5.3	<11	<0.35	<1.7

Notes:
All data presented in micrograms per cubic meter
Compounds analyzed by USEPA Method TO-15.
Bold indicatres detection above reporting limit: yellow highlighted results exceed the industrial sub-slab vapor screening levels.
CAS - Chemical Abstracts Service.
< - Not detected at or above the reported detection limit.
* = Data considered invalid due to loss of vacuum in canister during transit from laboratory to PRR.
USEPA - United States Environmental Protection Agency.
(a) USEPA Regional Screening Level for Industrial Air (USEPA, November 2012), adjusted for target risk of 1x10-5 and target hazard quotient of 1, divided by USEPA -recommended attenuation factor of 0.03.
(b) Screening level not available. Screening level for trans-1,2-dichloroethene was used due to chemical structural similarities.

Appendix L, Table 6
PRR
Building Sub-Slab Soil Vapor Data Summary
Prairie Ronde Realty, Dowagiac, Michigan

Compound	Sub-Slab Soil Vapor Screening Level(a)	Velthouse Antiques / VMP-13						Michigan Precision / VMP-14					
		23-Mar-12	7-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13	23-Mar-12	7-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13
Comments		Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS
Chloroethane	1,466,667	<140	<44	*	*	<0.75	<18.1	<88	<170	<170	<33	<0.80	<16.7
1,1-Dichloroethane	2,567	<80	<14	*	*	<1.1	<27.6	<51	<53	<52	<10	<1.2	<25.4
cis-1,2-Dichloroethene	8,667(b)	**170**	<18	*	*	**1.7**	<27.2	<66	<69	<68	<13	<1.2	<25.1
trans-1,2-Dichloroethene	8,667	<100	<18	*	*	<1.1	<27.2	<66	<69	<68	<13	<1.2	<25.1
Tetrachloroethene	6,000(c)	<180	<30	*	*	**1.0**	<23.2	<110	<120	<120	**25**	**8.9**	<21.4
1,1,1-Trichloroethane	733,333	**3,300**	**40**	*	*	**61.2**	**81.7**	<68	<725	<70	<14	**14.2**	<34.4
Trichloroethene	293	**32,000**	**1,400**	*	*	**1,160**	**1,870**	**8,900**	**6,300**	**6,700**	**1,100**	**10,800**	**4,780**
Vinyl Chloride	933	<34	<11	*	*	<0.36	<8.7	<21	<45	<44	<8.5	<0.39	<8.1

Compound	Sub-Slab Soil Vapor Screening Level(a)	North Rec. Park 1 / VMP-17						North Rec. Park 2 / VMP-18		
		23-Mar-12	7-Nov-12	12-Dec-12	13-Jan-13	15-Feb-13	Mar-13	13-Jan-13	15-Feb-13	Mar-13
Comments	**Pre SSDPS**	Pre SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS	Post SSDPS
Chloroethane	1,466,667	<2.1	<7.6	<4.0	<4.0	<0.75	<0.78	<440	<0.75	<16.7
1,1-Dichloroethane	2,567	**1.7**	<2.3	<1.2	<1.2	<1.1	<1.2	<130	**42.9**	<25.3
cis-1,2-Dichloroethene	8,667(b)	**8.2**	**3.4**	**2.8**	**2.8**	**3.3**	**2.7**	**770**	**1,790**	<25.0
trans-1,2-Dichloroethene	8,667	<1.6	<3.0	<1.6	<1.6	<1.1	<1.2	<180	**11.7**	<25.0
Tetrachloroethene	6,000(c)	**170**	<5.2	**10**	**9.0**	**13.6**	**11.7**	<300	**64.4**	<21.3
1,1,1-Trichloroethane	733,333	**58**	<3.1	<1.6	<1.6	<1.5	<1.6	**460**	**855**	<34.3
Trichloroethene	293	**670**	**220**	**56**	**48**	**39.8**	**36.1**	**18,000**	**29,800**	**60.0**
Vinyl Chloride	933	<0.51	<2.0	<1.0	<1.0	<0.36	<0.37	<110	<0.36	<8.0

Notes:
All data presented in micrograms per cubic meter
Compounds analyzed by USEPA Method TO-15.
Bold indicatres detection above reporting limit: yellow highlighted results exceed the industrial sub-slab vapor screening levels.
CAS - Chemical Abstracts Service.
< - Not detected at or above the reported detection limit.
* = Data considered invalid due to loss of vacuum in canister during transit from laboratory to PRR.
USEPA - United States Environmental Protection Agency.
(a) USEPA Regional Screening Level for Industrial Air (USEPA, November 2012), adjusted for target risk of 1x10-5 and target hazard quotient of 1, divided by USEPA -recommended attenuation factor of 0.03.
(b) Screening level not available. Screening level for trans-1,2-dichloroethene was used due to chemical structural similarities.